ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

Study on Supermarket Service Quality Optimization Based on Kano-QFD model—Take Beidaihe Ugrant Life Square as an Example

Wang Ce, Li Xinyue, Yin Fan, Liu Fuhai*

Hebei University of Environmental Engineering, Hebei, Qinhuangdao, 066000, China
**Corresponding Author: www.kawaii_fumiku@163.com*

Abstract: *In recent years, with the intensification of competition in the retail market, consumers' requirements for the quality of goods and services are constantly improving, and improving the service quality has become an important aspect to improve the competitiveness of retail enterprises. Through the investigation and analysis of customer demands at Beidaihe Ugrant supermarket using the Kano-QFD model, various aspects have been explored, including the importance of the customer base, the revised two-dimensional quality classification of the Kano model, the final importance of customer demands, service quality characteristics, and the importance-satisfaction quadrant analysis. The study has successfully identified the most critical projects in terms of customer demand and the projects that require significant improvements. By aligning the projects in need of improvement with the most critical customer demands, it is concluded that the key areas requiring optimization at Beidaihe Ugrant are "in-sales service primarily focused on online and offline promotional activities" and "after-sales service."*

Keywords: *Kano-QFD model; importance-satisfaction; chain supermarket; customer demand*

1. Introduction

1.1 Application of Kano-QFD model in supermarket service quality

Kano model is a model used to analyze the qualitative user needs, which can be targeted to improve the service quality and user satisfaction. The QFD model is a quality management tool designed to improve customer satisfaction and product quality by translating customer demand into design requirements for products or services. With the gradual development of the research, many scholars combine the two to form a Kano-QFD model to compensate for some of the errors caused by a single model.

However, for the improvement of supermarket service quality, there is few in-depth discussion on combining Kano model with other quantitative methods in China. Considering that the research method of combining Kano model and QFD is relatively mature, Kano-QFD model is chosen to classify and quantify supermarket customer needs, and rank the importance of customer needs to better identify customer needs.

1.2 Composition of The House of Quality

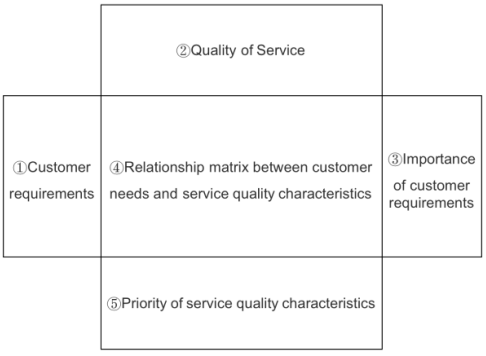

Figure.1 Composition of The House Of Quality

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

The core of quality function development is to build the binary matrix quality table, which is The House Of Quality,can match customer needs to product design requirements ,to ensure that the product or service can meet customer needs and expectations, so as to calculate the importance of different product functions, to determine the feasible design scheme to improve user satisfaction. The composition of the designed quality of supermarket service of The House Of Quality is shown in Figure 1.

1.3 Importance-satisfaction composition

Importance-satisfaction is a method used to analyze the quality characteristics of a product or service in the development of a quality function. This method divides user needs into two dimensions of importance and satisfaction, and plots them on a two-dimensional coordinate graph to help enterprises determine which needs are the most important and which needs need to be met first.

Based on “General rules of customer satisfaction measurements”, and combined with the five gap model proposed by Parasuramman [1]and the research of Wang Cunying and Zhang Dechun [2,3], two sets of questionnaires were designed. They are respectively the "Pair-to-pair Comparison Questionnaire of the importance of the supermarket Service" and the "Kano two-way evaluation and importance of the supermarket service demand - Satisfaction Questionnaire". The SERVQUAL scale was used to divide customer demand into 5 primary needs and 23 secondary needs, and all the needs were numbered.

Among them, the tangibility includes: A1 supermarket infrastructure is complete and comfortable; A2 Staff appearance standards; A3 Perfect traffic facilities, convenient and efficient access; The price of goods in A4 supermarket is reasonable; A5 supermarket is in good hygiene condition.

Reliability includes: B1 supermarket product categories are complete; The service facilities provided by B2 supermarket have security guarantee, so that consumers have a sense of security; B3 supermarket fresh products (vegetables, fruits and meats) are relatively fresh; The appearance and quality of goods in B4 supermarket are good; B5 supermarket building beautiful appearance and supermarket popularity.

Guarantees include: C1 supermarket all kinds of signs, signs eye-catching, clear instructions; C2 supermarket consulting services improved; C3 supermarket has a good image and does not cheat consumers; C4 supermarket after-sales service is perfect.

Reactivity includes: D1 supermarket service staff's meticulous work on consumers; D2 supermarket service staff can effectively deal with consumers' problems; D3 rarely waits for services such as shopping in supermarkets; D4 supermarket service staff have strong adaptability to different situations.

Caring includes: E1 supermarket can enjoy special services, and have a good experience; E2 supermarket has a good shopping atmosphere; E3 supermarket can take into account the needs of special groups, and has special facilities; E4 supermarket payment method is convenient; E5 supermarket offers a wide range of online and offline promotions.

With reference to Duan Liming and Huang Huan [4], who took Kano's results as QFD data and the solution of the complementary advantages of the two models, they built an importance - satisfaction model suitable for supermarkets, taking the importance of demand as the X-axis, satisfaction as the Y-axis, and the average value of the two as the intersection point, and made the demand item data into the following scatter plot. To present the results of the most crucial service quality characteristics in a more intuitive manner and to conduct a comprehensive analysis and optimization of the challenges encountered by supermarkets.

In the figure, the first quadrant is "maintain excellent", which means that the demand item in this area is the most important and the most satisfying demand item for customers. The second quadrant is "maintain stability", which means that the demand items in this area are not important in the eyes of customers, but the satisfaction is higher; The third quadrant is "low priority", indicating that the needs of the area are not important in the eyes of customers, and the satisfaction is not high; The fourth quadrant is "key improvement", indicating that the demand in this area indicates that it is very important in the eyes of users, but the satisfaction is low.

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

2. Research and design of supermarket service quality improvement model based on Kano-QFD model

2.1 Present situation of Ugrant Life Square in Beidaihe

Beidaihe Ugrant Life Square (hereinafter referred to as "Beidaihe Ugrant"), opened in May 2022, belongs to Qinhuangdao Ugrant Commercial Chain Co., LTD., is a large-scale chain comprehensive supermarket, located in the downtown area of Beidaihe, is one of the main places for local residents and students to shop and consume. The brand in Qinhuangdao area has a good brand reputation and influence. However, with the intensification of market competition and the changing customer needs of young consumer groups, mainly college students, Beidaihe Ugrant is also facing challenges and opportunities to improve service quality.

2.2 Data source and sample selection

Only the customers who have shopping and consumption experience in Beidaihe Ugrant are selected as the survey objects. Affected by the geographical location of Beidaihe Ugrant and the ability of researchers, the sample selection is mainly college students in Beidaihe District.

Due to the geographical limitations of the survey objects, the survey method mainly adopts offline written physical questionnaires and supplemented by online questionnaires. The designed online and offline questionnaires are distributed simultaneously through sampling. Due to the complexity of this questionnaire, when the questionnaire was issued, the specialist gave guidance to fill in, in order to pursue the reliability of data.

2.3 Questionnaire delivery and retrieval

The questionnaire was designed on the basis of the data collected from the literature discussion. After the preliminary questionnaire was issued to 20 customers, the formal questionnaire design was completed. In order to ensure the validity of each questionnaire, 149 questionnaires were distributed at the gate of the supermarket, and 100 questionnaires were recovered, of which 100 were valid.

2.4 Variable Definition

2.4.1 Basic importance of requirements

Regarding the creation of the priority matrix, the study conducted by Du Dong[5] can be referred to. When two factors are compared, there is a certain relativity. The scale method of 0.1 to 0.9 is used to describe the relative importance of two factors.

In terms of the establishment of fuzzy consistent matrix, two different factors i and j are compared, and through quantitative analysis of fuzzy factors, the matrix A= (aij)n×n can be obtained, assuming that the matrix conforms to the following algorithm:

①$0 \le a_{ij} \le 1$, $a_{ii}=0.5$, $a_{jj}=0.5$, i=1, 2, …, n; ②$a_{ij}+a_{ji}=1$, i, j=1, 2, …, n.

It is a fuzzy complementary judgment matrix. When any factor i and j satisfy $a_{ij}=a_{ik}-a_{jk}+0.5$**,** it can be determined as a fuzzy consistent matrix.

Calculate the transformation of the priority matrix into a fuzzy consistent matrix. First, add all the data in the priority matrix by row to obtain:

$$a_i=\sum_{i=1}^{n} r_{ik},\ (k=1,2,\ldots,n) \tag{1}$$

Then the consistency formula can be used to complete the transformation, as follows:

$$a_{ij}=\frac{a_i-a_j}{2(n-1)}+0.5(n \text{ is the order of the matrix}) \tag{2}$$

The following formulas are calculated in turn:

$$\overline{w_i}=\sum_{j=1}^{n} a_{ij}-0.5 \tag{3}$$

$$\sum_i \overline{w}=\frac{n(n-1)}{2} \tag{4}$$

Relative importance degree of each factor:

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

$$W_i=\frac{\overline{w_i}}{\sum_i \overline{w_i}} \quad (5)$$

The basic importance is equal to the relative importance of each requirement multiplied by the relative importance of the factor dimensions, namely:

$$W*=W_i \cdot W \quad (6)$$

2.4.2 Calculation of final importance

The questionnaire was divided into two types of positive and negative questions, and the answers used a 4-level Likert scale, that is, there were four types of positive and negative answers: like, should be like, indifferent, and dislike. According to the answer, the demand items are determined. Since R is the reverse demand and Q is the invalid data with suspicious results, neither of these two cases appear in the data, the attributes of the demand items are classified into A, O, M and I, namely, charm demand, one-dimensional demand, natural demand and undifferentiated demand, and their K values are 4, 2, 1 and 0 respectively. Kano's classification and judgment are shown in Figure 2.

Kano Analysis		Negative question answers			
		Like	Normal	Don't care	Don't like
Positive question answers	Like	Q	A	A	O
	Normal	R	I	I	M
	Don't care	R	I	I	M
	Don't like	R	R	R	Q

Figure. 2 Classification of Kano 2D quality elements

With reference to "increasing customer satisfaction coefficient and reducing customer dissatisfaction coefficient" proposed by Matzler and Hinterhuber[6] CS and DS, that is, user sensitivity coefficient after product attributes achieve this requirement and user sensitivity coefficient when product attributes do not achieve this requirement, are calculated.

$$CS=(A+O)/(A+O+M+I) \quad (7)$$

$$DS=-(O+M)/(A+O+M+I) \quad (8)$$

Using the comprehensive evaluation method, the factor is continued to be debugged, and the specific calculation of the modified factor f is shown as follows.

$$f=MAX(|CS|,|CD|) \quad (9)$$

In order to improve the ratio of customer demand and satisfaction level in the study, the improvement ratio is calculated as follows:

$$R_0=I/U,\ I,\ U\in[1,5] \quad (10)$$

Where, I represents the average importance of demand, and U represents the level value of the current average satisfaction of demand.

Referring to the calculation method of Chaudha et al. [7] and combining the K value in Kano with QFD, the formula for calculating the improved ratio after adjustment is summarized as follows:

$$R_1=(1+f)^k \times R_0 \quad (11)$$

After the above calculation process, the final importance can be obtained by multiplying the basic importance and the modified improvement ratio.

2.4.3 Revision of Kano classification

The average importance of each demand is calculated, and compared with the average importance of all demands 3.7603, the revised Kano classification can be obtained, as shown in Table 1.

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

Table 1: Revised Kano classification

Kano Two-Dimensional Quality Model	Refined Kano Model	Refined Kano
Attractive Quality Element	Average of the importance of each requirement≥3.7603	High Attractive Quality Element
	Average of the importance of each requirement <3.7603	Low Attractive Quality Element
One-Dimensional Quality Element	Average of the importance of each requirement≥3.7603	High One-Dimensional Quality Element
	Average of the importance of each requirement <3.7603	Low One-Dimensional Quality Element
Must-Be Quality Element	Average of the importance of each requirement≥3.7603	High Must-Be Quality Element
	Average of the importance of each requirement <3.7603	Low Must-Be Quality Element
Indifferent Quality Element	Average of the importance of each requirement≥3.7603	High Indifferent Quality Element
	Average of the importance of each requirement <3.7603	Low Indifferent Quality Element

3. Research results and analysis

3.1 Reliability and validity analysis

Using SPSS 25 software, Cronbach's α analysis was carried out on the Kano forward and backward scale data of this questionnaire, and the coefficient obtained was 0.96, indicating good consistency of the scale, and KMO value was suitable for subsequent analysis in the significant-satisfaction questionnaire.

3.2 Customer demand analysis

3.2.1 Requirement Basic Importance

Using the fuzzy consistent matrix obtained by equations (1) and (2), referring to each fuzzy consistent matrix, using equations (3), (4) and (5), the relative importance Wi is obtained as follows: W=(0.136,0.151,0.209,0.247,0.257); W_A=(0.167,0.175,0.215,0.216,0.237); W_B=(0.197,0.239,0.128,0.218,0.218); W_C=(0.247,0.277,0.16,0.317);

W_D=(0.285,0.237,0.232,0.247); W_E=(0.166,0.228,0.175,0.209,0.222),

According to the previous calculation rules, the overall importance is as follows: W^*=(0.136W_A,0.151W_B,0.209W_C,0.247W_D,0.257W_E).

3.2.2 Final importance of requirements

In order to determine the final importance of customer demand, Kano analysis and importance-satisfaction analysis were carried out on the questionnaire data, and the analysis results were shown in Table 2.

Table 2: Kano 2D quality classification and ranking of importance-satisfaction average

Quality of service		Kano Two-Dimensional Quality Model				Importance		Satisfaction		
SERVQUAL	Customer Demand	A	O	M	I	Mean value	Sequence	Mean value	Sequence	Two-Dimensional Quality
Tangibles	A1		19	77	4	4.27	7	3.61	6	M
	A2	6	29	33	32	3.14	20	3.43	8	M
	A3	7	35	40	18	4.23	8	3.26	13	M
	A4	8	43	38	11	4.49	1	3.09	15	O
	A5		4	94	2	4.42	3	4.06	2	M
Reliability	B1		9	68	23	4.19	9	2.99	18	M
	B2		16	73	11	4.48	2	4.42	1	M
	B3		77	23		4.38	5	3.33	12	O
	B4	1	41	51	7	4.02	10	3.08	16	M
	B5	3	26	29	42	2.62	23	3.52	7	I
Assurance	C1	4	70	24	2	4.33	6	2.19	23	O
	C2		19	42	39	3.36	17	2.55	22	M
	C3	1	4	69	29	3.21	19	3.42	9	M
	C4	2	33	63	2	4.40	4	3.06	17	M
Responsiveness	D1	12	11	44	33	3.46	15	3.18	14	M
	D2	15	16	30	39	3.28	18	3.36	11	I
	D3	44	34		22	3.38	16	3.66	4	A
	D4	10	7	22	61	2.90	21	2.94	19	I
Empathy	E1	12	42	12	34	2.83	22	2.78	21	O
	E2	21	7	19	53	3.84	12	3.39	10	I
	E3	9	1	33	57	3.62	14	3.79	3	I
	E4	13	44	26	17	3.79	13	3.64	5	O
	E5	58	19	4	19	3.91	11	2.79	20	A

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

Then the average importance of each demand is compared with the average importance of all demands, and the revised Kano classification is obtained, in which the high attractiveness demand has E1; Low attractiveness needs are D3; High one-dimensional requirements are A4, B3, C1, E4; Low one-dimensional demand has E1; High demand is A1, A3, A5, B1, B2, B4, C4; Low natural demand is A2, C2, C3, D1; High indifference demand is E2; The low and non-differential requirements are B5, D2, D4, E3.

Based on the above content, the values of K, CS, DS, f, R0 and R1 and the basic importance of each demand can be obtained by using equations (6), (7), (8), (9), (10) and (11), and then the basic importance can be modified to finally calculate the final importance(W**), as shown in Table 3.

Table 3: Final importance ranking

Customer Demand	W*	K	CS	DS	f	R_0	R_1	W**	Sequence
A1	0.0227	1	0.19	-0.81	0.81	1.18	2.14	0.0486	20
A2	0.0238	1	0.35	-0.65	0.65	0.92	1.52	0.0362	22
A3	0.0292	2	0.42	-0.58	0.58	1.30	3.25	0.0949	11
A4	0.0294	2	0.51	-0.49	0.51	1.45	3.31	0.0973	9
A5	0.0322	1	0.04	-0.96	0.96	1.09	2.14	0.0689	14
B1	0.0297	1	0.09	-0.91	0.91	1.40	2.67	0.0793	13
B2	0.0361	1	0.16	-0.84	0.84	1.01	1.86	0.0671	16
B3	0.0193	2	0.77	-0.23	0.77	1.32	4.14	0.0799	12
B4	0.0330	1	0.42	-0.58	0.58	1.31	2.07	0.0683	15
B5	0.0330	0	0.29	-0.71	0.71	0.74	0.74	0.0244	23
C1	0.0516	2	0.74	-0.26	0.74	1.98	5.99	0.3091	3
C2	0.0579	1	0.19	-0.81	0.81	1.32	2.39	0.1384	5
C3	0.0334	1	0.05	-0.95	0.95	0.94	1.86	0.0621	18
C4	0.0662	1	0.35	-0.65	0.65	1.44	2.38	0.1576	4
D1	0.0704	1	0.23	-0.77	0.77	1.09	1.93	0.1359	7
D2	0.0585	1	0.31	-0.69	0.69	0.98	1.66	0.0971	10
D3	0.0573	4	0.78	-0.22	0.78	0.92	9.24	0.5295	2
D4	0.0610	0	0.17	-0.83	0.83	0.99	0.99	0.0604	19
E1	0.0427	2	0.54	-0.46	0.54	1.02	2.42	0.1033	8
E2	0.0586	0	0.28	-0.72	0.72	1.13	1.13	0.0662	17
E3	0.0403	0	0.10	-0.90	0.90	0.96	0.96	0.0387	21
E4	0.0537	2	0.57	-0.43	0.57	1.04	2.56	0.1375	6
E5	0.0571	4	0.77	-0.23	0.77	1.40	13.74	0.7846	1

3.3 Establishment of the House of Quality

3.3.1 Expansion of quality characteristics

Based on the classification standard of supermarkets and related standard documents, 17 quality characteristics of supermarkets are summarized, which are Z1 quality. Z2 product freshness; Z3 Commodity price; Z4 Product categories; Z5 Commodity packaging; Z6 Payment method; Z7 Service attitude; Z8 pre-sales service; Z9 in-sale service; Z10 after-sales service; Z11 in-store environment; Z12 security guarantee; Z13 brand image; Z14 Brand loyalty; Z15 Social responsibility; Z16 special service; Z17 Location.

3.3.2 Customer demand-quality feature correlation matrix

In the matrix, "◎" means highly correlated, "○" means generally correlated, "△" means little correlated, and blank means no correlated, as shown in Figure 3.

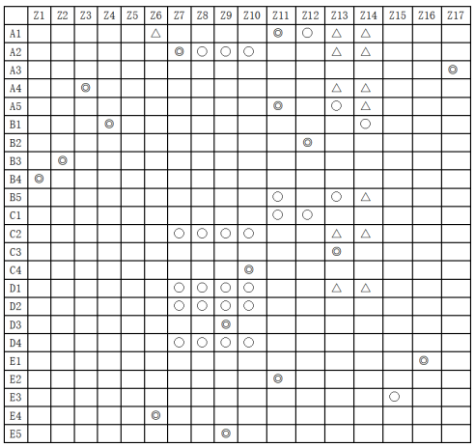

Figure. 3. Customer demand-quality feature correlation matrix

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

3.3.3 Ranking of Quality Characteristic

The values of highly relevant, moderately relevant, and not very relevant are 5, 3, and 1 respectively, which are multiplied by the final importance of each demand, so that the ranking of quality characteristics can be determined, thus forming a complete house of quality, as shown in Table 4.

Table 4: Ranking of quality characteristics

Number	Importance	Sequence
z1	0.58	12
z2	0.61	11
z3	0.49	14
z4	0.4	16
z5	0.35	17
z6	0.74	10
z7	2.73	3
z8	1.4	8
z9	7.97	1
z10	2.01	6
z11	1.96	7
z12	1.03	9
z13	2.55	4
z14	5.16	2
z15	2.47	5
z16	0.52	13
z17	0.47	15

3.4 Importance-satisfaction analysis

With reference to the above data, the average importance value of each demand is taken as the X-axis, the average satisfaction value of each demand is taken as the Y-axis, and the intersection point between the final importance value of each demand and the average satisfaction value of each demand is taken as the zero point, and the importance-satisfaction analysis quadrant diagram shown in figure 4 can be obtained.

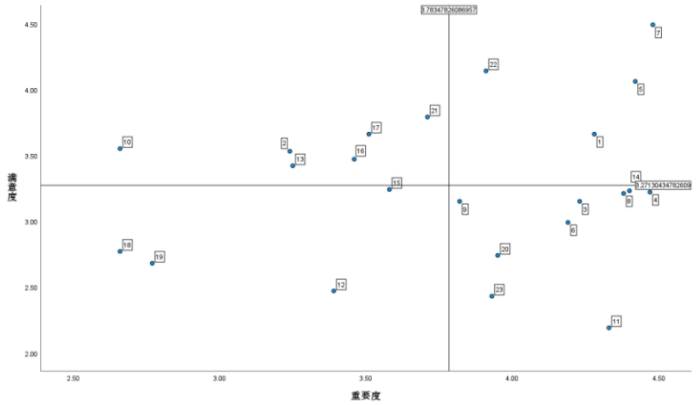

Figure. 4 Importance-satisfaction quadrant

4. Conclusions

To sum up, the top five of the average importance are: reasonable prices in supermarkets; The service facilities provided by the supermarket have security guarantee, so that consumers have a sense of security; The supermarket is in good hygiene condition; The supermarket after-sales service is perfect; Fresh products (vegetables, fruits and meats) in the supermarket are relatively fresh.

The high charm demand in the revised Kano 2D quality classification enriched the online and offline promotional activities of supermarkets; Low charm demand is rarely waiting for services such as shopping at the supermarket.

The top five of the ultimate importance of customer demand are: the supermarket has abundant online and offline promotional activities; There is little waiting for services such as shopping at the supermarket; All kinds of supermarket signs, signs eye-catching, clear instructions; The supermarket after-sales service

ISSN 2616-5902 Vol. 6, Issue 6: 53-60, DOI: 10.25236/AJBM.2024.060609

is perfect; Supermarket consulting services are perfect.

The top five important characteristics of service quality are in-sale services: supermarkets should provide in-sale services such as shopping guides and promotional activities to provide consumers with a better shopping experience. Brand loyalty: Supermarkets should provide quality services and products to enhance consumer loyalty to the brand. Service attitude: Supermarket staff should have a good service attitude, warm, polite, patient to provide services to consumers. Social responsibility: Supermarkets should actively fulfill their social responsibilities, such as environmental protection, public welfare and charity.

Folding the above conclusions, it is not difficult to see that the most critical items for the customer needs of Guangyuan in Beidaihe are abundant online and offline promotion activities in the supermarket, little waiting for shopping and other services in the supermarket, good sanitary condition in the supermarket, and perfect after-sales service in the supermarket. Among them, the most critical demand items are in-sale service and service attitude, which need to be focused on.

Acknowledgements

Research results of "Teaching Reform and Practice of" Market Research and Statistics "based on OBE" in Hebei University of Environmental Engineering.(QNJG202202)

References

[1] Parasuraman A, Zeithaml V A, Berry L L. A Conceptual Model of Service Quality and Its Implications for Future Research[J].Journal of Marketing,1985,49(4):41-50.
[2] Wang Cunying.Study on the improvement of customer satisfaction in Zhengzhou DS chain supermarket[D].Zhengzhou:Henan University of Economics and Law,2022.
[3] Zhang Dechun.Research on the Influencing Factors of Customer Satisfaction of D Supermarket in Taicang.[D].Harbin:Northeast Agricultural University,2022.
[4] Duan Liming,Huang Huan.Integration and application of Kano's model into quality function development[J]. Journal of Chongqing University,2008(05):515-519.
[5] Du Dong.Study on 0．1～0．9 Scale in AHP [J]. Systems Engineering and Electronics,2001,23(5):36-38.
[6] Matzler K, Hinterhuber H H.How to Make Product Development Projects More Successful by Integrating Kano\"s Model of Customer Satisfaction into Quality Function Deployment[J]. 1998,18(1):38.
[7] Chaudha A, Jain R, Singh A R,et al.Integration of Kano's Model into Quality Function Deployment (QFD)[J]. International Journal of Advanced Manufacturing Technology,2011,53(5-8):689-698.