

# From User Needs to Sustainable Innovation: An Integrated NLP–Grounded Theory–Kano–AHP–QFD Approach to the Modern Design of Yi Ethnic Lacquerware Chairs

Yuanshuai Yang <sup>a</sup>, Songming Zou,<sup>b</sup> Guang Cao,<sup>c</sup> Xiaohui Liu,<sup>d</sup> and Xiaozhou Liu<sup>e,\*</sup>

A close relationship exists among cultural expression, craftsmanship transmission, and user experience in intangible cultural heritage (ICH) furniture. However, the modernization of ethnic cultural products requires systematic understanding of users' latent cultural and emotional needs. Using the Yi ethnic lacquerware chair as a focus, this study proposes a user-centered design framework integrating cultural genes, emotional resonance, and design innovation. User requirements were identified from 49,671 valid online comment records using natural language processing and Grounded Theory, complemented by semi-structured interviews with 12 experts. User requirements were classified using the Kano model and weighted via the Analytic Hierarchy Process. Quality Function Deployment was used to translate prioritized user needs into technical characteristics, while the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was applied to evaluate alternative design schemes. It was found that cultural symbolism, emotional value, and narrative expression exerted stronger influences on user preference than functional attributes. Technical priorities include culturally themed form expression, sustainable application of Yi lacquerware craftsmanship, and digital integration of ethnic patterns. The proposed NLP–Kano–AHP–QFD–TOPSIS system reduces subjectivity in design decision-making and offers a transparent and transferable approach for ethnic furniture design, ICH product development, and sustainable cultural innovation.

DOI: 10.15376/biores.21.2.4375-4407

*Keywords:* Intangible cultural heritage furniture; Yi ethnic lacquerware chairs; Emotional cultural experience; User requirements; Sustainable design

*Contact information:* a: Department of Environmental Design, Qingdao Huanghai University, No.1145 Linghai Road, Huangdao District, Qingdao, Shandong Province, China, NC 266555 CN; b: Teaching and Research Office, Guangyuan Open University, No.125, Wenhua Road, Lizhou District, Guangyuan City, Sichuan Province, China, NC 628017 CN; c: School of Art Design, Shandong Youth University of Political Science, No. 31699 Jingshi East Road, Jinan, Shandong Province, China, NC 250103 CN; d: Department of Spatial Design, Graduate School, Hongik University, No. 72-1 Sangsu-dong, Mapo-gu, Seoul 04066, Republic of Korea, NC 04066 KR; e: Digital Media Arts, Hengxing University, No.588 Jiu Shui East Road, Licang District, Qingdao, Shandong Province, China, NC 266041 CN;

\* Corresponding author: wahahax2014@163.com

## INTRODUCTION

Against the dual backdrop of accelerating globalization and the renewed evaluation of cultural diversity, integrating intangible cultural heritage (ICH) into contemporary design has become a central concern in design research, cultural heritage preservation, and the creative industries. This integration must both safeguard cultural authenticity and respond to rapidly evolving market demands (Chen *et al.* 2025). As a vital bearer of ethnic culture, ICH encapsulates distinctive historical memories and artistic values (Sun and Yue 2025). In recent years, cultural consumption has shifted from a material-oriented paradigm toward one centered on emotional experience and cultural identity. Accordingly, ethnic cultural products are increasingly recognized as key media for conveying identity, social emotions, and cultural values. However, the accelerating pace of social modernization has placed many traditional crafts under dual pressures: challenges to intergenerational transmission and growing disconnection from contemporary markets (Zhang and Hong 2023). Addressing how to translate cultural genes into modern contexts, systematically optimize user experience, and sustain product innovation while preserving cultural authenticity remains a critical challenge for both research and practice.

Yi ethnic lacquerware is a highly representative form of ethnic art from southwestern China. It embodies the accumulated wisdom of Yi ancestors and constitutes a valuable form of intangible cultural heritage with significant practical and aesthetic value (Yan 2021). Beyond its functional and visual qualities, Yi lacquerware conveys collective historical narratives, cosmological concepts, and ritualized cultural structures, forming a highly recognizable system of cultural symbols. Despite these strengths, lacquerware furniture products face three major challenges in marketization and adaptation to contemporary lifestyles. First, during the design and production of Yi lacquerware furniture, cultural symbols are often reduced to superficial representations, lacking an authentic translation of underlying cultural genes and narrative systems. Second, traditional Yi lacquerware craftsmanship is difficult to integrate effectively into modern manufacturing processes, sustainable material frameworks, and emerging technological systems. Third, the design of such cultural products frequently lacks systematic analysis of user needs, resulting in a disconnect between cultural attributes and user experience.

International studies indicate that many ICH-related design practices suffer from a triple disconnection among culture, technology, and users. This disjunction is reflected in abstracted cultural imagery, limited consideration of user psychology, and misaligned technological implementation (Hou *et al.* 2023; Liu *et al.* 2023). Accordingly, establishing a structured linkage among cultural value, user experience, and sustainable technology has become a critical pathway for advancing the contemporary development of ICH. In recent years, design research has shifted from a primary focus on formal aesthetics toward user-centered approaches that emphasize sustainable innovation and social impact. This transition is evident in theoretical frameworks that expand sustainable design from the product level to system innovation and social behavior. It is also reflected in design strategies that prioritize user experience, emotional needs, and long-term sustainability (Ceschin and Gaziulusoy 2016). As a result, user experience and emotional value have become key determinants of cultural product competitiveness. In the field of chair design, user requirements extend beyond comfort and functionality to encompass deeper dimensions such as cultural identity, aesthetic preference, and emotional resonance (Norman 2013).

Therefore, incorporating the concept of User-Centered Design (UCD) into ethnic cultural product design can enhance user satisfaction and market acceptance while promoting the modern translation and innovative dissemination of ethnic culture. At the theoretical and methodological levels, traditional design research has primarily relied on qualitative analysis and experiential judgment, resulting in limited systematic, quantitative, and hierarchical examination of user needs. In recent years, however, the integrated application of Grounded Theory, the Kano model, the Analytic Hierarchy Process (AHP), and Quality Function Deployment (QFD) has offered new methodological pathways for multidimensional user-need analysis and design innovation. Grounded Theory facilitates the identification of latent user-need structures from large-scale textual data (Glaser and Strauss 1967). The Kano model differentiates levels of satisfaction drivers (Kano *et al.* 1984), while AHP quantifies the relative importance of user requirements (Saaty 1977). QFD further translates user needs into specific design attributes, forming a closed-loop framework linking needs, functions, and innovation (Fan and Wang 2025). Despite these advances, research on the integrated application of these methods in the modernization of ICH-related product design remains limited. This gap is particularly pronounced in ethnic furniture design, where systematic frameworks integrating cultural genes, user psychology, and sustainable innovation are still underdeveloped.

A potential challenge in the dissemination of Yi ethnic lacquerware furniture is the limited cultural awareness among broader consumer groups, which may affect users' understanding of symbolic design elements and their engagement. This does not necessarily hinder market acceptance; rather, it underscores the role of design as a mediating mechanism that translates cultural meanings into accessible forms. In this regard, cultural communication can be strengthened through educational initiatives, museum exhibitions, digital platforms, and commercial practices such as brand storytelling, thereby enhancing user understanding and supporting the broader dissemination of intangible cultural heritage.

This study focuses on Yi ethnic lacquerware chairs and aims to elucidate the pathways through which ethnic cultural products progress from user-need identification to sustainable innovative design through the integration of multi-source data and methodological approaches. An analytical framework is developed based on an integrated model that combines Natural Language Processing (NLP) with the Kano, Analytic Hierarchy Process (AHP), and Quality Function Deployment (QFD) methods. The specific objectives are as follows: (1) to extract authentic user feedback from social media big data and identify the core dimensions of user needs in cultural furniture design; (2) to apply Grounded Theory to derive cultural symbols and user psychological characteristics embedded in Yi ethnic lacquerware chairs design; (3) to integrate the Kano model, AHP, and QFD to quantify the priority of user needs and establish mapping relationships between user requirements and design elements; and (4) to propose design strategies and models that simultaneously promote cultural inheritance and sustainable innovation.

In this study, "success" is defined not as large-scale industrial production or mere aesthetic reinterpretation, but as the integration of cultural authenticity, user-centered experience, and sustainable design. Success lies in balancing cultural expression, user satisfaction, and practical feasibility. It refers to enabling Yi ethnic lacquerware chairs to retain cultural meaning and craftsmanship value while adapting to contemporary user needs and production contexts.

This study takes the contemporary design of Yi ethnic lacquerware chairs as its point of departure and systematically investigates the intersection of cultural inheritance,

user needs, and design innovation. The research is guided by the following three core questions:

Q1: Within the cultural context of ICH-related furniture, how can users' authentic, multi-level needs be accurately identified and synthesized from social media texts, user interviews, and expert knowledge to effectively integrate cultural value, functional performance, and emotional identification?

Q2: How can multi-source methods—such as Natural Language Processing (NLP), Grounded Theory (GT), the Kano model, the Analytic Hierarchy Process (AHP), and Quality Function Deployment (QFD)—be effectively integrated in design research to establish a comprehensive, end-to-end design process encompassing user-need extraction, demand attribute classification, and technical feature development?

Q3: While ensuring user satisfaction and overall experience, how can sustainability principles be embedded throughout the full life cycle of Yi ethnic lacquerware chairs design—including material selection, process implementation, cultural transmission, and adaptation to contemporary contexts—to support the regeneration and long-term value realization of ICH furniture?

## EXPERIMENTAL

### Research Framework

This study employs a systematic, multi-stage research framework to ensure rigor and scientific validity from raw data to final design outcomes (Fig. 1).

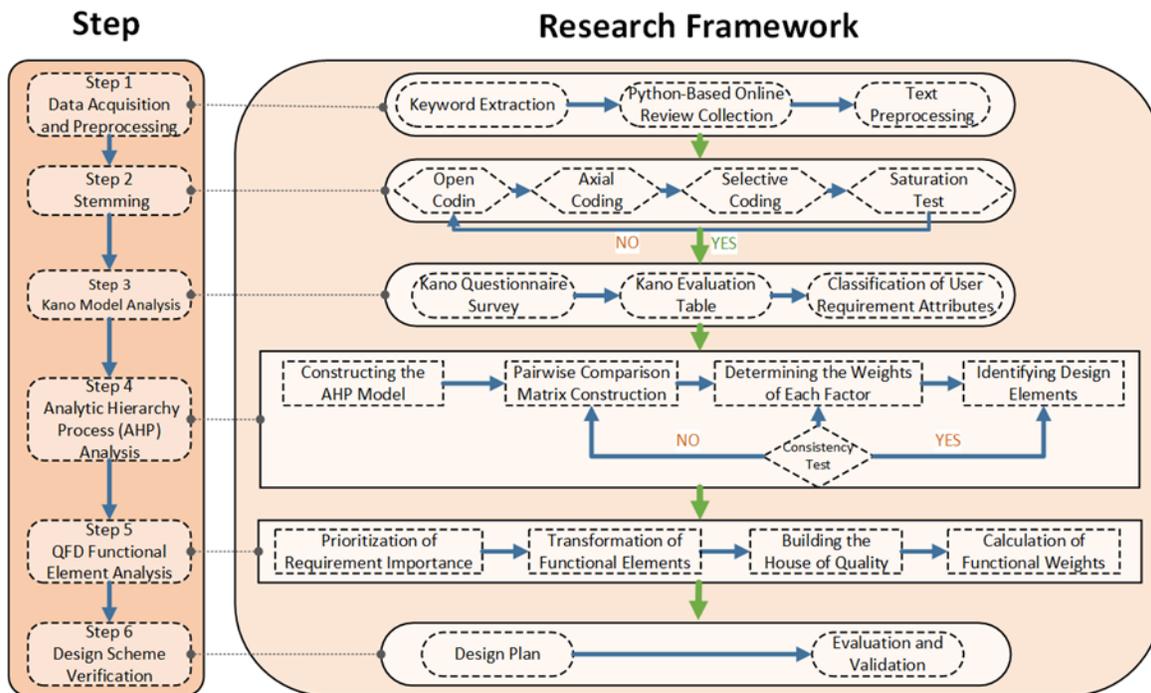


Fig. 1. Overview of the research workflow

First, online review data are collected through web crawling techniques and subjected to text preprocessing to establish the analytical foundation. Second, qualitative

research methods—including open, axial, and selective coding—are applied to extract core user needs, with category saturation tests conducted to ensure completeness. Third, the Kano model is implemented *via* questionnaire surveys to classify demand attributes based on the Kano evaluation matrix. Fourth, design priorities are quantified using the Analytic Hierarchy Process (AHP) to construct judgment matrices and determine the relative weights of each factor. Fifth, Quality Function Deployment (QFD) translates user needs into specific product functional elements, followed by the calculation and ranking of functional importance within the constructed quality layers. Sixth, design solutions are generated based on the preceding analyses, and a systematic TOPSIS evaluation is conducted to complete the closed-loop research process. Overall, this stepwise and logically structured framework effectively ensures the reliability of the research findings.

### User Data Collection Based on RPA

In this study, the systematic collection of data related to Yi ethnic lacquerware chairs began with the construction of a keyword database. Keywords were derived from three primary sources. First, core concepts identified through desk research were collected, including terms related to Yi culture, Yi lacquerware, lacquerware furniture, chair design, and Yi ethnic lacquerware chairs (*e.g.*, “ethnic symbols,” “ICH,” “cultural regenerative design,” and “craft aesthetics”). Second, a five-person focus group discussion on design preferences for Yi ethnic lacquerware chairs was conducted, comprising two product design students, two Yi students with cultural knowledge, and one Yi lacquerware artisan. Frequently used terms from their everyday discourse on Yi lacquerware furniture design were extracted. Third, an expert panel of two researchers specializing in intangible cultural heritage and furniture product design was consulted to reconcile differences between professional terminology and user expressions. Based on contributions from the seven-member research group, a target keyword list was finalized to support subsequent automated data collection (Table 1).

**Table 1.** Target Words List

Type	Count	Key Characteristics
Yi Culture	19	Fire worship, totemic symbolism, oral traditions, reverence for the color black, cosmological beliefs, clan systems, ritual practices, cultural heritage, traditional craftsmanship, and color symbolism, ...
Yi Lacquerware	10	Natural lacquer, traditional hand-lacquering techniques, red–black chromatic contrast, spiral motifs, flame patterns, geometric compositions, and aesthetic integration, ...
Lacquerware Furniture	15	Lacquering techniques, material integration, surface gloss and texture, emotional resonance, decorative motifs, craftsmanship ethos, chromatic layering, and cultural symbolism, ...
Chair Design	9	Ergonomics, structural rationality, formal aesthetics, material expression, craftsmanship details, emotional design, and sustainable design, ...

This study selected Xiaohongshu (also known as “Little Red Book,” a Chinese lifestyle-oriented social media and e-commerce platform) and Weibo (a Chinese microblogging platform similar to Twitter) as the primary data sources. Data were collected using Python 3.9, which combined publicly available platform interfaces with web page content parsing to automatically extract textual information related to “Yi culture,” “Yi lacquerware,” “lacquerware furniture,” and “chair design”. The web crawler retrieved

posts, comments, and associated metadata containing the target keywords, including publication time, user nicknames, and regional tags, to ensure data completeness and representativeness. In addition, publicly available user interaction data—such as likes, bookmarks, and reposts—were incorporated as supplementary indicators. These data provide empirical support for subsequent analyses of the cultural dissemination patterns and design aesthetic orientations of Yi ethnic lacquerware chairs.

This study collected user comment data using RPA-based web crawling techniques, resulting in 72,795 textual records. The dataset comprised two primary categories. The first included comments directly related to Yi ethnic lacquerware chairs and associated ethnic furniture products, reflecting users' cognitive evaluations and emotional responses to aspects such as form design, comfort of use, craftsmanship quality, and cultural expression. The second category consisted of comments related to users' interest orientations and everyday life contexts, which were used to characterize aesthetic preferences and cultural identity within broader furniture consumption and cultural product usage scenarios. After removing duplicate and invalid entries, 49,671 valid text records were retained for subsequent Grounded Theory coding and the construction of the design requirement model (Tables 2 and 3 and Fig. 2).

**Table 2.** Classification of User's Emotional Tendency

Emotion Category	Number of Entries	Percentage (%)
Positive Emotions	36497	73.48
Neutral Emotions	6379	12.84
Negative Emotions	6795	13.68

**Table 3.** High Frequency Characteristic Words and Word Frequency Statistics

Item	Term Frequency	Item	Term Frequency	Item	Term Frequency
Yi Ethnic Group	2559	History	324	Raw lacquer	45
Culture	2503	Art	311	Furniture	34
Ethnicity	1734	Design	198	Pattern	30
Liangshan (Liangshan Yi Autonomous Prefecture, Sichuan Province, China)	980	Chair	110	Inspiration	25
Feelings	871	Creativity	103	Design Pattern	23
Cultural Inheritance	696	Craftsmanship	100	Hand-painted	23
Clothing	675	Lacquerware	94	Chinese style	23
Tradition	631	Cultural Heritage	82	Lacquer art	15
Life	539	Handmade	68		
China	499	Manufacturing	49		



**Fig. 2.** Word cloud of high-frequency keywords (original Chinese terms translated into English for presentation)

### User Need Coding Based on Grounded Theory

Based on the preprocessed online textual data, Grounded Theory was employed to extract user requirements through a structured coding process. During the data collection stage, a systematic literature review was conducted to obtain an in-depth understanding of the formal characteristics and cultural connotations of Yi ethnic lacquerware chairs. Relevant studies were retrieved from the CNKI (China National Knowledge Infrastructure) and Web of Science databases using the keywords “Yi lacquerware,” “lacquerware furniture,” and “chair design.” Key publications were then identified based on citation frequency and download metrics. In addition, the bibliometric analysis tool VOSviewer was employed to annotate and analyze the core literature. Grounded Theory requires rigorous analysis of raw data to identify latent patterns and relationships while ensuring the representativeness of selected participants and minimizing external bias (Belfrage and Hauf 2017). Accordingly, a careful selection process was undertaken to form an expert panel comprising 12 university professors specializing in Yi culture and Yi lacquerware furniture research, along with recognized inheritors of Yi lacquerware craftsmanship as intangible cultural heritage and professional furniture product designers. Based on insights from this expert panel, a semi-structured interview guide for Yi ethnic lacquerware chairs was developed (Tables 4 and 5).

Grounded Theory, as an inductive research approach, structures research findings into three stages: open, axial, and selective coding. This approach enhances the academic rigor and methodological completeness of the study (Reed *et al.* 2021). Formal interviews were conducted with 12 participants between 12 September and 21 October, 2025. This sample size is considered typical in phenomenological research, which emphasizes data depth and quality over quantity (Starks and Brown Trinidad 2007). The study employed both online (*via* Tencent Meeting) and offline semi-structured interviews. Interview durations ranged from 25 to 75 minutes, with an average of approximately 50 minutes. All interviews were audio-recorded and transcribed verbatim. Data analysis followed Braun and Clarke’s six-phase thematic analysis framework (Braun and Clarke 2006) and was supported by the qualitative analysis software NVivo 14.0.

**Table 4.** Semi-Structured Interview Protocol

No.	Semi-Structured Interview Questions
1	What is your overall assessment of Yi ethnic lacquerware chairs as an expression of traditional craftsmanship, and what distinguishes them most clearly from other forms of ethnic furniture?
2	Which Yi cultural elements—such as totemic motifs, flame patterns, or color schemes—do you consider most representative of Yi identity?
3	When encountering or using a Yi ethnic lacquerware chairs, do you experience cultural resonance or emotional identification? Please describe these perceptions.
4	Do the cultural identity or spiritual symbolism embodied in Yi ethnic lacquerware chairs evoke a particular sense of affinity or belonging for you?
5	In your view, how can traditional craftsmanship be effectively integrated with modern manufacturing technologies to preserve handcrafted aesthetics while enhancing functionality and practicality?
6	Beyond their utilitarian function, what cultural or social roles should Yi ethnic lacquerware chairs fulfill in contemporary society?

**Table 5.** Semi-structured Interview Demographics ( $n = 12$ )

Participants	Research Field	Age	Education	Workplace	Employment	Location
P1	Furniture Manufacturing	38	University	Manufacturing Factory	Designer	Qingdao
P2	Yi Lacquerware Lacquering Techniques (ICH Inheritor)	45	High School	Yi Lacquerware Workshop	Assistant ICH Inheritor	Liangshan Prefecture
P3	Ethnic Culture and Intangible Cultural Heritage Research	34	PhD	University	Lecturer	Chengdu
P4	Product Design (Furniture Specialization)	29	Master's	Furniture Company	Product Designer	Shenzhen
P5	Lacquerware Handcrafting and Cultural Creative Development	41	Associate	Cultural and Creative Enterprise	Craftsman	Kunming
P6	Environmental Design (ethnic Culture Integration)	36	Master's	University	Associate Professor	Qingdao
P7	Wood Structural Design and Furniture Engineering	39	Bachelor's	Furniture Enterprise	Senior Engineer	Qingdao
P8	Sociological Research on Yi Culture	48	PhD	Research Institute	Researcher	Xichang
P9	Lacquer Material Science and Coating Technology	41	PhD	University	Associate Professor	Nanjing
P10	Furniture User Experience and User Research	31	Master's	Design Consultancy	User Researcher	Hangzhou
P11	Cultural Creative Product Development (ethnic Crafts)	28	Bachelor's	Cultural Creative Brand	Product Manager	Chongqing
P12	Product Design (Furniture Specialization), Graduate Student	25	Master's Candidate	University	Graduate Student	Qingdao

**Table 6.** Grounded Theory Coding Results

Open Coding	Axial Coding	Selective Coding
A1 Yi totems; A2 flame motifs; A3 geometric patterns; A4 black–red color scheme; A5 ritual symbols; A6 cultural genes; A7 ethnic identity	B1 Cultural Symbols	C1 Cultural Genes
A8 cultural narratives; A9 oral traditions; A10 group symbolism; A11 historical continuity; A12 ICH spirit	B2 Cultural Narratives	
A13 aesthetic preference; A14 cultural identity; A15 sense of belonging; A16 sense of pride	B3 User Emotions	C2 Emotional Resonance
A17 ritual sensibility; A18 spiritual fulfillment; A19 cultural–psychological identification	B4 Emotional Value	
A20 seating comfort; A21 structural stability; A22 safety of use; A23 functional diversity	B5 Functional Needs	C3 Functional Optimization
A24 dimensional proportions; A25 portability; A26 ease of operation; A27 structural rationality	B6 Ease of Use	
A28 streamlined form; A29 spatial coordination; A30 proportional balance; A31 stylistic coherence	B7 Aesthetic Integration	
A32 natural lacquer; A33 wood texture; A34 hand lacquering; A35 craftsmanship details	B8 Craft Aesthetics	C4 Craft Innovation
A36 eco-friendly materials; A37 low-carbon processes; A38 material integration; A39 technological integration	B9 Material Innovation	
A40 brand recognition; A41 market acceptance; A42 cultural dissemination pathways	B10 Market Perception	C5 Sustainability
A43 social dissemination; A44 cultural marketing; A45 contextual experience; A46 cultural promotion	B11 Dissemination Pathways	
A47 environmental awareness; A48 ICH protection mechanisms; A49 social responsibility	B12 Sustainable Culture	
A50 design ethics; A51 social impact; A52 long-term value	B13 Social Sustainability	

To ensure analytical rigor and validity, three researchers independently coded the data and cross-validated the results. The open coding phase yielded 52 initial concepts (A1–A52). These were subsequently consolidated into 13 axial codes (B1–B13) and five selective codes (C1–C5). Detailed coding outcomes are reported in Table 6.

Grounded Theory seeks to progressively generate concepts, categories, and explanatory theoretical models through continuous comparison and inductive analysis of raw data. In this study, interview transcripts from 12 experts were systematically analyzed using a three-stage coding process—open, axial, and selective coding—resulting in the identification of 52 initial concepts. By the tenth interview, all newly derived data could be integrated into existing categories, with no additional concepts or categories emerging, indicating that theoretical saturation had been reached. To further strengthen the completeness and reliability of the findings, data from the remaining two expert interviews were also coded. This analysis similarly produced no new concepts or categories, thereby confirming the adequacy and stability of theoretical saturation (Liu *et al.* 2024). The resulting coding structure provided a theoretical foundation for the subsequent classification and quantification of user requirements using the Kano model and AHP.

### **User Requirement Classification Based on the Kano Model**

Based on the three-stage coding results derived from Grounded Theory, the 52 user concepts identified through open coding were consolidated into five core requirement categories—cultural genes, emotional resonance, functional optimization, craft innovation, and sustainability—through axial and selective coding. On this basis, a Kano questionnaire comprising 13 items was developed, with each item formulated as paired functional and dysfunctional questions to evaluate users' satisfaction characteristics across different design attributes of Yi ethnic lacquerware chairs. The questionnaire not only reflects the findings of the user corpus analysis but also demonstrates the methodological transition from qualitative inquiry to quantitative assessment.

#### *Questionnaire construction*

Based on the open coding results derived from Grounded Theory (GT), a Kano-based user requirement satisfaction scale was developed to systematically classify functional attributes according to user perceptions (Madzik *et al.* 2019). The questionnaire employs a dual-dimensional evaluation framework, in which respondents assess each requirement attribute from two perspectives: perceived satisfaction when the function is present and perceived dissatisfaction when the function is absent. In this framework, each requirement is assessed using a pair of questions: a functional question evaluating responses when the feature is present, and a dysfunctional question assessing reactions when it is absent.

This bidirectional design captures the asymmetric relationship between feature performance and user satisfaction, allowing requirements to be classified into Kano categories such as must-be, one-dimensional, and attractive attributes. To enhance data reliability, a five-point Likert scale was adopted, with scores ranging from 1 (“not important at all”) to 5 (“very important”). Compared with higher-order scales, the five-point scale offers moderate complexity and effectively reduces respondents' cognitive load, making it widely applicable in questionnaire-based research (Table 7).

**Table 7.** Kano Questionnaire Structure

User Requirement	Question	Dislike	Tolerable	Neutral	Expected	Like
Cultural Symbols	How would you feel if the chair design incorporates Yi totems, flame motifs, or other cultural symbols?					
	How would you feel if the chair design does not reflect any Yi cultural symbols?					

*Data collection*

Data were collected using a combination of online and offline questionnaire distribution. The survey was conducted between November 20 and December 18, 2025, at two public parks in Xichang City, Sichuan Province, China—Wanghai Park and Tangyuan Park—which were selected as representative sampling sites. Structured questionnaires were administered through face-to-face interactions to obtain authentic user feedback on the functional attributes of Yi ethnic lacquerware chairs from typical user groups. In total, 290 questionnaires were distributed, including 170 at Wanghai Park and 120 at Tangyuan Park. Of these, 257 valid responses were collected, comprising 156 from Wanghai Park and 101 from Tangyuan Park. By targeting representative user populations and aligning data collection with the questionnaire design, this study generated diverse empirical data, providing a robust foundation for subsequent statistical analyses and model validation (Table 8).

**Table 8.** Kano Model Evaluation Classification Matrix

Function/Service		Dysfunctional Question				
		Dislike (1)	Tolerable (2)	Indifferent (3)	Expected (4)	Like (5)
Functional Question	Dislike (1)	Q	R	R	R	R
	Tolerable (2)	M	I	I	I	R
	Indifferent (3)	M	I	I	I	R
	Expected (4)	M	I	I	I	R
	Like (5)	O	A	A	A	Q

Notes: A = Attractive attribute; O = One-dimensional (performance) attribute; M = Must-be attribute; I = Indifferent attribute; R = Reverse attribute; Q = Questionable attribute.

*Reliability and validity testing*

Based on the user survey data, SPSS was used to conduct a comprehensive assessment of reliability and validity, with detailed results reported in Table 9. Reliability was first evaluated using Cronbach's alpha to assess the internal consistency of the measurement scale. The overall Cronbach's  $\alpha$  value was 0.822, exceeding the recommended threshold of 0.7 and indicating satisfactory reliability and strong internal consistency. To examine the suitability of the data for the proposed theoretical model, structural validity was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity within a six-dimensional evaluation framework. The KMO

value reached 0.666, surpassing the acceptable criterion of 0.6, while Bartlett’s test was statistically significant ( $p = 0.000 < 0.05$ ). Together, these results confirm the adequacy, quality, and representativeness of the dataset, providing a robust empirical foundation for subsequent multifactorial analyses.

**Table 9.** Overall Reliability and Validity Results of the Questionnaire (n = 257)

Test	Indicator	Value
Cronbach’s Test	Cronbach’s $\alpha$	0.822
Bartlett’s Test of Sphericity	KMO measure	0.666
	Bartlett’s chi-square	7055.061
	Degrees of freedom (df)	325
	p-value	0.000

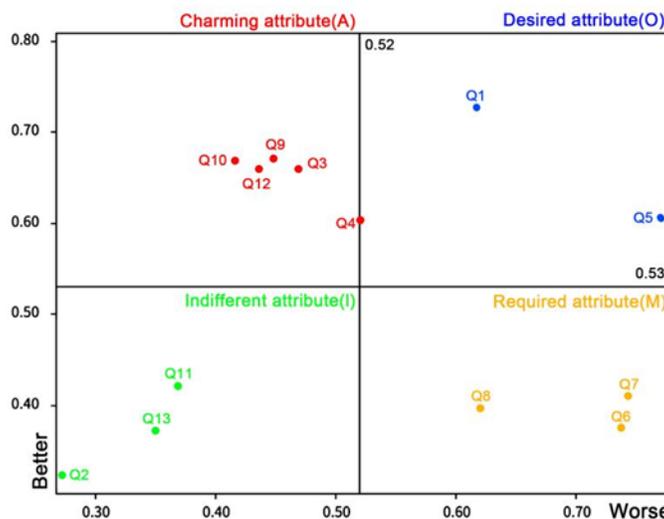
*Kano classification results*

Based on the Kano model, this study performed a statistical analysis to classify the requirement attributes associated with each evaluation indicator. The detailed classification results are presented in Table 10. For each functional attribute, the final category was determined by identifying the most frequently selected requirement type in respondents’ evaluations. The results show that the requirement items were distributed across must-be (M), one-dimensional (O), attractive (A), indifferent (I), reverse (R), and questionable (Q) categories. This distribution indicates that the evaluation indicator system exhibits strong discriminative capability and adequate representativeness.

Furthermore, each functional attribute was subjected to comparative analysis based on the Kano classification matrix, and the Satisfaction Impact (SI) and Dissatisfaction Impact (DSI) coefficients were calculated to quantify the influence of different attributes on user perception. The corresponding calculations are presented in Eq. 1 and 2.

$$SI = \frac{(A+O')}{(A+O'+M+I)} \tag{1}$$

$$DSI = -\frac{(O'+M')}{(A+O'+M+I)} \tag{2}$$



**Fig. 3.** Better-worse analysis results

**Table 10.** Results of the Kano Analysis

No.	A	O	M	I	R	Q	Type	Better	Worse
Q1 Cultural Symbols	34.63%	37.74%	23.74%	3.50%	0.39%	0.00%	O	72.66%	-61.72%
Q2 Cultural Narratives	22.18%	10.12%	17.12%	50.58%	0.00%	0.00%	I	32.30%	-27.24%
Q3 User Emotions	48.25%	18.29%	28.79%	4.67%	0.00%	0.00%	A	66.54%	-47.08%
Q4 Emotional Value	42.80%	17.12%	35.02%	4.67%	0.00%	0.39%	A	60.16%	-52.34%
Q5 Functional Needs	5.06%	54.47%	21.40%	17.51%	0.00%	1.56%	O	60.47%	-77.08%
Q6 Ease of Use	21.40%	14.01%	56.03%	3.50%	3.50%	1.56%	M	37.30%	-73.77%
Q7 Aesthetic Integration	20.62%	20.23%	54.09%	5.06%	0.00%	0.00%	M	40.86%	-74.32%
Q8 Craft Aesthetics	21.79%	17.12%	43.97%	15.56%	1.56%	0.00%	M	39.53%	-62.06%
Q9 Material Innovation	50.19%	17.51%	27.63%	4.67%	0.00%	0.00%	A	67.70%	-45.14%
Q10 Market Perception	53.31%	14.01%	27.63%	4.67%	0.00%	0.39%	A	67.58%	-41.80%
Q11 Dissemination Pathways	23.35%	18.68%	18.29%	39.69%	0.00%	0.00%	I	42.02%	-36.96%
Q12 Sustainable Culture	50.97%	15.18%	28.40%	4.67%	0.00%	0.78%	A	66.67%	-43.92%
Q13 Social Sustainability	20.62%	15.56%	18.68%	42.80%	0.00%	2.33%	I	37.05%	-35.06%

Notes: A = Attractive attribute; O = One-dimensional (performance) attribute; M = Must-be attribute; I = Indifferent attribute; R = Reverse attribute; Q = Questionable attribute.

The positive and negative coefficients reflect the sensitivity of each indicator to user satisfaction. A higher SI value indicates that an attribute contributes more strongly to enhancing user satisfaction, whereas a lower DSI value suggests that its absence is more likely to generate substantial dissatisfaction (McKelvie 1978). The detailed results are presented in Fig. 3.

### User Requirement Weight Calculation and Ranking Based on AHP

After constructing the hierarchical model of user requirements, the Analytic Hierarchy Process (AHP) was employed to develop judgment matrices for user needs. This method facilitates the hierarchical decomposition of complex, multi-objective decision problems. Consistency tests were subsequently conducted to verify the validity of the judgments and to determine the relative weights of user requirements, thereby reducing decision bias and improving the reliability of the weighting results.

### Construction of the Hierarchical Structure Model

Before conducting the AHP-based quantitative weighting analysis, user requirements were systematically organized into hierarchical levels to clearly define evaluation objectives and weight allocation pathways. Based on the classification of user requirements derived from prior Kano model studies, a three-level hierarchical structure was established, consisting of a goal level, a criteria level, and a sub-criteria level.

As illustrated in Fig. 4, the goal level centers on the “core requirements of Yi ethnic lacquerware chairs design,” thereby defining the primary decision objective of the study. The criteria level incorporates three key requirement categories from the Kano model that positively influence user satisfaction: attractive (A), one-dimensional (O), and must-be (M) requirements. This configuration retains the theoretical strength of the Kano model in capturing the asymmetric nature of user satisfaction responses, while excluding indifferent (I) and reverse (R) requirements from the evaluation framework. As a result, the discriminative capacity and precision of weight allocation are enhanced (Peterson and Kim 2013). At the sub-criteria level, ten representative functional attributes are systematically mapped. Together, this AHP-based hierarchical structure establishes a coherent linkage between the user satisfaction model and the functional attribute system, providing a computable foundation for subsequent quantitative weight determination.

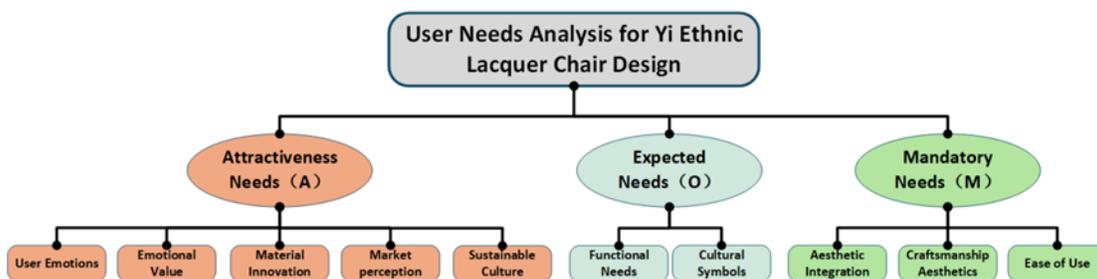


Fig. 4. Hierarchical structure of user requirements based on AHP

### Construction of the Judgment Matrix and Weight Calculation

After establishing the hierarchical structure model, 12 experts from the fields of environmental design, product design, and furniture design were invited to perform pairwise comparisons of indicators at each level using Saaty’s 1–9 scale. Based on these comparisons, a judgment matrix was constructed as follows,

$$A=(a_{ij})_{n \times n} \quad (3)$$

where  $a_{ij}$  represents the relative importance of indicator  $i$  compared with indicator  $j$ , subject to the conditions  $a_{ij} > 0$ ,  $a_{ii} = 1$ , and

$$a_{ij} = \frac{1}{a_{ji}}, (i, j = 1, 2, 3, \dots, n) \quad (4)$$

To determine the indicator weights  $\omega$ , the maximum eigenvalue  $\lambda_{\max}$  of the judgment matrix was calculated through the following steps. First, each column of matrix A was normalized in Eq. 5.

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} (i, j = 1, 2, 3, \dots, n) \quad (5)$$

Second, the normalized matrix was summed row by row, as in Eq. 6.

$$c_i = \sum_{j=1}^n b_{ij} (i, j = 1, 2, 3, \dots, n) \quad (6)$$

Finally, the vector  $C=(c_1, c_2, \dots, c_n)$  was normalized to obtain the weight  $\omega_i$  ( $i=1, 2, 3, \dots, n$ ), as shown in Eq. 7.

$$\omega_i = \frac{c_i}{\sum_{i=1}^n c_i} (i=1, 2, 3, \dots, n) \quad (7)$$

Based on Eq. 3, a judgment matrix for the criteria level of user requirements for Yi ethnic lacquerware chairs was first constructed, as presented in Table 11, and the relative weights of each requirement were calculated using Eqs. 4 through 6. The same procedure was applied to construct judgment matrices for the ten functional attributes at the sub-criteria level, with the corresponding results reported in Table 12. Subsequently, sub-criteria weights were combined with their respective upper-level criteria weights through weighted aggregation and normalized to derive the composite weight of each functional attribute within the overall hierarchical structure. Finally, all indicators were ranked according to their composite weight values.

As illustrated in Fig. 5, the composite weight analysis reveals that cultural and emotional factors dominates the user requirement structure of Yi ethnic lacquerware chairs. Cultural symbols (0.2060) exhibit the highest weight, indicating that users place markedly greater emphasis on Yi totems, color symbolism, and other cultural identifiers than on alternative design factors. Cultural recognizability therefore emerges as the primary driver of user preference. This is followed by user emotions (0.1915) and emotional value (0.1680), highlighting the decisive role of cultural affect, identity recognition, and emotional resonance in shaping the usage experience. Collectively, these findings demonstrate that emotional dimensions strongly influence users' acceptance of and affinity toward lacquerware chairs.

At the functional level, functional requirements (0.1030), although important, rank substantially lower than cultural and emotional factors. This pattern reflects a distinctly non-utilitarian hierarchy of user needs, characterized by a "culture–emotion–function" sequence. The relatively high weights assigned to sustainable culture (0.1029) and market perception (0.0722) further indicate that users consider not only the intrinsic qualities of the product but also its cultural dissemination, environmental responsibility, and market positioning. In contrast, more technical and form-oriented factors—such as material innovation (0.0471), craft aesthetics (0.0485), and aesthetic integration (0.0424)—exert a moderate influence. This suggests a consistent user concern for craftsmanship quality, albeit one that is secondary to cultural and emotional dimensions. Ease of use (0.0185)

receives the lowest weight, implying that users do not perceive it as a decisive attribute; rather, basic functionality is treated as a default condition that contributes little to differentiated satisfaction.

**Table 11.** Criteria-Level Judgment Matrix

User Requirements for Yi Ethnic Lacquerware Chairs Design	One-Dimensional Requirements (O)	Attractive Requirements (A)	Must-Be Requirements (M)	Relative Weight
One-Dimensional Requirements (O)	1	1/2	3	0.3090
Attractive Requirements (A)	2	1	5	0.5816
Must-Be Requirements (M)	1/3	1/5	1	0.1095

**Table 12.** Sub-Criteria–Level Judgment Matrices

Primary Category	Secondary Indicator	Judgment Matrix					Relative Weight
Attractiveness Needs(A)	A1 User Emotions	1	1	4	3	2	0.3293
	A2 Emotional Value	1	1	3	2	2	0.2888
	A3 Material Innovation	1/4	1/3	1	1/2	1/2	0.0809
	A4 Market perception	1/3	1/2	2	1	1/2	0.1241
	A5 Sustainable Culture	1/2	1/2	2	2	1	0.1769
Expected Needs(O)	O1 Functional Needs	1	1/2	/			0.3333
	O2 Cultural Symbols	2	1				0.6667
Mandatory Needs(M)	M1 Aesthetic Integration	1	1	3	/		0.4434
	M2 Craftsmanship Aesthetics	1	1	2			0.3874
	M3 Ease of Use	1/3	1/2	1			0.1692



**Fig. 5.** Hierarchical ranking of user requirements

Overall, these findings offer clear guidance for prioritizing the design of Yi ethnic lacquerware chairs. Design emphasis should move beyond a predominantly function-oriented approach toward a core focus on cultural expression and emotional resonance. By reinforcing pattern symbolism, cultural narratives, and user emotional experiences, designers can create cultural product value that is both highly recognizable and emotionally engaging. Simultaneously, maintaining essential functionality while incorporating

appropriate craftsmanship innovation and sustainability principles can significantly enhance user satisfaction and the effectiveness of cultural dissemination.

### Consistency Test

After deriving the weights for each judgment matrix, the logical consistency of expert evaluations was examined to ensure that the resulting weight system is statistically valid (Deng *et al.* 2023).

First, the maximum eigenvalue  $\lambda_{max}$  of the judgment matrix was calculated using the eigenvector method,

$$\lambda_{max} = \sum_{i=1}^n \frac{(P\omega)_i}{n\omega_i} \quad (i, j=1, 2, 3, \dots, n) \quad (8)$$

where  $(P\omega)_i$  denotes the  $i$ -th component of the vector obtained by multiplying the judgment matrix  $P$  by the weight vector  $\omega$ , and  $n$  represents the order of the judgment matrix.

Subsequently, the consistency index (CI) was calculated based on  $\lambda_{max}$ :

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (9)$$

With reference to the random consistency index (RI) proposed by Saaty, the consistency ratio (CR) was then computed as:

$$CR = \frac{CI}{RI} \quad (10)$$

When  $CR < 0.1$ , the judgment matrix is considered to exhibit acceptable consistency, indicating that expert judgments show no significant logical bias and that the derived weights are suitable for subsequent decision analysis (Madzík *et al.*, 2024).

Following this procedure, consistency tests were performed for both the criteria level and the sub-criteria level, as presented in Table 13. All CR values were below 0.1, confirming that the data met the consistency requirements. These results demonstrate a high level of agreement among expert evaluations, indicating that the weight system is both statistically and logically sound and can serve as a reliable quantitative basis for subsequent QFD analysis.

**Table 13.** Consistency Test Results

Index	P	M	O	A
$\lambda_{max}$	3.0037	3.0183	2.0000	5.0654
CI	0.0036	0.0176	0.0000	0.0146
RI	0.52	0.52	0.00	1.12
CR	0.007	0.034	0	0.013

Notes: CI, consistency index; CR, random consistency index

### Transformation of Requirements into Technical Characteristics

After establishing the priority weights of user requirements, this study introduced the Quality Function Deployment (QFD) method to systematically translate user requirements into actionable technical characteristics, thereby forming a bidirectionally coupled “requirement–technology” transformation mechanism. QFD provides a structured approach to ensuring that user requirements are identified, addressed, and embedded at the early stages of product development, offering clear guidance for subsequent functional realization (Wang *et al.* 2013).

To ensure the methodological rigor of the QFD analysis, the research team selected the top 50% of high-priority user requirements—11 items in total—based on the weights derived from the AHP model, and used them as the core inputs for technical mapping. This strategy follows the Pareto principle in optimizing user satisfaction while effectively controlling the structural complexity of the House of Quality, thereby improving analytical focus and visualization efficiency (Padilla-Garrido *et al.* 2014). To achieve an accurate correspondence between technical attributes and user requirements, insights from prior user interviews, expert workshops, and representative case studies were synthesized to preliminarily identify a pool of potential technical attributes relevant to Yi ethnic lacquerware chairs design. Subsequently, an independent panel of 12 multidisciplinary experts conducted multiple rounds of relevance evaluation on these mappings. Through iterative assessment and cross-validation, 11 key technical characteristics were ultimately confirmed, as presented in Table 14.

**Table 14.** Requirement–Technology Mapping for Yi Ethnic Lacquerware Chairs Design

Goal Level	Criteria Level	Sub-Criteria Level	Technical Characteristics
Yi Ethnic Lacquerware Chairs Design	M	M1 Aesthetic Integration	D1 Coordinated design of form and decorative patterns
		M2 Craft Aesthetics	D2 Fine-grained natural lacquer coating techniques
		M3 Ease of Use	D3 Lightweight and portable structural design
	O	O2 Cultural Symbols	D4 Digital integration of Yi cultural patterns
		O1 Functional Requirements	D5 High-strength mortise-and-tenon structural system
	A	A1 User Emotions	D6 Cultural theme–oriented form expression
		A2 Emotional Value	D7 Narrative-based pattern expression system
		A5 Sustainable Culture	D8 Sustainable application framework for ICH craftsmanship
		A4 Market Perception	D9 Standardized pattern and color scheme system
		A3 Material Innovation	D10 Application of composite natural lacquer materials

The House of Quality (HOQ) serves as the core analytical tool of Quality Function Deployment (QFD). It consists of three primary components: the requirement–technology matrix, the correlation matrix, and the technical interaction matrix. Together, these elements are used to evaluate and calibrate the degree of alignment and feasibility between user requirements and technical characteristics (Hu *et al.* 2024). Within this structured analytical framework, researchers can quantitatively and transparently assess the contribution of different technical pathways to satisfying specific user requirements, while also identifying priority rankings and potential synergies among technical solutions in practical applications.

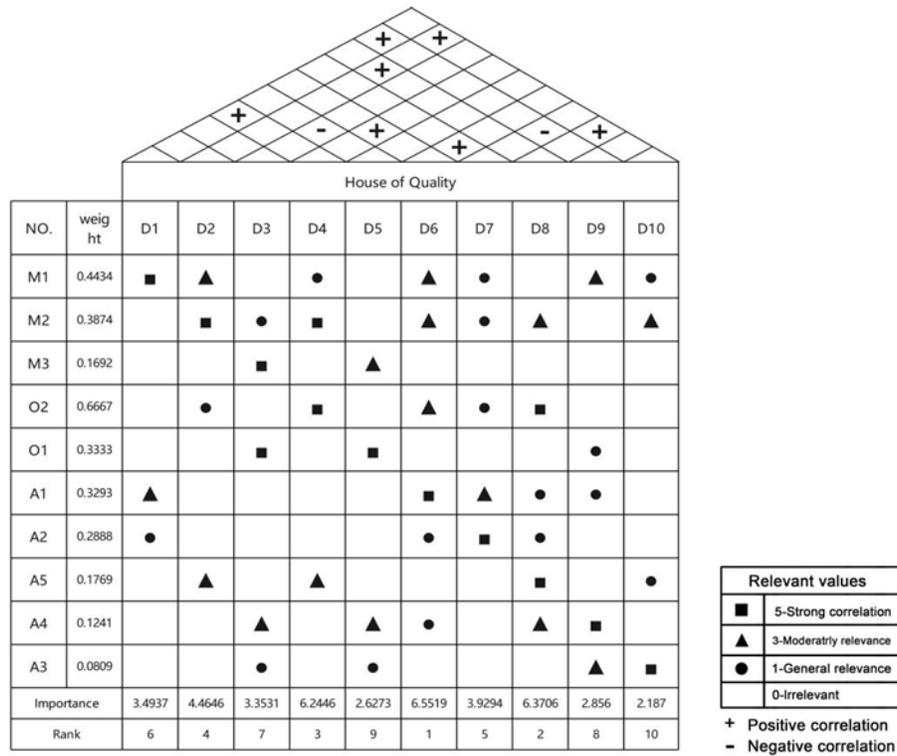


Fig. 6. House of quality (HOQ) model for Yi ethnic lacquerware chairs design

In this study, a comprehensive House of Quality (HOQ) model was constructed based on the 10 user requirements and their corresponding technical characteristics identified in the preceding stages. Eight active users were randomly selected from each of the two parks (Xichang City, Sichuan Province, China). Together with the twelve experts described above, they formed a QFD evaluation panel consisting of 20 participants. A collaborative scoring method was employed to assign values to the strength of association between each pair of user requirements and technical characteristics, resulting in the construction of the HOQ relationship matrix. As illustrated in Fig. 6, user requirements are positioned on the “left wall” of the HOQ, their composite weights are placed on the “right wall,” and technical characteristics are arranged along the “top wall,” thereby forming an engineering-oriented design response structure. Positive and negative correlations between technical characteristics are indicated by “+” and “-” symbols, respectively, which together constitute the roof of the HOQ. Regarding the scoring rules, associations were evaluated based on the relationships between user requirements and the technical characteristics of Yi ethnic lacquerware chairs, with the chair design treated as the central “room” of the HOQ. The strength of each association is represented by the symbols “■” “▲” and “●” corresponding to numerical values of 5, 3, and 1, respectively, while a blank cell indicates a value of 0. These symbols denote strong, moderate, weak, and no association, respectively (Dunford *et al.* 2014). The formulas used to calculate the weights are presented below,

$$w'_i = \frac{W_i}{\sum_{i=1}^n w_i} \tag{10}$$

$$w_j = \sum_{i=1}^n w'_i R_{ij} \tag{11}$$

$$w'_j = \frac{W_j}{\sum_{j=1}^n w_j} \quad (12)$$

where  $w'_i$  denotes the relative importance of user requirements;  $w_i$  represents their absolute importance;  $R_{ij}$  denotes the correlation coefficient;  $w_j$  indicates the importance of quality characteristics; and  $w'_j$  represents their relative importance (Fig. 6).

### Analysis of QFD Results

To further elucidate the priority distribution of technical elements in Yi ethnic lacquerware Chairs design, this study classified technical characteristics into three importance levels based on the composite importance values obtained from the QFD analysis. Characteristics with values greater than 6 were designated as Level 1 (high priority), those ranging from 3 to 6 as Level 2 (medium priority), and those below 3 as Level 3 (low priority). On this basis, a structured synthesis of the functional configuration and a ranked hierarchy of technical attributes were established. As presented in Table 15, the overall functional deployment strategy for Yi ethnic lacquerware Chairs is systematically summarized and refined.

**Table 15.** Importance Ranking of Technical Characteristics for Yi Ethnic Lacquerware Chairs

Level	Requirement Attribute	Design Element (Functional Attribute)	Priority Rank
Level 1	A	D6 Cultural theme-oriented form expression	1
	A	D8 Sustainable application system of intangible cultural heritage craftsmanship	2
	O	D4 Digital integration of Yi ethnic patterns	3
Level 2	M	D2 Fine natural lacquer coating craftsmanship	4
	A	D7 Narrative pattern expression system	5
	M	D1 Coordinated form and pattern design	6
Level 3	M	D3 Lightweight and portable structural design	7
	A	D9 Standardized pattern and color system	8
	O	D5 High-strength mortise-and-tenon structure	9
	A	D10 Application of composite natural lacquer materials	10

#### *Level-1 functional analysis*

At the primary functional level, the design objectives of Yi ethnic lacquerware chairs focus on two core values: Cultural recognizability and sustainability. Together, these values define the product's overarching design logic. First, D6: cultural theme-oriented form expression, identified as the highest-weighted design element, enables a tangible representation of ethnic culture through visual components such as totemic motifs, symbolic color schemes, and narrative forms. Users' preferences for cultural symbols and their emotional engagement closely correspond to the "reflective level" in Norman's emotional design theory, in which cultural meaning is cognitively interpreted to establish emotional connections with products and reinforce perceptions of ethnic identity. Second, D8: a sustainable application system for intangible cultural heritage (ICH) craftsmanship ranks next in importance, reflecting users' intention to balance cultural continuity with environmental responsibility. By integrating traditional lacquering techniques with contemporary sustainability standards (e.g., ISO 14001), the design both preserves the vitality of ICH practices and addresses modern expectations for life-cycle-oriented green

design. Third, D4: digital integration of Yi patterns employs digital technologies to achieve accurate translation and innovative reinterpretation of traditional motifs, thereby enhancing the dissemination potential of cultural symbols in contemporary contexts. This approach aligns with the concept of “cultural translation” in digital heritage conservation, whereby traditional cultural elements are adapted to new contexts and generate renewed value through digital platforms. Overall, the primary functional layer—anchored in cultural centrality and sustainability—establishes the foundational framework for innovative Yi ethnic lacquerware chairs design and clarifies the product’s positioning between cultural heritage preservation and contemporary user demands.

#### *Level-2 functional analysis*

The secondary functional layer focuses on deepening craft aesthetics and constructing a coherent narrative system to reinforce the core values established at the primary level through enhanced aesthetic quality and cultural experience. D2: refined natural lacquer coating craftsmanship, as the principal vehicle of traditional techniques, strengthens material authenticity and artisanal expressiveness *via* handcrafted textures and material articulation, thereby heightening users’ tactile and cultural engagement during use. D7: narrative pattern expression system develops a culturally inflected visual language through motif integration, symbolic logic, and structured storytelling, increasing cultural immersion and contextual participation. This approach aligns with narrative design principles, whereby visual symbols convey cultural stories and facilitate the internalization of cultural identity through aesthetic experience. Furthermore, D1: coordinated form and pattern design ensures structural and visual coherence between seating forms and cultural elements, yielding a more unified and complete aesthetic expression. Collectively, the progressive integration of craftsmanship, cultural narration, and formal coherence deepens the primary-level cultural expression, transforming traditional culture from symbolic display into a perceptible, experiential aesthetic system and thereby strengthening users’ emotional attachment and cultural identification.

#### *Level-3 functional analysis*

The tertiary functional layer addresses product practicality and the optimization of technical details. Although these functions are assigned lower priority within the user requirement hierarchy, they are critical to product feasibility and market scalability. D3, lightweight and portable structural design, enhances mobility and spatial adaptability, enabling flexible deployment across diverse usage contexts. D5, high-strength mortise-and-tenon structures, preserve traditional furniture craftsmanship while improving structural stability and durability, thereby enhancing safety and ensuring reliability in contemporary applications. D10, the application of composite natural lacquer materials, integrates traditional techniques with modern material engineering to improve durability and environmental adaptability, expanding the potential for the contemporary use of traditional craftsmanship. D9, the establishment of standardized pattern and color systems, strengthens brand recognition and production consistency, thereby increasing reproducibility and market diffusion. Collectively, the tertiary functional layer follows a logical progression from structure to materials to standardization, providing a robust technical foundation for mass production, functional performance, and usage safety, and enabling cultural expression to be effectively integrated into modern industrial systems.

## RESULTS AND DISCUSSION

### Design Scheme Generation

To enable the efficient translation of user requirements into implementable design solutions, this study built upon the QFD analysis to develop a hybrid rapid-prototyping workflow using Doubao and Google Nano Banana. This workflow was designed to enhance semantic fidelity and improve functional coverage during the early stages of design development (Alexander 2017). The ten key design elements identified in the QFD phase, along with their priority weights, were employed as the primary semantic inputs. Design prompts were formulated using a triadic semantic framework—function, form, and lacquer craftsmanship—to generate visual sketch proposals for Yi ethnic lacquerware chairs. Through iterative generation, a series of candidate prototypes was produced, forming a preliminary design dataset for Yi ethnic lacquerware chairs (Fig. 7).



Fig. 7. Dataset of Yi ethnic lacquerware chairs designs



Fig. 8. Design proposals 1–3 for Yi ethnic lacquerware chairs

The research team then conducted a systematic evaluation based on functional coverage, semantic congruence, and design completeness, ultimately selecting three highly representative and well-aligned schemes. These selected proposals constitute the core design outcomes of the present study (Fig. 8).

### Evaluation of Design Proposals

To reduce the inherent subjectivity associated with QFD and expert-based scoring and to achieve an objective ranking of multiple design alternatives, this study employed the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) for the comprehensive evaluation of Yi ethnic lacquerware chairs design proposals. By relying on quantitative distance measures, TOPSIS minimizes subjective bias and supports scientifically robust decision-making through assessing the relative proximity of each alternative to an ideal solution (Fu *et al.* 2022; Shirali *et al.* 2023).

To ensure the accuracy and validity of the evaluation results, a panel comprising two Yi ethnic students familiar with Yi lacquerware, five professors specializing in furniture design, and three professional furniture designers was convened to evaluate the three design proposals. Each evaluator assessed 13 design factors for each proposal using a 10-point rating scale. The scale was defined as follows: scores of 1–3 indicate very poor performance; 3–5 indicate inadequate performance; 5–6 indicate good performance; 6–8 indicate excellent performance; and 8–10 indicate outstanding performance. The arithmetic mean of the scores was calculated to obtain the initial evaluation values. Based on these values, the initial evaluation matrix was constructed using Eq. 13, as shown in Table 16.

$$X = (X_{ij})_{mn} \quad (13)$$

**Table 16.** Initial Evaluation Matrix

Requirement Category	Design Element (Functional Attribute)	Proposal 1	Proposal 2	Proposal 3
A	D6 Cultural theme-oriented form expression	8.2	8	9
A	D8 Sustainable application system for intangible cultural heritage craftsmanship	7.9	8	9
O	D4 Digital integration of Yi ethnic patterns	8.4	7.3	9
M	D2 Fine natural lacquer coating craftsmanship	7	8	8
A	D7 Narrative pattern expression system	8	7	9
M	D1 Coordinated form and pattern design	7.6	8	8.7
M	D3 Lightweight and portable structural design	7	7	8
A	D9 Standardized pattern and color system	7	7	8
O	D5 High-strength mortise-and-tenon structure	7.7	8	8
A	D10 Application of composite natural lacquer materials	7	7	8

The weighted normalized matrix was subsequently computed. The initial evaluation matrix is defined in Equation (14), and the corresponding weighted normalized

evaluation matrix is presented in Equation (15). The weighted normalized matrix  $Z=(Z_{ij})_{mn}$  is calculated as follows:

$$Y_{ij}=\frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}} \quad (i=1,2\dots m,j=1,2\dots n) \quad (14)$$

$$Z_{ij}=W_j Y_{ij} \quad (i=1,2\dots m,j=1,2\dots n) \quad (15)$$

Subsequently, the positive ideal solution and the negative ideal solution for the evaluation alternatives were determined. The computation of the positive ideal solution is given in Eq. 16, while the negative ideal solution is defined in Eq. 17. The resulting positive and negative ideal solutions, denoted as  $Z^+$  and  $Z^-$ , respectively, are reported in Table 17.

$$Z^+=(Z_1^+,Z_2^+,\dots,Z_n^+) \quad (16)$$

$$Z^-= (Z_1^-,Z_2^-, \dots,Z_n^-) \quad (17)$$

**Table 17.** Positive and Negative Ideal Solutions in the TOPSIS Evaluation

Item	Positive Ideal Solution ( $Z^+$ )	Negative Ideal Solution ( $Z^-$ )
D6	0.981	0.000
D8	0.996	0.000
D4	0.840	0.000
D2	0.707	0.000
D7	0.894	0.000
D1	0.940	0.000
D3	1.000	0.000
D9	1.000	0.000
D5	0.707	0.000
D10	1.000	0.000

The Euclidean distances  $D^+$  and  $D^-$  from each of the three design alternatives to the positive and negative ideal solutions, respectively, were calculated using Eqs. 18 and 19. Based on these distances, the closeness coefficient  $C$  for each alternative was subsequently determined. A higher value of  $C$ , approaching 1, indicates closer proximity to the ideal solution and thus superior overall performance. The computation of  $C$  is defined in Equation (20), and the final TOPSIS evaluation results are reported in Table 18.

$$D_i^+=\sqrt{\sum_{i=1}^n (Z^+-Z_{ij})^2} \quad (18)$$

$$D_i^-=\sqrt{\sum_{i=1}^n (Z^- -Z_{ij})^2} \quad (19)$$

$$C_i=\frac{D_i^-}{D_i^++D_i^-} \quad (20)$$

**Table 18.** Results of the TOPSIS Evaluation

Item	Distance to Positive Ideal Solution ( $D^+$ )	Distance to Negative Ideal Solution ( $D^-$ )	Relative Closeness ( $C$ )	Rank
Alternative 1	0.797	0.262	0.247	3
Alternative 2	0.826	0.309	0.272	2
Alternative 3	0.000	0.915	1.000	1

## **Systematic Validation of a Culture- and Emotion-Driven User Requirement Structure**

The results indicate that, within the user requirement system for Yi ethnic lacquerware chairs, cultural symbols, emotional resonance, and cultural identity constitute the dominant driving forces, exerting substantially greater influence than functional and technical requirements. This finding suggests that the value of ethnic cultural furniture extends beyond utilitarian performance and is primarily rooted in its capacity to construct cultural identity, foster emotional attachment, and convey narrative meaning. The Kano classification further revealed the asymmetric nature of this requirement structure: cultural form and narrative symbolism are identified as attractive requirements (A), which generate the strongest positive effects on user satisfaction, whereas craftsmanship stability and structural safety are classified as must-be requirements (M), whose absence results in dissatisfaction but whose presence does not significantly enhance satisfaction. Overall, user requirements exhibit a clear culture- and emotion-first pattern, consistent with the concept of reflective-level emotion in Norman's emotional design theory. This correspondence highlights cultural meaning as a critical determinant of user acceptance of ethnic cultural furniture.

## **Sustainability and Digitalization as Key Technical Pathways for Cultural Translation**

The QFD-based technology mapping identifies cultural theme-oriented form expression, sustainable application systems for intangible cultural heritage (ICH) craftsmanship, and digital integration of Yi patterns as the three most critical technical characteristics in the design process. These findings indicate that the modernization of ethnic cultural products extends beyond the mere reuse of symbolic elements. Instead, it involves a systematic enhancement of cultural expression through digital technologies that increase precision and communicability, together with sustainable techniques that reinforce the vitality and contemporary adaptability of traditional craftsmanship. Accordingly, cultural translation emerges as a composite pathway characterized by digitalization-sustainability-narrativity, which not only addresses current imperatives in ICH preservation but also provides a technically viable foundation for the industrialization and contemporary evolution of cultural products.

## **A Multi-Method Integrated Framework Strengthening the Logical Chain from User Requirements to Design Solutions**

The integrated framework proposed in this study—NLP - GT - Kano - AHP - QFD - TOPSIS—helps address long-standing challenges in traditional cultural product design, including ambiguous user requirements, misclassification of requirement attributes, and discontinuities between requirements and technical solutions. Natural language processing (NLP) and Grounded Theory establish an empirical foundation by systematically eliciting authentic user needs, while the Kano model distinguishes differentiated response mechanisms across requirement attributes. The Analytic Hierarchy Process (AHP) and Quality Function Deployment (QFD) further quantify abstract requirements and translate them into specific technical characteristics, and TOPSIS provides an objective and methodologically rigorous evaluation of design alternatives. Through the coordinated integration of these methods, a closed-loop logic linking “user expression” and “design implementation” is established, thereby enhancing the interpretability, traceability, and verifiability of ethnic cultural product design.

## Design Evaluation Confirming the Priority of Culture, Sustainability, and Narrativity

The TOPSIS evaluation results demonstrate that Proposal 3 significantly outperformed the other alternatives in terms of cultural expression depth, narrative completeness, and the realization of sustainable craftsmanship. Its final score shows a high degree of consistency with the technical weight rankings derived from the QFD analysis. These findings indicate that, in the design of ethnic cultural furniture, prioritizing cultural symbolism and aesthetic cognition, establishing sustainable and reliable craftsmanship systems, and incorporating narrative patterns with emotionally expressive forms can substantially enhance user satisfaction and market acceptance. Moreover, the evaluation outcomes further validate the robustness of the preceding requirement analysis and technical weight allocation, confirming that the proposed design logic and priority framework possess strong practical applicability and predictive validity.

## CONCLUSIONS

1. In this study, a systematic model integrating user requirements, cultural genes, and technical transformation was established, thereby enabling a closed and traceable design pathway for Yi ethnic lacquerware chairs from requirement identification to solution generation. The results suggest that cultural symbolism and emotional value may constitute the primary drivers of user preference and represent key leverage points for innovation in ethnic cultural furniture design.
2. The results further demonstrate that digitalized pattern development, cultural narrative articulation, and sustainable craftsmanship constitute three critical pathways for cultural translation. These pathways not only enhance the accuracy and richness of cultural expression but also improve the contextual adaptability and long-term sustainability of intangible cultural heritage (ICH) craftsmanship within contemporary design contexts.
3. Through the integrated application of the Kano model, the Analytic Hierarchy Process (AHP), and Quality Function Deployment (QFD), together with TOPSIS-based scheme validation, the priority structure between user requirements and technical attributes was systematically identified. The high degree of consistency observed between the derived weight system and user preferences confirms the robustness of the analytical framework and provides reliable quantitative evidence for the structured optimization of ethnic cultural furniture design.
4. From the perspective of furniture and product design research, this study is particularly significant in positioning the Yi ethnic lacquerware chairs as a user-centered design decision-making case, rather than merely as an object of cultural or intangible heritage discourse. The proposed research framework can be generalized as a reusable design decision-making paradigm, providing methodological guidance for the design of culturally embedded furniture products. In particular, it offers systematic support for early-stage design planning, trade-off analysis, and innovation decision-making, while directly addressing the central concerns of user orientation and evidence-based decision-making in contemporary furniture product design.

## ACKNOWLEDGMENTS

### Use of Generative AI

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) solely for language editing and translation assistance of certain sections of the text. The AI tool was employed solely to improve the clarity, fluency, and academic tone of the English version of the manuscript, particularly for passages originally drafted in Chinese. All content generated or refined by AI was thoroughly reviewed, verified, and edited by the authors to ensure accuracy, consistency with the original research, and adherence to academic standards.

In addition to using Doubao and Google Nano Banana to generate relevant design schemes during the scheme design validation phase—as described in the manuscript—no other AI tools were employed for data analysis, image/figure creation, or substantive content generation.

## REFERENCES CITED

- Alexander, C. (2017). *A City Is Not a Tree*, Sustasis Press / Off the Common Books, Portland, OR, USA.
- Belfrage, C., and Hauf, F. (2017). “The gentle art of retroduction: Critical realism, cultural political economy and critical grounded theory,” *Organization Studies* 38(2), 251-271. <https://doi.org/10.1177/0170840616663239>
- Braun, V., and Clarke, V. (2006). “Using thematic analysis in psychology,” *Qualitative Research in Psychology* 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Ceschin, F., and Gaziulusoy, I. (2016). “Evolution of design for sustainability: From product design to design for system innovations and transitions,” *Journal of Cleaner Production* 160, 10-24. <https://doi.org/10.1016/j.jclepro.2016.09.002>
- Chen, J., Xia, H., and Yu, S. (2025). “Integration of intangible cultural heritage elements into furniture design based on symbolic semantics and AHP: A case study of Qianci,” *BioResources* 20(2), 3714-3731. <https://doi.org/10.15376/biores.20.2.3714-3731>
- Deng, L., Romainoor, N. H., and Zhang, B. (2023). “Evaluation of the usage requirements of hospital signage systems based on the Kano model,” *Sustainability* 15(6), article 4972. <https://doi.org/10.3390/su15064972>
- Dunford, R., Su, Q., Tamang, E., and Wintour, A. (2014). “The Pareto principle,” *The Plymouth Student Scientist* 7(1), 140-148. <https://doi.org/10.24382/swfr-wr17>
- Fan, J., and Wang, W. (2025). “Sustainable gift packaging design based on KANO–AHP–QFD,” *BioResources* 20(4), 8528-8550. <https://doi.org/10.15376/biores.20.4.8528-8550>
- Fu, Y., Zhang, M., Nawaz, M., Ali, M., and Singh, A. (2022). “Information technology-based revolution in music education using AHP and TOPSIS,” *Soft Computing* 26(20), 10957-10970. <https://doi.org/10.1007/S00500-022-07247-W>
- Glaser, B. G., and Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Aldine, Chicago, IL, USA.
- Hou, Y., Kenderdine, S., Picca, D., Egloff, M., and Adamou, A. (2022). “Digitizing intangible cultural heritage embodied: State of the art,” *Journal on Computing and Cultural Heritage* 15(3), article 55, 1-20. <https://doi.org/10.1145/3494837>
- Hu, Z., Jia, D., Qiao, X., and Zhang, N. (2024). “Construction and application of product

- optimisation design model driven by user requirements,” *Scientific Reports* 14(1), article 16381. <https://doi.org/10.1038/s41598-024-67406-x>
- Kano, N., Seraku, N., Takahashi, F., and Tsuji, S. (1984). “Attractive quality and must-be quality,” *Journal of the Japanese Society for Quality Control* 14(2), 39-48.
- Liu, S., and Pan, Y. (2023). “Exploring trends in intangible cultural heritage design: A bibliometric and content analysis,” *Sustainability* 15(13), article 10049. <https://doi.org/10.3390/su151310049>
- Liu, Z., and Zhang, W. (2024). “A qualitative analysis of Chinese higher education students’ intentions and influencing factors in using ChatGPT: A grounded theory approach,” *Scientific Reports* 14(1), article 18100. <https://doi.org/10.1038/s41598-024-74034-y>
- Madzík, P., Budaj, P., Mikuláš, D., and Zimon, D. (2019). “Application of the Kano model for a better understanding of customer requirements in higher education—A pilot study,” *Administrative Sciences* 9(1), article 11. <https://doi.org/10.3390/admsci9010011>
- Madzík, P., Shahin, A., Zimon, D., and Yadav, N. (2024). “Requirements classification in Kano model—from strict categories to satisfaction and dissatisfaction potential,” *Total Quality Management and Business Excellence* 35(11-12), 1418-1438. <https://doi.org/10.1080/14783363.2024.2370470>
- McKelvie, S. J. (1978). “Graphic rating scales—How many categories?,” *British Journal of Psychology* 69(2), 185-202. <https://doi.org/10.1111/j.2044-8295.1978.tb01647.x>
- Norman, D. A. (2013). *The Design of Everyday Things*, Revised and expanded edition, Basic Books, New York, NY, USA.
- Padilla-Garrido, N., Aguado-Correa, F., Cortijo-Gallego, V., and López-Camacho, F. (2014). “Multicriteria decision making in health care using the analytic hierarchy process and Microsoft Excel,” *Medical Decision Making* 34(7), 931-935. <https://doi.org/10.1177/0272989X14534533>
- Peterson, R. A., and Kim, Y. (2013). “On the relationship between coefficient alpha and composite reliability,” *Journal of Applied Psychology* 98(1), 194-198. <https://doi.org/10.1037/a0030767>
- Reed, M. S., Ferré, M., Martin-Ortega, J., Blanche, R., Lawford-Rolfe, R., Dallimer, M., and Holden, J. (2021). “Evaluating impact from research: A methodological framework,” *Research Policy* 50(4), article 104147. <https://doi.org/10.1016/j.respol.2020.104147>
- Saaty, T. L. (1977). “A scaling method for priorities in hierarchical structures,” *Journal of Mathematical Psychology* 15(3), 234-281. [https://doi.org/10.1016/0022-2496\(77\)90033-5](https://doi.org/10.1016/0022-2496(77)90033-5)
- Shirali, G. A., Rashnoudi, P., Salehi, V., and Ghanbari, S. (2023). “A hierarchical assessment of resilience engineering indicators in petrochemical industries using AHP and TOPSIS,” *Human Factors and Ergonomics in Manufacturing and Service Industries* 33(1), 3-26. <https://doi.org/10.1002/hfm.20980>
- Starks, H., and Brown Trinidad, S. (2007). “Choose your method: A comparison of phenomenology, discourse analysis, and grounded theory,” *Qualitative Health Research* 17(10), 1372-1380. <https://doi.org/10.1177/1049732307307031>
- Sun, P., and Yue, X. (2025). “Exploring the ways of inheriting and promoting intangible cultural heritage in universities,” *Lecture Notes in Education, Arts, Management and Social Science* 3(8), 55-58. <https://doi.org/10.18063/LNE.v3i8.824>
- Wang, Y. M., Luo, Y., and Xu, Y. S. (2013). “Cross-weight evaluation for pairwise

comparison matrices,” *Group Decision and Negotiation* 22(3), 483-497.

<https://doi.org/10.1007/s10726-011-9279-x>

Yan, W. (2021). “A brief analysis of the inheritance and development of Yi lacquerware in Sichuan,” *Art Observation* (06), 72-73.

Zhang, L., and Hong, J. (2023). “Research on the sustainable development of traditional crafts under the perspective of service design,” in *The IAFOR International Conference on Education – Hawaii 2023 Official Conference Proceedings*, pp. 27-36. <https://doi.org/10.22492/issn.2189-1036.2023.3>

Article submitted: January 27, 2026; Peer review completed: March 15, 2026; Revised version received and accepted: March 20, 2026; Published: April 1, 2026.

DOI: 10.15376/biores.21.2.4375-4407

## APPENDIX

### Kano-Based Questionnaire on User Requirements for Yi Ethnic Lacquerware Chairs

Dear Respondent,

This questionnaire is designed to investigate your perceptions of the Yi ethnic lacquerware chairs with respect to cultural expression, emotional experience, functional use, craftsmanship innovation, and sustainability. A bidirectional questioning format based on the Kano model is employed. You are kindly requested to respond according to your immediate and intuitive impressions. No personal or sensitive information is collected in this survey, and all data will be used solely for academic research purposes. Please feel assured that your responses will remain confidential. Thank you very much for your time, support, and cooperation.

#### I. Instructions for Completion

Each item in this questionnaire consists of **two questions: Functional (positive) question:** How do you feel when this feature is present? **Dysfunctional (negative) question:** How do you feel when this feature is absent? For each question, please select the single option that **best reflects your true feelings:** 1.Dislike 2.Tolerable 3.Neutral 4.Expect it to be that way 5.Like

#### II. Basic Information (Optional)

1. Gender: MaleFemaleOther
2. Age: 18–2526–3536–4546 or above
3. Occupation: StudentDesign-relatedCulture/Education  
Other: \_\_\_\_\_
4. Have you previously been familiar with or exposed to ethnic cultural furniture?  
FrequentlyOccasionallyHave heard of it  
Never

#### III. KANO Bidirectional Requirement Evaluation Items

##### Q1 Cultural Symbols

(1) Functional Question: How would you feel if Yi totems, flame motifs, or other representative cultural symbols were incorporated into the design of a Yi ethnic lacquerware chairs?

1.Dislike 2.Tolerable 3.Neutral 4.Expected 5.Like

(2) Dysfunctional Question: How would you feel if no Yi cultural symbols were reflected in the design of the Yi ethnic lacquerware chairs?

1.Dislike 2.Tolerable 3.Neutral 4.Expected 5.Like

##### Q2 Cultural Narrative

(1) Functional Question: How would you feel if Yi ethnic lacquerware chairs were designed to convey Yi cultural stories and historical meanings through their form or decorative patterns?

1.Dislike 2.Tolerable 3.Neutral 4.Expected 5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs did not incorporate any form of cultural storytelling or narrative expression?

1.Dislike 2.Tolerable 3.Neutral 4.Expected 5.Like

##### Q3 User Emotions

(1) Functional Question: How would you feel if the use of Yi ethnic lacquerware chairs evoked feelings of pleasure, familiarity, or emotional resonance?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the use of Yi ethnic lacquerware chairs elicited no emotional response at all?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q4 Emotional Value**

(1) Functional Question: How would you feel if Yi ethnic lacquerware chairs provided a sense of cultural identity, belonging, or spiritual fulfillment?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs offered only basic functional utility and conveyed no emotional value?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q5 Functional Needs**

(1) Functional Question: How would you feel if Yi ethnic lacquerware chairs demonstrated satisfactory performance in terms of load-bearing capacity, safety, and structural stability?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs exhibited noticeable deficiencies in functional performance?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q6 Ease of Use**

(1) Functional Question: How would you feel if Yi ethnic lacquerware chairs were lightweight, easy to move, and convenient to maintain during everyday use?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs were heavy, difficult to use, or inconvenient to maintain?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q7 Aesthetic Integration**

(1) Functional Question: How would you feel if the overall form of the Yi ethnic lacquerware chairs were harmoniously integrated with contemporary interior design styles?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the Yi ethnic lacquerware chairs appeared visually incongruent or stylistically incompatible within a modern spatial context?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q8 Craftsmanship Aesthetics**

(1) Functional Question: How would you feel if the Yi ethnic lacquerware chairs demonstrated refined natural lacquer craftsmanship and a high level of artisanal aesthetic quality?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the Yi ethnic lacquerware chairs exhibited coarse craftsmanship and lacked a sense of hand-crafted quality?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q9 Material Innovation**

(1) Functional Question: How would you feel if the Yi ethnic lacquerware chairs preserved traditional natural lacquer characteristics while integrating modern environmentally friendly or composite materials?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the Yi ethnic lacquerware chairs exhibited no material innovation and relied entirely on conventional materials?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q10 Market Perception**

(1) Functional Question: How would you feel if the Yi ethnic lacquerware chairs exhibited a clear brand identity and a high level of market recognizability?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the Yi ethnic lacquerware chairs lacked brand recognition, making its cultural value difficult to distinguish?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q11 Communication Path**

(1) Functional Question: How would you feel if Yi ethnic lacquerware chairs were widely disseminated through exhibitions, social media platforms, or cultural events?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs had little to no opportunity for dissemination or public display?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q12 Sustainable Culture**

(1) Functional Question: How would you feel if the design of Yi ethnic lacquerware chairs explicitly reflected principles of intangible cultural heritage preservation and sustainable cultural transmission?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if the design of Yi ethnic lacquerware chairs did not consider cultural heritage preservation or long-term cultural sustainability at all?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

#### **Q13 Social Sustainability**

(1) Functional Question: How would you feel if the production and design of Yi ethnic lacquerware chairs contributed to local employment, cultural dissemination, and the realization of social value?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

(2) Dysfunctional Question: How would you feel if Yi ethnic lacquerware chairs had no positive impact on social development or cultural advancement?

1.Dislike  2.Tolerable  3.Neutral  4.Expected  5.Like

Thank you for taking the time to complete this questionnaire. Your valuable feedback will provide important insights for the innovative design of Yi ethnic lacquerware chairs and the contemporary transmission of intangible cultural heritage. We sincerely appreciate your support and wish you all the best.