

## Research Article

# Jewelry Packaging User Demand Analysis Based on Fuzzy Kano Model

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China's jewelry sales maintain a good momentum of annual growth, and consumption potential is huge. However, jewelry packaging design faced many problems. Even though China has many jewelry brands, the packaging is poorly designed. The fundamental reason lies in the lack of targeted design of jewelry packaging and the lack of detailed analysis and research, only to meet the functional use. Fuzzy front-end is suitable for the initial stage of product design and determines the success or failure of product design. In view of the uncertain factors, such as consumer demand, technical characteristics, and competitive environment that need to be considered in jewelry packaging design, this paper takes jewelry packaging products, jewelry brands, and fuzzy front-end as research objects, analyzes the existing problems, and makes quantitative analysis by using methods such as questionnaire survey, brainstorming, and scenario analysis. Rough set theory and Kano Model are used to classify and analyze user demand information and determine the realization opportunity. Finally, the research ideas of this topic are formed, and the corresponding research methods and models for ring packaging in jewelry are put forward and verified by examples, so as to form a research method suitable for fuzzy front-end design of jewelry packaging and improve the quality of jewelry packaging design.

## 1. Introduction

In 2020, the sales volume of precious metal jewelry in China has exceeded 200 billion yuan. It can be seen that Chinese people's consumption demand for jewelry products is extremely strong. As the carrier and bridge between consumers and jewelry brands, jewelry packaging also embodies the practical functions of protection, display, and collection. Therefore, jewelry packaging design occupies an important position in the gold and silver jewelry sales market. At present, jewelry packaging design in the market generally has problems such as lack of aesthetic feeling, brand difference, less correlation between packaging and jewelry, and single function [1]. The occurrence of these problems shows that the current jewelry packaging does not consider the consumers, brands, and product characteristics for creative design, which needs to be analyzed based on the comprehensive factors of consumer psychology, science, technology, culture, and processing technology.

The design process can be divided into fuzzy front-end (FFE) stages according to the chronological order of design, new product development (NPD), and commercialization stage. Among them, the fuzzy front-end (FFE) is the initial stage of product design, which determines the success or failure of product design [2]. Since there are a series of unknown and unclear factors in this stage, such as consumer needs, technical characteristics, and market conditions, this stage is also the most critical and difficult to control of the entire product design process.

## 2. Fuzzy Front-End Design Theory and Method

Scholars have done a lot of research on fuzzy front-end theory which is mainly used in the field of management. Therefore, there are relatively few fuzzy front-end theories and application methods for product packaging. Scholars such as Moenaert and Meyer [3] summarized the fuzzy front-end as the enterprise determines the concept for the new

product development and whether it needs to invest the resources owned by the enterprise in the detailed product development process. This paper uses the fuzzy front-end theory to solve the problems existing in jewelry packaging. The first person to introduce the concept of fuzzy front-end in China should be Professor Chen Jin and his team from Zhejiang University, and they elaborated on the content and procedures of fuzzy front-end management in detail [4].

Ashish Dutta and Ajay Pal Singh Rathore published an article saying: Ergonomic attributes play an important role in cars and passengers. Identify 20 important attributes, obtain user needs, and build a new framework combining quality functions [5].

Dou and Li point out in their article: The degree of satisfaction improvement of each product attribute is measured from two aspects of customer perception and competitor performance, and House of Quality (HoQ) is used to calculate the optimal improvement scheme [6].

Kim and Hong mainly studied the analysis of fruit packaging quality with Fuzzy Kano Model [7].

Fuzzy front-end (FFE) refers to the first stage of product design. Many factors need to be considered, including consumers, materials, technologies, and markets. Fuzzy uncertainty increases the failure rate of new product development. It is easy to cause blind design and lack of classification, generalization, and analysis of influencing factors. Through the analysis of relevant literature, several common methods for fuzzy front-end design are summarized: (1) brainstorming method: it is a kind of "group thinking," emphasizing unlimited creativity, focusing on quantity, and problem guidance, highlighting the thinking of seeking differences. (2) Scenario analysis method: scenario analysis method requires centralized analysis of component users and use environment, to find problems and solutions in the design. (3) Cluster analysis: cluster analysis is a multivariate statistical technique that performs cluster analysis on similar samples or indicators. (4) Rough set theory: this theory analyzes inaccurate, inconsistent, and incomplete information and forms complementary with fuzzy theory. (5) Quality function deployment: quality function deployment is a systematic decision-making technique based on satisfying user requirement [8], which helps researchers to accurately construct the demand matrix.

Quantitative analysis was carried out by means of brainstorming, scenario analysis, cluster analysis, rough set theory, etc., and the information was classified and analyzed by using Analytic Hierarchy Process (AHP) and Kano Model and realized the opportunity. Finally, the research of this paper is formed the corresponding methods and combined with specific design examples to verify.

### 3. Analysis of Jewelry Packaging Design

Jewelry packaging products revolve around the types of jewelry, mainly including the following: ring box, paired ring box, pendant box, bracelet box, long chain box, watch box, and suit box. Commonly used processes include the following: hot stamping, hot silver, embossing, embroidery, silk

screen, UV, and other more than 10 kinds of processes. Optional materials include the following: paper, PU leather, leather, microfiber, cotton, linen, and flannel. Common shapes are as follows: square, rectangle, circle, heart shape, and irregular shape [9].

There are many problems in jewelry packaging design. The biggest difference between jewelry products and other products is the small in size and high in value, and jewelry, as a form of gifts, may exist between buyers and users who are not the same one. Therefore, the objects to be considered are also different. On the one hand, analyze the type of jewelry and design according to the size parameters of the jewelry. On the other hand, consider increasing the value of jewelry through packaging design artistically. It also has the function of general packaging and needs to have the function of emotional transmission. If it can reflect the emotional expression of the gifter, will be more favored by consumer groups.

Another important problem of jewelry packaging is that the production of jewelry packaging and jewelry product brand enterprises are in mostly cases are separated. The packaging is designed and produced by the packaging company, and there are many cases of general packaging, which are mainly customized by brand.

## 4. Research Content of Jewelry Packaging Based on Kano Model

*4.1. Opportunity Identification: Obtaining User Demand.* Opportunity identification is the first stage of fuzzy front-end design. The sources of opportunity identification include the following: brainstorming method, scenario analysis method, and questionnaire survey method. This paper selects jewelry entrepreneurs, salespersons, and consumers as questionnaires and interview objects, uses scenario analysis to improve consumer needs, and uses brainstorming to obtain  $N$  requirements of customers [10]. This paper takes the new product of a jewelry packaging and processing enterprise as the research event object and applies the research theory of product fuzzy front-end design to verify the results. The specific implementation steps are as follows:

*4.1.1. Determine the Perceptual Vocabulary.* Collect perceptual words from advertisements, Internet, magazines, and other channels, use semantic differential [11] to formulate an evaluation form, make questionnaire, and select six groups of the most representative words describing jewelry packaging as shown in Table 1.

*4.1.2. Evaluate Perceptual Vocabulary against Product Samples.* Combined with the survey samples, a semantic difference scale was established, formed a questionnaire to obtain the perceptual cognition of the test on the product and to obtain the priority planning of various functions of the jewelry packaging product.

Through the analysis of consumers' requirement for products, the keywords of the problem are extracted, and the requirements of jewelry packaging in terms of function,

TABLE 1: Describes the most representative words for jewelry packaging.

Forward feature	Reverse feature	Forward feature	Reverse feature
Beautiful	Ugly	Expensive	Cheap
Rich	Monotone	Transparent	Opaque
Unique	Featureless	Hard	Soft

appearance, and performance are obtained as the main concerns; the specific function points are displayed in Figure 1.

*4.1.3. Determine Design Elements.* The sample pictures of jewelry packaging are adopted color removal process, which does not affect consumers' evaluation. As shown in Figure 2, select 20 groups for analysis:

Select 20 representative jewelry packaging samples for designed jewelry packaging products. Combined with consumer perceptual vocabulary analysis, we can better analyze the functional requirements of packaging.

*4.2. Assumption Screening.* Through the above methods, obtain the consumers' data acquisition of products, the information is disordered and chaotic, the hierarchical structure of information needs integrated, and the cluster analysis method and AHP analysis method are used to process the relevant information. Combined with the above research, enterprises can obtain the most core "concerns" of consumers' products, to obtain the importance of customer needs and new "selling points" of products [12]. Make the final product plan designed by the enterprise in line with the research conclusions, get the sales results to verify the success of the plan by putting it in the market, improve the profit rate of the enterprise and the satisfaction of consumers, and expand the brand influence, thus proving the fuzzy front-end design method applied in this paper as feasible and scientific.

*4.2.1. Analysis of the Customer Demand.* On the basis of jewelry packaging three requirements, use Likert scale method to form the consumer's satisfaction with certain requirement [13]. The specific methods are as follows:

Firstly, define the demand evaluation set  $V = \{V_1, V_2, V_3, V_4, V_5\}$ ,  $V$  is the name of the set, and there are five elements in the set, from  $V_1$  to  $V_5$ , respectively, representing the satisfaction of a certain demand for jewelry packaging. Specifically,  $V_1 = 1$  means that consumers are very dissatisfied with this demand,  $V_2 = 2$  means that consumers are dissatisfied with this demand,  $V_3 = 3$  means that consumers are generally satisfied with this demand,  $V_4 = 4$  means satisfied, and  $V_5 = 5$  means very satisfied with this requirement.

Secondly, according to the survey of consumer set  $L = \{L_1, L_2, L_3\}$  for the fifteen items of demand results of jewelry packaging in three aspects: function, appearance, and performance, create a consumer demand evaluation gradient table based on rough set theory [14]. The evaluation gradient of consumers is shown in Tables 2 and 3.

Among them,  $T$  is the set of different conditional demand properties defined in the evaluation form, consumers fill in the satisfaction value CS according to different demand properties, the combination of consumer demand properties is represented by  $A$ , and the combination of satisfaction properties is represented by  $B$ .

According to the Relative Positive Field Theory, the Relative Positive Field of consumer  $L_1$ 's requirement  $CR_1$  can be expressed by the following formula:

$$\begin{aligned} \text{POS}_{A-\{CR_1\}}(B) = & \{T_4, T_{26}\}, \{T_6, T_{15}, T_{38}\}, \{T_8, T_{16}, T_{24}\}, \\ & \cdot \{T_9, T_{17}\}, \{T_{10}, T_{18}\}, \{T_{13}, T_{21}\}, \\ & \cdot \{T_{22}, T_{37}\}, \{T_{28}, T_{39}\}, \{T_{31}, T_{35}\}. \end{aligned} \quad (1)$$

The Relative Positive domain of consumer  $L_1$ 's demand  $CR_2$  can be expressed by the following formula:

$$\text{POS}_{A-\{CR_2\}}(B) = \{T_9, T_{11}\}, \{T_{33}, T_{37}\}, \{T_{34}, T_{38}\}. \quad (2)$$

The Relative Positive domain of consumer  $L_1$ 's demand  $CR_3$  can be expressed by the following formula:

$$\begin{aligned} \text{POS}_{A-\{CR_3\}}(B) = & \{T_1, T_2, T_5\}, \{T_3, T_4\}, \{T_9, T_{10}\}, \{T_{17}, T_{18}\}, \\ & \cdot \{T_{22}, T_{23}\}, \{T_{29}, T_{30}\}, \{T_{33}, T_{34}\}. \end{aligned} \quad (3)$$

For consumer  $L_1$ , because it satisfies the positive constraint of formula (4), it can be concluded that the three requirements  $CR_1$ ,  $CR_2$ , and  $CR_3$  of consumer  $L_1$  cannot be simplified relative to the satisfaction value CS. The same conclusion can be drawn for consumers  $L_2$  and  $L_3$ .

$$\begin{aligned} \text{POS}_{A-\{CR_1\}}(B) & \neq \text{POS}_A(B), \\ \text{POS}_{A-\{CR_2\}}(B) & \neq \text{POS}_A(B), \\ \text{POS}_{A-\{CR_3\}}(B) & \neq \text{POS}_A(B). \end{aligned} \quad (4)$$

Then, calculate the importance of each demand to consumers  $\lambda_{iL}$ , where  $i$  represents the demand variable,  $CR_i$ , ( $i = 1, 2, 3$ ), and  $L$  is the set of consumers. For the consumer  $L_1$ , the importance of the three requirements  $CR_1$ ,  $CR_2$ , and  $CR_3$  is expressed by the following formula:

$$\left\{ \begin{aligned} \lambda_{1L_1} &= \frac{|\text{POS}_A(B)|}{|T|} - \frac{|\text{POS}_{A-\{CR_1\}}(B)|}{|T|} = 1 - \frac{20}{40} = 0.5, \\ \lambda_{2L_1} &= \frac{|\text{POS}_A(B)|}{|T|} - \frac{|\text{POS}_{A-\{CR_2\}}(B)|}{|T|} = 1 - \frac{6}{40} = 0.85, \\ \lambda_{3L_1} &= \frac{|\text{POS}_A(B)|}{|T|} - \frac{|\text{POS}_{A-\{CR_3\}}(B)|}{|T|} = 1 - \frac{15}{40} = 0.625. \end{aligned} \right. \quad (5)$$

According to the contents of Tables 3 and 4, calculate the importance degree of demand of consumers  $L_2$  and  $L_3$ ,

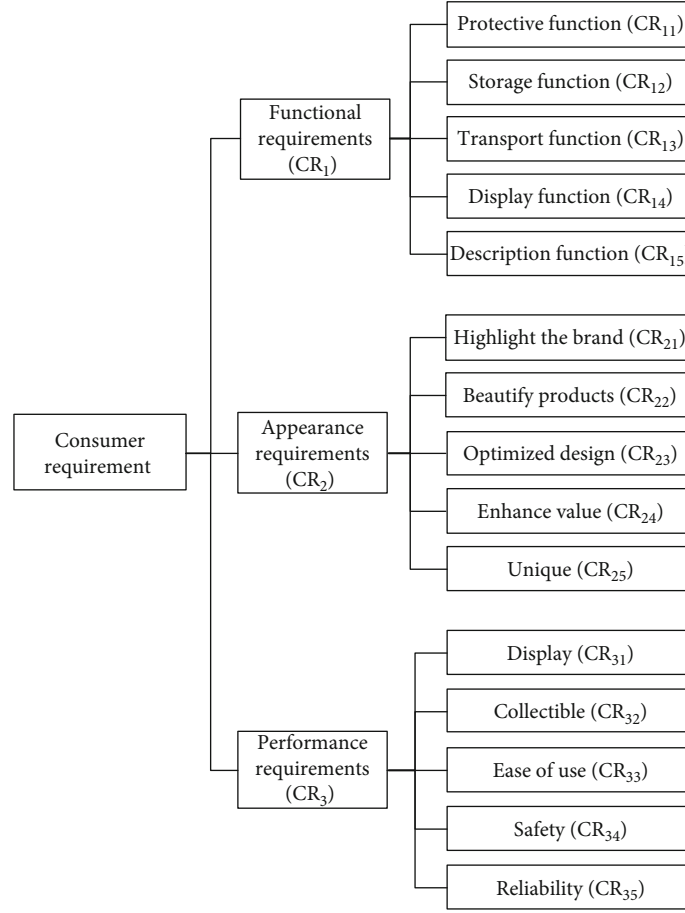


FIGURE 1: Three consumer demands for jewelry packaging.

and calculate the average value of all demand importance degrees in the consumer set  $L$  to obtain the average degree of importance of basic needs, as shown in the formulas (6)–(8).

$$\lambda_1 = \frac{\sum_{L=L_1}^3 \lambda_{1L}}{\text{count}(L)} = \frac{\lambda_{1L_1} + \lambda_{1L_2} + \lambda_{1L_3}}{3} = \frac{0.5 + 0.6 + 0.575}{3} = 0.558, \quad (6)$$

$$\lambda_2 = \frac{\sum_{L=L_1}^3 \lambda_{2L}}{\text{count}(L)} = \frac{\lambda_{2L_1} + \lambda_{2L_2} + \lambda_{2L_3}}{3} = \frac{0.85 + 0.6 + 0.575}{3} = 0.675, \quad (7)$$

$$\lambda_3 = \frac{\sum_{L=L_1}^3 \lambda_{3L}}{\text{count}(L)} = \frac{\lambda_{3L_1} + \lambda_{3L_2} + \lambda_{3L_3}}{3} = \frac{0.625 + 0.4 + 0.625}{3} = 0.55. \quad (8)$$

According to the above calculation results,  $\lambda_2 > \lambda_1 > \lambda_3$ , it can be concluded that consumers pay the most attention to the appearance requirements of jewelry packaging, followed by the functional requirements, and the performance requirements are the least concerned.

Finally, after obtaining the importance of the requirements of the first layer ( $CR_1$ ,  $CR_2$ , and  $CR_3$ ), the importance

of the second layer of requirement attributes is obtained according to quantitative statistics as shown in Table 5,  $\lambda'_{CR}$  as  $CR$  represents the number of layers of requirements and the serial number of specific requirements.

The importance of the first layer of demand calculated by formulas (6)–(8) and the calculation method of calculating the importance of the second layer of demand in formula (9) can be concluded that consumers have quantitative statistics on each layer of jewelry packaging. The importance of each requirement is shown in Table 6.

$$\lambda_{iCR} = \lambda_i \cdot \lambda'_{CR}. \quad (9)$$

**4.2.2. Correction and Quantification of Requirement Importance Based on Competitive Product Analysis.** On the basis of obtaining the importance of various needs of jewelry packaging through consumer survey results, it is also necessary to consider the evaluation and scoring of other competing products, so as to obtain more comprehensive analysis conclusion of the market competitive advantage of jewelry packaging needs.

Firstly, define  $G = \{G_1, G_2, \dots, G_j\}$ , and  $j = 1, 2, 3, 4, 5$  to quantify the pros and cons of consumers' requirements for the product compared with similar products in the market. Specifically,  $G_1$  means that the product has no

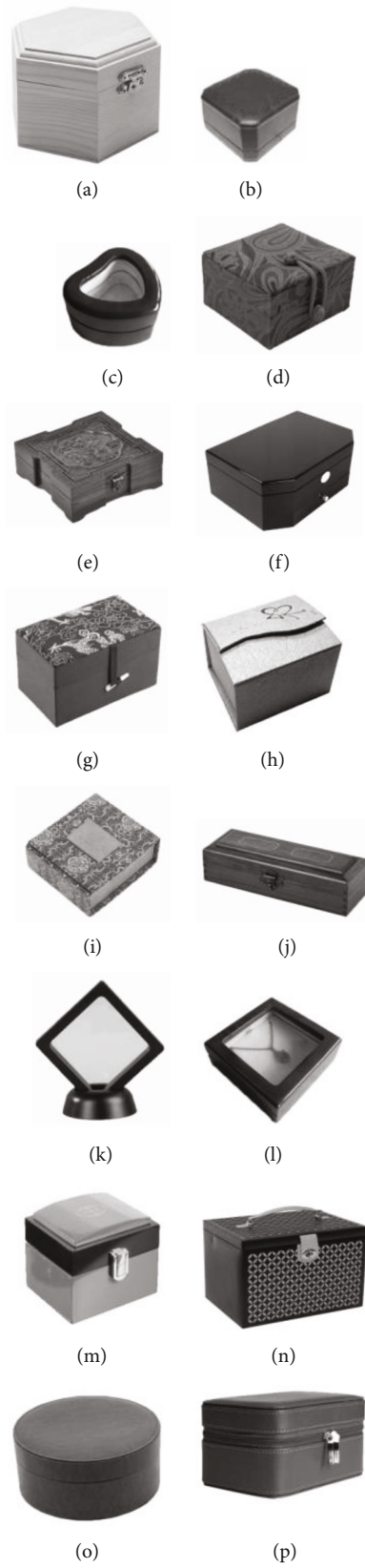


FIGURE 2: Continued.

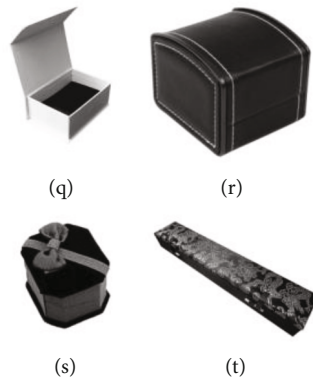


FIGURE 2: 20 representative jewelry packaging samples.

TABLE 2: Evaluation gradient of consumer  $L_1$ .

$T$	$CR_1$	$CR_2$	$CR_3$	$CS$	$T$	$CR_1$	$CR_2$	$CR_3$	$CS$	$T$	$CR_1$	$CR_2$	$CR_3$	$CS$
1	1	2	3	1	15	2	4	5	4	29	4	1	3	3
2	1	2	5	1	16	3	1	1	1	30	4	1	5	3
3	1	3	2	1	17	3	1	3	2	31	4	2	1	3
4	1	3	5	1	18	3	1	5	2	32	5	1	1	2
5	1	2	4	1	19	3	2	1	2	33	5	1	3	4
6	1	4	5	4	20	3	3	2	2	34	5	1	5	4
7	1	5	4	2	21	3	3	5	3	35	5	2	1	3
8	2	1	1	1	22	3	5	3	4	36	5	3	2	4
9	2	1	3	2	23	3	5	5	4	37	5	5	3	4
10	2	1	5	2	24	4	1	1	1	38	5	4	5	4
11	2	2	3	2	25	4	3	2	3	39	5	4	5	5
12	2	3	4	2	26	4	3	5	1	40	5	5	3	5
13	2	3	5	3	27	4	4	2	4					
14	2	4	2	2	28	4	4	5	5					

TABLE 3: Evaluation gradient of consumer  $L_3$ .

$T$	$CR_1$	$CR_2$	$CR_3$	$CS$	$T$	$CR_1$	$CR_2$	$CR_3$	$CS$	$T$	$CR_1$	$CR_2$	$CR_3$	$CS$
1	1	1	1	1	15	2	4	2	2	29	4	2	3	3
2	1	1	2	1	16	2	4	5	3	30	4	2	5	3
3	1	1	3	1	17	2	5	3	3	31	4	3	2	3
4	1	2	3	1	18	2	5	5	4	32	4	3	5	4
5	1	2	5	1	19	3	1	5	3	33	4	5	3	4
6	1	2	4	1	20	3	2	1	2	34	4	5	5	5
7	1	4	5	1	21	3	2	3	3	35	5	1	1	2
8	1	3	4	2	22	3	2	5	3	36	5	1	3	4
9	2	2	3	2	23	3	4	2	3	37	5	2	3	3
10	1	5	4	2	24	3	4	5	4	38	5	3	5	4
11	2	1	1	1	25	3	5	3	4	39	5	3	2	4
12	2	2	5	3	26	3	5	5	4	40	5	5	3	4
13	2	3	4	2	27	4	1	1	3					
14	2	3	5	3	28	4	2	1	3					

TABLE 4: Evaluation gradient of consumer  $L_2$ .

$T$	$CR_1$	$CR_2$	$CR_3$	CS	$T$	$CR_1$	$CR_2$	$CR_3$	CS	$T$	$CR_1$	$CR_2$	$CR_3$	CS
1	1	1	1	1	15	2	5	3	3	29	4	2	3	3
2	1	1	2	1	16	2	5	5	4	30	4	2	5	3
3	1	1	3	1	17	3	1	1	2	31	4	4	2	4
4	1	3	2	1	18	3	1	3	2	32	4	4	5	4
5	1	3	5	1	19	3	1	5	3	33	4	5	3	4
6	1	3	4	2	20	3	2	1	2	34	4	5	5	5
7	1	5	5	2	21	3	3	2	2	35	5	1	5	4
8	1	5	4	2	22	3	3	5	3	36	5	2	1	3
9	2	1	1	1	23	3	4	2	3	37	5	2	3	3
10	2	1	3	2	24	3	4	5	4	38	5	3	5	4
11	2	1	5	2	25	3	5	3	4	39	5	5	3	5
12	2	2	3	2	26	4	1	3	3	40	5	5	5	5
13	2	2	4	2	27	4	1	5	3					
14	2	2	5	3	28	4	2	1	3					

TABLE 5: The importance of peer-level requirements of the second-level requirements.

Contents of the second layer requirements	The importance of peer requirements	Contents of the second layer requirements	The importance of peer requirements
Protective function	0.245	Enhance value	0.195
Storage function	0.09	Unique value	0.265
Transport function	0.215	Display	0.235
Display function	0.255	Collectible	0.225
Description function	0.195	Ease of use	0.175
Highlight the brand	0.29	Safety	0.2
Beautify products	0.125	Reliability	0.165
Optimized design	0.125		

TABLE 6: Importance of consumers' requirements for jewelry packaging.

First floor requirements	Basic importance	Second floor requirements	Basic importance
Functional requirements $CR_1$	0.558	Protective function	0.137
		Storage function	0.05
		Transport function	0.119
		Display function	0.143
		Description function	0.109
Appearance requirements $CR_2$	0.675	Highlight the brand	0.196
		Beautify products	0.084
		Optimized design	0.084
		Enhance value	0.132
		Unique	0.179
Performance requirements $CR_3$	0.55	Display	0.129
		Collectible	0.124
		Ease of use	0.096
		Safety	0.11
		Reliability	0.090



TABLE 7: Market competitive advantages of each requirement.

Consumer requirement		Market competitiveness evaluation			
First floor requirements	Second floor requirements	Similar product in the market (G)		Requirement functional relevance (F)	Market competitiveness (H)
		Zhou**	Northwest**		
CR <sub>1</sub>	CR <sub>11</sub>	4	3	4	0.733
	CR <sub>12</sub>	3	3	3	0.600
	CR <sub>13</sub>	4	3	2	0.600
	CR <sub>14</sub>	3	3	2	0.533
	CR <sub>15</sub>	3	4	3	0.667
CR <sub>2</sub>	CR <sub>21</sub>	5	4	5	0.933
	CR <sub>22</sub>	4	4	3	0.733
	CR <sub>23</sub>	4	3	3	0.667
	CR <sub>24</sub>	2	2	2	0.400
	CR <sub>25</sub>	4	3	4	0.733
CR <sub>3</sub>	CR <sub>31</sub>	2	2	3	0.467
	CR <sub>32</sub>	4	5	5	0.933
	CR <sub>33</sub>	2	3	2	0.467
	CR <sub>34</sub>	2	3	3	0.533
	CR <sub>35</sub>	2	4	3	0.600

TABLE 8: Market competitive advantages of each requirement.

Consumer requirement		Basic importance correction			
First floor requirements	Second floor requirements	Selling point		Standard increase rate (L)	Kano correction factor (K)
		Existing products	New products		
CR <sub>1</sub>	CR <sub>11</sub>	4	5	1.25	1.2
	CR <sub>12</sub>	3	3	1.00	1
	CR <sub>13</sub>	3	3	1.00	1
	CR <sub>14</sub>	3	3	1.00	1.3
	CR <sub>15</sub>	3	4	1.33	1
CR <sub>2</sub>	CR <sub>21</sub>	3	5	1.67	1
	CR <sub>22</sub>	4	5	1.25	1
	CR <sub>23</sub>	4	5	1.25	1.4
	CR <sub>24</sub>	3	3	1.00	1
	CR <sub>25</sub>	3	4	1.33	1
CR <sub>3</sub>	CR <sub>31</sub>	3	3	1.00	1.3
	CR <sub>32</sub>	3	4	1.33	1
	CR <sub>33</sub>	2	2	1.00	1.2
	CR <sub>34</sub>	3	3	1.00	1
	CR <sub>35</sub>	3	3	1.00	1

competitive advantage;  $G_2$  means that the advantage is lacking;  $G_3$  means that it has a general advantage;  $G_4$  means that the advantage is strong;  $G_5$  means that the product has a strong advantage.

Secondly, define  $F = \{F_1, F_2, \dots, F_f\}$ ,  $f = 1, 2, 3, 4, 5$  as the quantitative rating of the product designer on whether

a certain requirement of the product is related to similar products in the market. Specifically,  $F_1$  means that the requirement is not related to the existing product;  $F_2$  means that it is generally related;  $F_3$  means that it is relatively related;  $F_4$  means that it is closely related;  $F_5$  means that it is very related.



TABLE 9: Final importance correction results.

Consumer requirement	Second floor requirements	Basic importance ( $\lambda$ )	Market competitiveness ( $H$ )	Basic importance correction Kano correction factor ( $K$ )	Standard increase rate ( $L$ )	Final importance indicator ( $P$ )
First floor requirements	Protective function CR <sub>11</sub>	0.137	0.733	1.2	1.25	0.150
	Storage function CR <sub>12</sub>	0.050	0.600	1	1.00	0.030
	Transport function CR <sub>13</sub>	0.120	0.600	1	1.00	0.072
	Display function CR <sub>14</sub>	0.142	0.533	1.3	1.00	0.099
	Description function CR <sub>15</sub>	0.109	0.667	1	1.33	0.097
Functional requirements CR <sub>1</sub>	Highlight the brand CR <sub>21</sub>	0.196	0.933	1	1.67	0.305
	Beautify products CR <sub>22</sub>	0.084	0.733	1	1.25	0.077
	Optimized design CR <sub>23</sub>	0.084	0.667	1.4	1.25	0.098
	Enhance value CR <sub>24</sub>	0.132	0.400	1	1.00	0.053
	Unique CR <sub>25</sub>	0.179	0.733	1	1.33	0.175
Appearance requirements CR <sub>2</sub>	Display CR <sub>31</sub>	0.129	0.467	1.3	1.00	0.078
	Collectible CR <sub>32</sub>	0.124	0.933	1	1.33	0.154
	Ease of use CR <sub>33</sub>	0.096	0.467	1.2	1.00	0.054
	Safety CR <sub>34</sub>	0.110	0.533	1	1.00	0.059
	Reliability CR <sub>35</sub>	0.091	0.600	1	1.00	0.054
Performance requirements CR <sub>3</sub>						

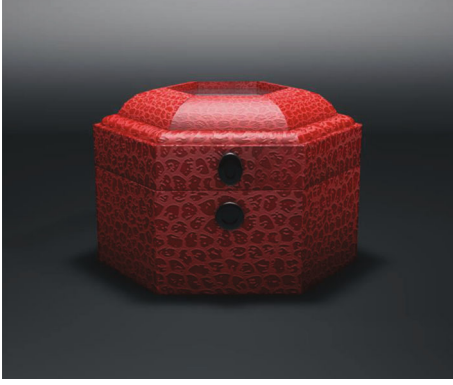


FIGURE 3: Ruby ring packaging design renderings.

Then, define the variable set  $H = \{H_1, H_2, \dots, H_h\}$ ,  $h = 1, 2, 3 \dots$  for the analysis of the product market competitive advantage of  $h$  consumers surveyed, and compare  $N$  related similar competing products; then, for specific consumer, the following calculation formula can be obtained.

$$H_h = \frac{\sum_{n=1}^N G + \sum_{n=1}^N F}{(i + f) \cdot (N + 1)}. \quad (10)$$

In this paper, we compared the packaging design of two similar brand products in the market: Zhou\*\* and North-west\*\*, scored the competitive evaluation of each demand, to obtain the market competitive advantage table of each demand, such as shown in Table 7.

**4.2.3. The Final Quantification of the Importance of Consumer Requirements Based on the Kano Model.** According to the consumer requirement hierarchy chart for jewelry packaging, the functional demand is protection function, the appearance demand is to highlight the brand and beautify the product, it is unique, and the performance requirement is highly collectible. Brand, uniqueness, and collectability will be the main “selling points” of jewelry packaging development and design, and the company’s existing products will be compared with the new products to be developed and designed; the horizontal growth rate of each requirements will be obtained. Specific data is shown in Table 8.

The calculation of the final importance degree  $P_{CR_i}$  of each consumer demand is defined as formula (11),  $\lambda_{iCR}$  is the basic importance degree of the consumer to the requirements  $CR_i$ , and its value is obtained from Section 4.2.1;  $H_i$  is the market competitiveness of the requirement  $CR_i$ . Its value is given by formula (10);  $K_i$  is the modified quantitative parameter of the requirements;  $L_i$  is the horizontal growth value of the market demand of the demand.

$$P_{CR_i} = \lambda_{CR_i} \cdot H_i \cdot K_i \cdot L_i, i = 1, 2, 3, \dots, n. \quad (11)$$

In this paper, according to the quantitative formula, the basic importance of comprehensive consumer requirements, the market competitiveness of consumer requirements, the use of Kano Model to correct various requirements quantitative parameters and the horizontal growth value [15], the

final importance of customer demand for jewelry packaging products is obtained. The quantification results are shown in Table 9.

**4.3. Realization Opportunities.** After the abovementioned stages, it can be seen from Table 6 that consumers are more concerned about the three requirements of jewelry packaging, namely, “brand highlighting  $CR_{21}$ ,” “unique  $CR_{25}$ ,” and “display function  $CR_{14}$ .” After the above market competition analysis, it can be concluded from Table 9: adding the influencing factors between the market and competing products, the “collectible  $CR_{32}$ ” of jewelry packaging has replaced “display function  $CR_{14}$ ” as the third content of concern, the two needs of “highlighting the brand  $CR_{21}$ ” and “unique  $CR_{25}$ ” are still the focus of consumers’ attention, so it can be concluded that for the field of jewelry packaging design, attention should be paid to the innovation of appearance design needs, and packaging needs to be considered at the same time, providing new selling points for jewelry sales.

## 5. Ruby Ring Packaging Design Practice Based on Kano Model

**5.1. Appearance Design.** The design drawing shown in Figure 3 is based on the theme of ruby rings. The ring shape is relatively small, and the structure is stable [16]. Combined with the design process and conclusion of the Fuzzy Kano Model, first of all, the consumer demand for ruby rings is analyzed to understand the weight of consumer demand for each part, appearance demand more than function requirements more than performance requirements, focusing on the analysis of appearance design. This packaging design adopts the expression form of leather material, hexagon, and red. Leather material is a high-grade material in the selection of jewelry packaging materials. The hexagon is a design in the shape of a turtle shell and a honeycomb. The red hue is consistent with the ruby ring of the package contents and is highly ornamental. The auspicious ornamentation in the outer packaging echoes the inner wall of the ring, increasing the relevance [17] and cultural nature of the packaging in the details.

**5.2. Functional Design.** According to the analysis of functional requirements of jewelry packaging, it is mainly reflected in the following: protection function, storage function, transportation function, display function, and explanation function. This packaging design has a rigorous packaging structure, which can protect the interior well. The regular hexagonal design is convenient for storage and transportation, and the transparent setting on the top can better display the jewelry.

**5.3. Dimensional Analysis.** As a ring packaging box, the packaging size should not be too large. The height of ring packaging currently on the market is generally between 1.8 cm and 3.5 cm. Therefore, this packaging design adopts 3.5 cm and hexagonal diameter 6 cm, which is more in line with the grip of the hand. The size is easy to carry, and the specific product size chart is shown in Figure 4.

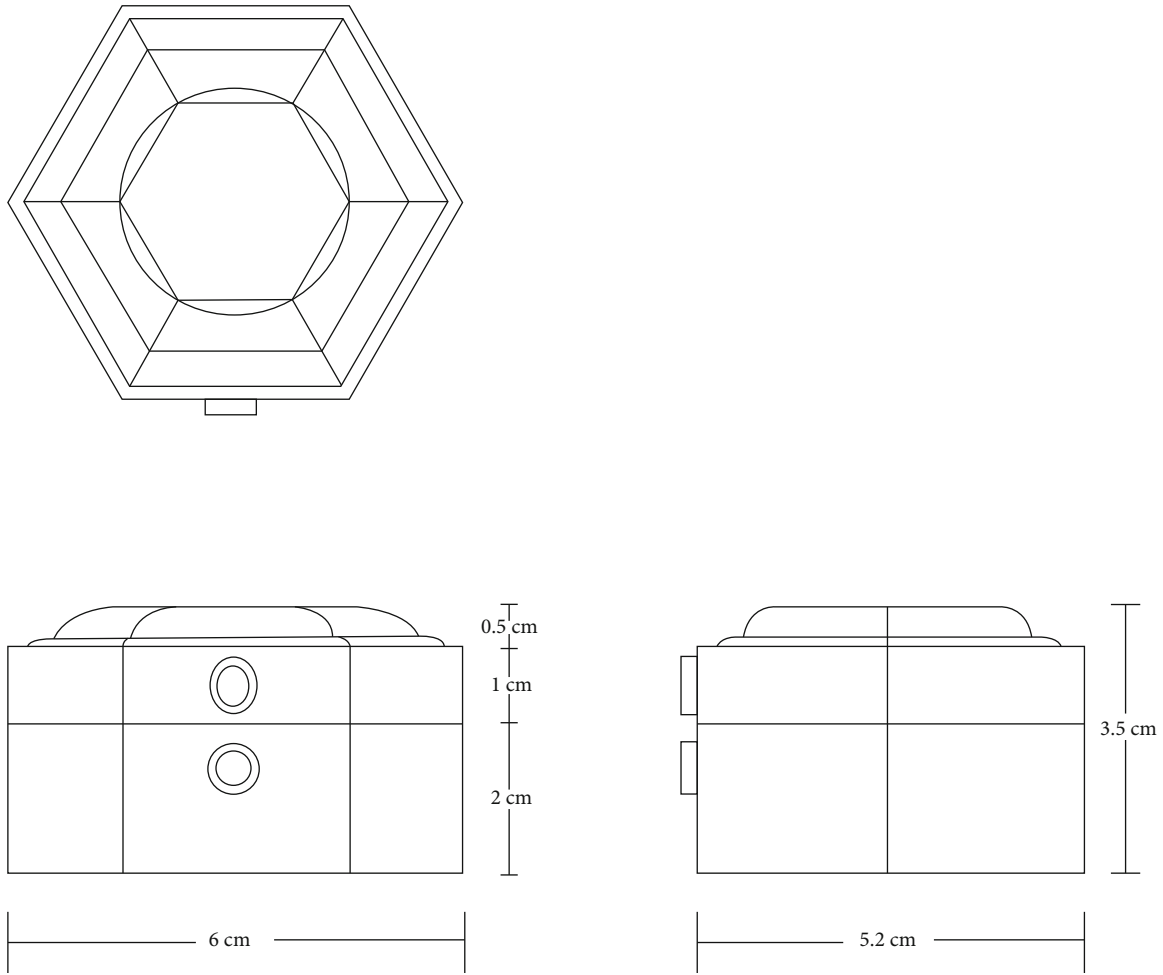


FIGURE 4: Packaging design dimensions.

5.4. *Unique Analysis.* Based on the Kano Model summary, obtain the unique design requirements for jewelry packaging. This packaging design has a dark pattern on the surface of the packaging, which has good unified echo with the inner wall pattern of the ring. It is customized packaging design and has certainly collection [18], to satisfy the consumer requirement for high-end jewelry packaging design.

## 6. Conclusion

Jewelry packaging products, as the “clothing” of jewelry, have many important functions. In view of the fact that domestic enterprises currently not pay much attention to the front-end development of jewelry packaging, it is hoped that through the research content of this article, enterprises can understand the demands of jewelry packaging. Regarding the weight relationship of various needs of jewelry packaging, we design products that satisfy consumers. Through the research on the fuzzy front-end design theory, combined with the specific placement, the weight analysis of the demand layer, and functional layer of jewelry packaging, in addition to highlighting the brand and unique characteristics, the front-end designer of jewelry packaging also needs to consider adding collection design; research in this aspect

can continue to combine fuzzy front-end theory and semi-otic theory to analyze specific design plans in the future.

Through research and the implementation of the fuzzy front-end theoretical feasibility plan, the randomness in the design process of the enterprise can be avoided, the experience value of jewelry can be improved, the sales and packaging innovation of the enterprise can be better promoted, the market share of the enterprise can be increased, and the brand influence can be expanded.

## Data Availability

All data, models, and code generated or used during the study appear in the submitted article.

## Conflicts of Interest

The author declares no conflicts of interest.

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