Research on Usability Design of Leisure Agriculture APP Interface Based on Kano-QFD

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Abstract. By mining the needs of land renting and land transfer groups, analyzing the correlation between user needs and functional requirements, obtaining the absolute weight of functional requirements, designing a leisure agriculture app that meets user needs and has a good user experience, and improves rural land use. Utilization rate and operational efficiency help rural revitalization and development. Based on the Kano model, through questionnaires and user interviews, determine the demand elements of the land transaction crowd, draw a user experience journey map, and establish a demand framework to prioritize functions. Through the quality function deployment theory (QFD), the mapping relationship between user needs and functional characteristics is established, and the QFD quality house is established. Design the information framework, interactive prototype, interface vision, and operation experience of the leisure agriculture APP, and verify the feasibility of the model and design practice with the SUS scale. The comprehensive application of the Kano-QFD model establishes a demand framework for leisure agriculture APP with high accuracy and objectivity and proposes a reasonable and usable innovative design scheme, which provides direction and reference for solving similar design problems. Taking the design of the leisure agriculture APP as an example, the effectiveness of the integration of Kano and QFD is verified, and an optimization idea is provided for the design of the leisure agriculture APP.

Keywords: QFD quality function deployment · Kano model · leisure agriculture · rural revitalization

1 Introduction

With the deepening of urbanization, the attractiveness of traditional rural culture is increasing day by day. Rural tourism, agricultural sightseeing, farming experience, fruit and vegetable picking, etc. have attracted a large number of urban residents. Rural tourism is an important strategy for rural development. It can not only increase the income of rural residents, and solve the "three rural" problems to a certain extent, but also meet the psychological needs of urban residents to experience rural life. Rural land construction is an important part of promoting the development of rural tourism, and it is also a solid

foundation for promoting rural revitalization. Rural land has the characteristics of low land cost, original ecology, and large area. It is a unique feature of villages. Developing rural abandoned or idle land and realizing the effective use of land resources is conducive to promoting the coordinated development of urban and rural economies.

At present, most studies on land are from the perspective of economics and management, and there are few kinds of literature on land from the perspective of design. Wang Chunjie et al. [1] analyzed the impact of local governments' differentiated investment attraction on urban innovation and pointed out that industrial structure, environmental pollution, and industrial agglomeration are important factors for the government's differential investment attraction. Ma Hongxuan [2] pointed out that rural land circulation is conducive to improving the scattered and extensive land management model, optimizing the allocation of land resources, and promoting the rapid development of the local economy. In the same way, Zhang Xi [3] discussed the improvement of the land transfer transaction mechanism and the protection of the legitimate rights and interests of farmers' land. Zhang Zhanlu et al. [4] proposed that land development rights transactions should be encouraged and properly promoted, the market-oriented allocation of land resources should be promoted, the channels for the flow of land elements between urban and rural areas should be opened up, and the integrated development and synergy of land, capital, and labor should be promoted.

2   Kano-QFD Design Method Explanation and Research Process

The Kano model was proposed by Japanese scholar Kano Noriaki in order to improve satisfaction with products and services. It is used to mine user needs and core problems that need to be solved, and solve similar problems by analyzing the relationship between quality characteristics and user satisfaction [5]. As a qualitative research method, this model first obtains the functional requirements of the leisure agriculture APP through user research, distinguishes the priority and type of requirements, and divides the requirements into must-have requirements M, expected requirements O, and attractive requirements A. There are five types of indifferent demand I and reverse demand R. Second, analyze the influence value of the demand and construct an influence matrix. Finally, obtain user needs through market research and user research, fill in the questionnaire data into the evaluation form, calculate the Better-Worse value, construct a quadrant map, and clarify the design requirements and function priorities.

QFD (Quality Function Deployment Theory, also known as House of Quality) was proposed by Japanese scholar Yoji Akao. It is a research method for quantitative analysis of needs [6], which uses diagrams to quantify the degree of correlation between user needs and functional attributes. Through the scoring of the demand technology matrix by the expert group, the impact value of product functions on user satisfaction is calculated in detail, the user needs are transformed into product functions, and the design scheme is derived.

The combination of the Kano model and QFD helps to visualize and parameterize the user needs to be obtained from the research, and to clarify the design entry point. Use the Kano model to preliminarily classify user needs, use QFD to quantitatively analyze the classified user needs and transform the design direction, and build a quality house. Design requirements – output design scheme process (see Fig. 1).
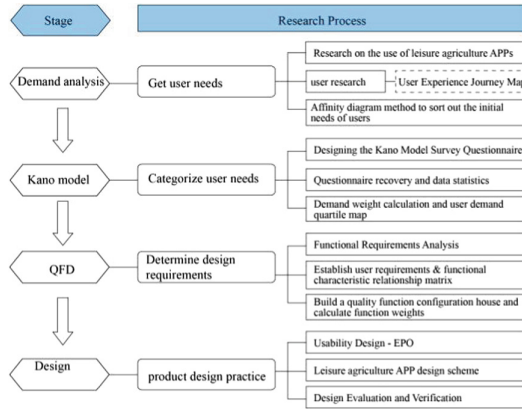
Fig. 1. Design and research process of leisure agriculture APP

3 Demand Acquisition Based on Kano Leisure Agriculture APP

3.1 Acquisition of User Needs

The mining of user needs is the design entry point for the innovative design of leisure agriculture apps. The purpose of the Kano questionnaire survey is to understand the real needs of users. Through in-depth research on target users and user interviews, fully understand the user's operation process for leisure agriculture apps, and disassemble each stage, behavior, and scene of user use in detail, design a user experience journey map, discover user pain points and convert them to design opportunity points, the user experience journey map is shown in Fig. 2.
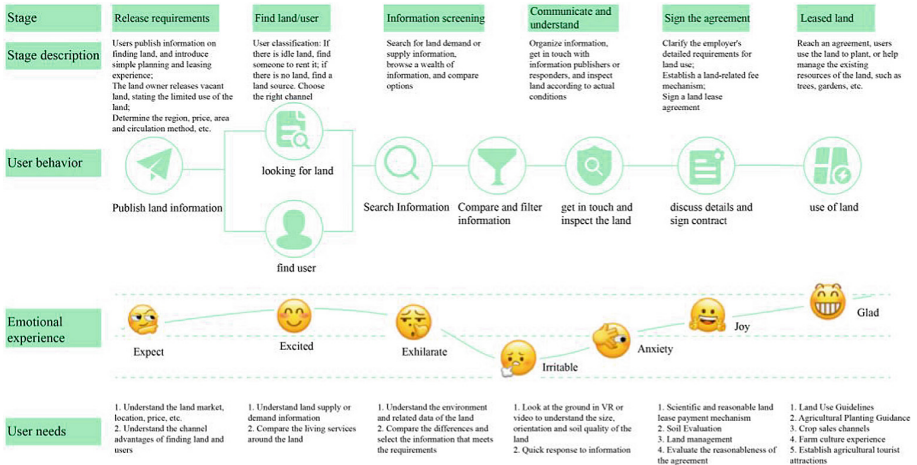

Fig. 2. User Experience Journey Map of Leisure Agriculture Apps

3.2 Kano Research

There are two main types of questionnaire surveys for leisure agriculture APPs: looking for land and looking for tenants. Since urban users are usually busy at work, few people live in rural areas for a long time, mainly to experience agricultural culture or learn rural planting knowledge. General short-term rental. Another type of tenant mainly wants to contract land, plant or manage fruit trees or vegetable gardens, etc., and needs to rent for a long time. However, landowners often have idle land or orchards due to travel or work and need to find someone to manage them so as not to be abandoned. Through in-depth interviews with the target users of the leisure agriculture APP, the first-level needs of users are sorted into information authenticity, soil quality assurance, land survey, agricultural guide, agricultural product sales, life sharing, quick screening, peripheral services, and cultural experience.

First, design the Kano questionnaire based on the above-mentioned first-level needs, and ask the respondents about the individual needs of users from the forward and reverse directions to determine the weight of the needs. Set the corresponding scores as 4, 2, 0, –2, and –4 through the five dimensions of satisfaction, desire, indifference, tolerance, and disgust to measure the impact of different needs on user satisfaction. Secondly, classify the interactive needs of the respondents on the leisure agriculture APP, construct the user demand influence matrix.

A total of 324 questionnaires have been released, and the targets are rural users who need to rent land and urban users who need to rent land. Among them, 234 people have experience in land planting and 100 people have no experience in land planting. If the information is excluded and the incomplete questionnaire is filled out, it is valid. 315 copies were recovered, with an effective recovery rate of 97%. The questionnaire has 9 measurement dimensions and 19 questions, including a question about whether there is land planting experience. It meets the requirement of the Kano model that the sample size is 5–20 times the number of questions (Table 1).

3.3 Calculation of the Importance of User Needs

The quantitative parameters of the Kano model were designed through the leisure agriculture APP questionnaire:

$$W_j = \sqrt{\overline{X}_j^2 + \overline{Y}_j^2} \tag{1}$$

In $\overline{X}_j$ represents the user satisfaction score when the requirement is not met, and $\overline{Y}_j$ represents the user satisfaction score when the requirement is met, W_j Indicates the importance of the function. Combine Better-Worse Taxonomy divides user needs according to Kano need types, expected needs (X > 2, Y > 2), necessary needs (X > 2, Y < 2), Charisma needs (X < 2, Y > 2), neutral demand (X < 2, Y < 2), neutral requirements have no impact on users.

Table 1. Average satisfaction of leisure agriculture APP users

User needs	Satisfaction without functionality $\overline{X}_j$	Satisfaction with functionality $\overline{Y}_j$	Importance W_j	Sequence
True information	1.72	4.22	4.56	2
Soil quality assurance	1.85	4.61	4.97	1
Land inspection	1.74	3.55	3.95	6
Agricultural guide	2.53	3.63	4.42	4
Farm for sale	1.26	4.32	4.50	3
Life sharing	2.42	2.51	3.50	9
Quick filter	2.13	3.64	4.22	5
Peripheral services	1.98	3.31	3.86	8
Cultural experience	1.54	3.57	3.89	7

4   Analysis of APP Functional Requirements Based on QFD

4.1   Mapping and Analysis of Functional Requirements

Based on the analysis of user needs and the Kano model, the user demand weight and first-level demand element indicators of leisure agriculture APPs are obtained, and the first-level functional requirements of QFD are mapped, and the first-level functional requirements are refined and decomposed to obtain the second-level functions. Requirements to ensure maximum satisfaction of user needs, as shown in Table 2.

4.2   Correlation Matrix of User Needs and Functional Characteristics

User requirements and quality characteristics are the core components of the QFD House of Quality, which can intuitively and effectively reflect the relationship between requirements and functions, and realize user requirements to the greatest extent. The left side of the House of Quality is user demand elements, the roof is functional characteristics, the ceiling is the relationship between functional characteristics, the room is the relationship between demand and function, and the right wall is the market competitiveness index comparison between this product and competing products, and the floor is the importance of engineering measures. In the house of quality of leisure agricultural APPs, the degree of correlation between requirements and functions is recorded as strong correlation 5, moderate correlation 3, weak correlation 1, and irrelevance 0 from high to low, and is scored by the expert group (Table 3).

Table 2. Expansion of functional elements

Primary demand elements	Level 1 Functional Requirements	Secondary Functional Requirements
C_1 True information	F_1 Certification Information	F_{11} Data review
		F_{12} Information Release
C_2 Soil quality assurance	F_2 Soil identification	F_{21} Intelligent Recognition
		F_{22} Soil Science
C_3 Land inspection	F_3 Broker	F_{31} Remote viewing
		F_{32} Site visit
C_4 Agricultural guide	F_4 Interface navigation	F_{41} Operation navigation
		F_{42} Agricultural Encyclopedia
C_5 Farm for sale	F_5 Online store	F_{51} Sell online
		F_{52} Business cooperation
C_6 Life sharing	F_6 Circle friends social	F_{61} Online dating
		F_{62} Agricultural dynamics
C_7 Quick filter	F_7 Personalized recommendation	F_{71} Recommendation
		F_{72} Credit Rating
C_8 Peripheral services	F_8 Land surrounding	F_{81} Market traffic
		F_{82} Hydropower management
C_9 Cultural experience	F_9 Book an experience	F_{91} Service package
		F_{92} Learning experience

4.3 Functional Requirements Weight Calculation

The weight of functional requirements is an important indicator to reflect the priority level of functions. By calculating the degree of correlation between a single functional requirement and a requirement element, the weight value of the functional requirement is obtained. The formula for calculating the weight value of each functional requirement is:

$$H_j = \sum_{i=1}^{n} W_i R_{ij} (j = 0, 1, 2, 3, \ldots\ldots m) \tag{2}$$

Table 3. Matrix of relationship between requirement elements and functional requirements

Elements of demand		Functional requirements																		
		$F1$		$F2$		$F3$		$F4$		$F5$		$F6$		$F7$		$F8$		$F9$	
user need	Importance	F_{11}	F_{12}	F_{21}	F_{22}	F_{31}	F_{32}	F_{41}	F_{42}	F_{51}	F_{52}	F_{61}	F_{62}	F_{71}	F_{72}	F_{81}	F_{82}	F_{91}	F_{92}
C_1	4.56	●	○	●	●	○	●			●	●	●		○	●			○	
C_2	4.97	○			●	○	●		△	△	○		△		○				
C_3	3.95	○	○		○	○	●							●	●				
C_4	4.42				△				●	△			○						●
C_5	4.50	○	●						●	●	●	△	○	○	○	●			
C_6	3.50		●							○	○	○	●						○
C_7	4.22							○		●	○						○		
C_8	3.86										△			○		●		○	●
C_9	3.89		○				○		○	○	○			●	○			●	●
Weights Hj		63.06	65.63	22.80	63.92	40.44	71.29	12.66	61.24	81.08	98.90	37.80	68.68	77.96	82.63	41.95	11.67	44.71	71.35
sequence		10	8	16	9	14	6	17	11	3	1	15	7	4	2	13	18	12	5

Note: ● means strong correlation, ○ means moderate correlation, △ means weak correlation, and blank means no correlation, scoring 5, 3, 1, 0 respectively

The importance of the functions is sorted by the weight values required by the functions, as shown in Table 3 above. The sale of agricultural products, quick screening, certification information, cultural experience, and land inspection are important parts of the APP information architecture design.

5 Leisure Agriculture APP Design Practice

5.1 Information Architecture Design

Based on the analysis and data of Kano-QFD preliminary research, the functional characteristics in QFD are transformed into the core functions of the leisure agriculture APP, and the abstract functions are concretized. Designed the usability of the information architecture from three aspects: environment, process, and operation, classify and cluster the functions, and use the nodes of the tree diagram as the basic unit of the information architecture to facilitate users to quickly find specific functions. Improve the efficiency and satisfaction of APP use. The information architecture design of the leisure agriculture APP is shown in Fig. 3.
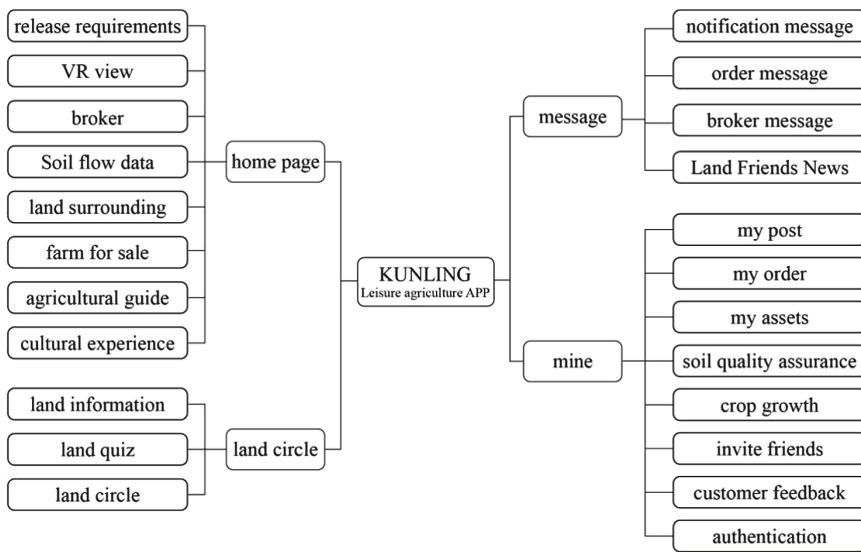

Fig. 3. Information architecture design of leisure agriculture APP

5.2 Interface Visual Design

Based on the interactive prototype of the leisure agricultural APP, analyze the usability of the product in terms of use environment, task process, and operation behavior, and improve the satisfaction of user operation. By analyzing the user's psychology and the nature of the APP, the color matching of the APP is positioned in a fresh, bright,

simple, and eye-catching green flat design style, and the main function buttons are highlighted, the secondary information is weakened, the user's visual burden is reduced, and the physical area of the button is strengthened, increase fault tolerance and function feedback, and ensure the effectiveness of function clicks. The visual design of some leisure agriculture APP interfaces is shown in Fig. 4.
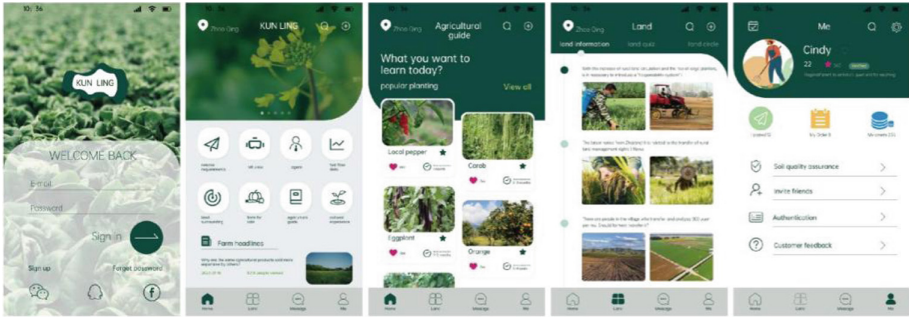

Fig. 4. Visual Design of the Leisure Agriculture APP—Kunling Interface

5.3   Design Evaluation

Design evaluation is an all-around evaluation of the scientific interaction logic, interface design aesthetics, and user operation fluency of leisure agriculture apps. Through the SUS scale, 5 positive questions and 5 reverse questions are set [7], and the testers rate the product from 1 to 5. By selecting 20 typical users to test Kunling APP and completing the SUS scale, the test questions and scoring results are shown in Table 4.

Through the base item Xi-1, the even item 5-Xi, the conversion scores of all items are added and then multiplied by 2.5 for calculation, the total score of the SUS scale is 77.75, and the grade is B + in the SUS score curve, which shows that the system has good usability.

Table 4. Appraisal on Interface Design of Leisure Agriculture APP—Kunling

Measurement items	Strong disagree	Different meaning	Generally	Agree	Firm agree	Average Score
1. I am willing to use leisure agriculture APP frequently	0	3	3	8	6	3.85
2. I don't think the system needs to be this complicated	5	10	3	1	1	2.15
3. I think the system is easy to use	0	4	2	5	9	3.95
4. I need help from others to use the system	8	7	3	2	0	1.95
5. I found that the different functions of the system are well integrated	1	1	2	4	12	3.90
I think there are too many inconsistencies in the system	9	4	3	4	0	2.10
I think most people can quickly learn to use this system	0	1	2	6	11	4.35
I found the system very clumsy to use	12	6	1	1	0	1.55
I feel confident using the system	0	0	3	6	11	4.40
I need to learn a lot to use the system	9	5	4	2	0	2.15

6   Conclusion

This study proposes to apply the Kano model and QFD house of quality in the interface design of a leisure agriculture APP. By transforming user needs into functional requirements and then into design requirements, and carrying out the design practice of the leisure agriculture APP, the Kano-QFD model is verified in the interactive usability of interface design. In the demand mining stage, use research interviews and user experience journey maps to initially extract user needs. In the requirements classification

stage, user requirements are refined and classified based on the Kano model, and the importance of requirements is distinguished. In the functional requirements stage, based on the QFD house of quality, the functional requirements are quantitatively analyzed and the relationship matrix between user requirements and technical functions is established to calculate the weight indicators of functional characteristics. In the design practice stage, the functional requirements are built as an information framework, the main functional structure of the leisure agriculture APP is controlled, and the interactive prototype design and visual interface design of the leisure agriculture APP is carried out. In the design evaluation stage, the SUS scale is used to evaluate the satisfaction of the leisure agriculture APP, and the interface design is further improved.

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