International Symposium on World Ecological Design
F. Ying et al. (Eds.)

doi:10.3233/FAIA240030

Research on the Interface Design of Fresh Product E-Commerce Platform Based on User Online Comments

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Abstract. Fresh products purchased from online became an important shopping method in people's lives. And with the weakening of the epidemic control, the dividend of fresh e-commerce is gradually fading, and fresh e-commerce has entered a new stage of development. In order to better improve the user experience of online fresh produce shopping, this paper based on the online reviews of fresh produce e-commerce platform, through word separation, lexical annotation and removal of deactivated words to obtain user requirements, followed by using KANO model to classify user requirements and find the weight of each requirement; finally, through expert scoring, the quality house of user requirements and functional requirements is constructed to find the priority of each functional requirement. Based on the user requirements obtained from online reviews, this paper completes the construction and practice of a fresh food e-commerce platform based on functional priorities and combined with interface design principles through the KANO-QFD method, and obtains high user satisfaction, which provides theoretical value and practical reference for the construction and design practice of the same type of system. Further following the user-centered design concept, the interaction efficiency and usability of the human-machine interface of the fresh produce e-commerce platform are improved, which plays a reference for the optimization of the human-machine interface design of the same type.

Keywords. Fresh products e-commerce, user online comments, interface design, user's experience

1. Introduction

People's demand for contactless shopping methods, coupled with fresh products as a high-frequency and immediate need, promoted the development of fresh e-commerce. With the weakening of the epidemic control and the gradual return to normal in people's daily lives, the shortcomings of fresh products e-commerce are increasingly reflected, and fresh products e-commerce has entered a new stage of development, requiring further improvement in user experience to increase the retention rate of platform users.

However, with the change of consumer habits, the demand for online purchase of fresh products is still huge. According to forecasts, the penetration rate of smart vegetable farms is increasing, and smart vegetable farms are entering a period of rapid development.

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The scale of smart vegetable farms is around 13.8 billion in 2020, and it is expected that the scale of smart vegetable farms can reach 60.4 billion in 2025[1]. With the increase in the number of e-commerce users, it also promotes the development and transformation of e-tailing, and the supply chain and logistics services for fresh produce are more efficient, which further ensures the quality of fresh products [2]. New breakthroughs have also been made at the level of quality monitoring of fresh produce, as Haojie Cong et al. developed a technology that can detect the freshness of aquatic products using smartphones and applied it to a WeChat app, which is a powerful tool for aquatic freshness as well as food safety testing [3].

Online reviews of users provide a large amount of research data for analyzing user requirements. Classification of needs as well as product improvement can be achieved based on online reviews [4]. Users' online reviews are also a key influencing factor on customers' purchase or use of services, and other customers' reviews represent that they have already experienced the product [5]. Therefore many companies also mine useful information from user reviews to improve user experience [6].

Most current research on fresh produce e-commerce focuses on supply chain, logistics, and distribution, while interface design of online fresh products sales platforms is less studied. yingmei Cang et al. found that website information has a significant impact on consumers' purchasing behavior [7]. Good interface design can effectively improve the user experience of APP [8]. Fresh products are not only displayed on fresh e-commerce platforms, but there are also many additional information that jointly influence consumers' purchasing behavior. Therefore, it is necessary to deeply explore consumers' needs and transform user needs into a reference basis for platform interface design, so as to improve the user experience of fresh e-commerce. Based on user online reviews, this paper clarifies user needs, improves user experience in purchasing fresh products online, and reduces user risk perceptions in fresh product consumption to promote the development of fresh product e-commerce platforms. It also establishes a set of design paths and methods for the fresh product e-commerce platform as an example to provide reference for the design of other similar e-commerce platforms.

2. Methodology

Online comments are an important channel for expressing user needs, and compared with traditional methods such as questionnaires and actual research, user needs can be obtained more comprehensively and accurately through user online comments [9]. By collecting the text of user comments on websites, the keywords of user needs can be obtained through the steps of word separation, lexical annotation, removal of deactivated words, and manual definition.

The KANO model was proposed by Professor Noriaki Kano in 1984, which reflects the relationship between product performance and user satisfaction and is widely used in other fields. the application of the KANO model in the design field can help designers to classify user needs, so as to improve products in a targeted manner and enhance the user experience of products [10].

QFD is an analysis method that translates user or market needs into design requirements, product quality characteristics or process requirements [11]. By building a quality house, we can translate the summarized user needs into functional requirements and

quantitatively analyze the priority of each function, providing a practical and usable reference for product design.

In order to better translate user needs into functional requirements and to quantify the weight between user needs and product functionality, it is necessary to integrate the KANO model and QFD. therefore, Matzler and Hinterhuber proposed a method to integrate the KANO model and QFD in 1998 [12]. Based on the research of these two men, Lai-Ming Duan proposed an improved approach by applying a more reasonable correlation coefficient to measure the correlation between user needs and functional requirements [13]. In this study, the use of the KANO-QFD method can more accurately and objectively translate the needs derived from user reviews into functional requirements for product design, thereby improving the user experience of fresh product e-commerce platforms from the interface design level.

3. Experiments

3.1. Summarize customer requirements

"Jingdong" as an early platform for fresh product e-commerce in China, has a wide range of product categories and a large number of users [14]. Therefore, this paper collects data from "Jingdong Fresh" to ensure the quantity and relevance of the data.

The online reviews of fresh products from users in the platform were collected through data crawling, and a total of 76,186 online reviews were collected from users. Use by word separation. After the steps of word separation, word annotation and removal of deactivated words, combined with manual definition to remove semantically similar words, for example, "merchant", "seller" and "store" are all similar words, and extract One of these words can be extracted. The finalized customer requirement items are shown in Table 1.

Table 1. Customer Requirements

Items	Customer Requirements	Items	Customer Requirements
CR_1	Taste	CR_{13}	Merchant
CR_2	Fresh	CR_{14}	Value for money
CR_3	Packing	CR_{15}	Child
CR_4	Logistic	CR_{16}	Discount
CR_5	Buy	CR_{17}	Product
CR_6	Convenient	CR_{18}	Service
CR_7	Quality	CR_{19}	Moisture
CR_8	Quantity	CR_{20}	Clean
CR_9	Price	CR_{21}	Description
CR_{10}	Compare	CR_{22}	Ice pack
CR_{11}	Comment	CR_{23}	Brand
CR_{12}	Recommend	CR_{24}	Picture

3.2. KANO Questionnaires

The KANO questionnaire was conducted based on customer requirements. A total of 71 questionnaires were collected, 5 invalid questionnaires were excluded, and the effective

rate of the questionnaire was 93%. The valid KANO questionnaire data were entered into SPSS software to calculate the reliability and validity, and the Cronbach's alpha coefficient was 0.950 for the positive question and 0.979 for the negative question. the KMO value for the positive question was 0.855 and the p value was 0.000, and the KMO value for the negative question was 0.811 and the p value was 0.000. therefore, the questionnaire can be used for further analysis. The results can be used for further analysis.

The KANO model classifies customer requirements into A (charismatic requirements), O (expectation requirements), M (essential requirements), and I (non-differentiated requirements). According to the classification of requirements by the KANO model, the type of each requirement is obtained, and the, $Y_i$and the relative weight value w_i of each requirement are obtained by equations (1), (2), and (3), as shown in Table 2.

Table 2. Customer requirement weights and attributes

Customer Requirements	A	O	M	I	R	X_i	Y_i	w_i	Attributes
CR_1	6	25	22	12	1	0.4769	0.7231	0.0503	O
CR_2	12	29	18	7	0	0.6212	0.7121	0.0581	O
CR_3	12	14	27	9	4	0.4194	0.6613	0.0460	M
CR_4	6	9	32	19	0	0.2273	0.6212	0.0432	M
CR_5	7	4	37	17	1	0.1692	0.6308	0.0439	M
CR_6	26	10	17	13	0	0.5455	0.4091	0.0510	A
CR_7	20	10	31	5	0	0.4545	0.6212	0.0432	M
CR_8	7	31	19	9	0	0.5758	0.7576	0.0538	O
CR_9	16	14	23	13	0	0.4545	0.5606	0.0425	M
CR_{10}	8	21	15	22	0	0.4394	0.5455	0.0411	I
CR_{11}	8	17	16	25	0	0.3788	0.5000	0.0354	I
CR_{12}	9	19	18	20	0	0.4242	0.5606	0.0397	I
CR_{13}	14	11	30	9	2	0.3906	0.6406	0.0446	M
CR_{14}	4	16	22	24	0	0.3030	0.5758	0.0401	I
CR_{15}	23	14	22	7	0	0.5606	0.5455	0.0524	A
CR_{16}	20	19	14	13	0	0.5909	0.5000	0.0552	A
CR_{17}	14	17	24	11	0	0.4697	0.6212	0.0439	M
CR_{18}	12	15	30	9	0	0.4091	0.6818	0.0475	M
CR_{19}	9	20	16	21	0	0.4394	0.5455	0.0411	I
CR_{20}	12	25	16	13	0	0.5606	0.6212	0.0524	O
CR_{21}	14	17	17	18	0	0.4697	0.5152	0.0439	I
CR_{22}	12	14	27	13	0	0.3939	0.6212	0.0432	M
CR_{23}	14	17	24	11	0	0.4697	0.6212	0.0439	M
CR_{24}	13	17	21	15	0	0.4545	0.5758	0.0425	M

Calculate the proportion of A, O, M, and I in a given demand:

$$X_i = \frac{A_i + O_i}{A_i + O_i + M_i + I_i} \quad (1)$$

$$Y_i = -\frac{O_i + M_i}{A_i + O_i + M_i + I_i} \quad (2)$$

X_i is the increase rate of user satisfaction when this requirement is available; Y_i is the decrease rate of user satisfaction when this requirement is not available.

From this, the relative weight w_i of each secondary demand can be obtained as follow.

$$w_i = max\left(\frac{X_i}{\sum_{i=1}^{n} X_i}, \frac{|Y_i|}{\sum_{i=1}^{n} |Y_i|}\right) \quad (3)$$

i=1,2,...,n, n is the number of customer requirements.

3.3. QFD-based requirements transformation and functional requirements ranking

The customer requirements are mapped into functional requirements to best meet the customer needs, and the results are shown in Table 3.

Table 3. Functional Requirements

Customer Requirements	Functional Requirements
CR_1 Taste	F_1 Comments
	F_2 Product picture
CR_2 Fresh	F_3 Production date
CR_3 Packing	F_2 Product picture
CR_4 Logistic	F_4 Logistics information
CR_5 Buy	F_5 Cart
CR_6 Convenient	F_6 Delivery time
CR_7 Quality	F_7 Brand information
	F_8 Merchant Information
CR_8 Quantity	F_9 Portion information
CR_9 Price	F_{10} Price information
CR_{10} Compare	F_2 Product picture
CR_{11} Comment	F_1 Review
CR_{12} Recommend	F_{11} Product recommendation
CR_{13} Merchant	F_8 Merchant Information
CR_{14} Value for money	F_{10} Price information
CR_{15} Child	F_{12} Product composition
CR_{16} Discount	F_{13} Discount information
CR_{17} Product	F_2 Product picture
CR_{18} Service	F_{14} Customer Service
	F_{15} After Sales Service
CR_{19} Moisture	F_{12} Product composition
CR_{20} Clean	F_2 Product picture
CR_{21} Description	F_{16} Product details
CR_{22} Ice pack	F_{17} Chilled and preserved
CR_{23} Brand	F_7 Brand information
CR_{24} Picture	F_2 Product picture

Then the relevance between functional requirements and user needs was scored by an expert group, which consisted of user experience experts, university design teachers and designers. The correlation between functional requirements and user needs was expressed by 5 points (strong correlation), 3 points (correlation), 1 point (weak correlation) and 0 points (no correlation). And the weights of each functional requirement were calculated by using formula (4).

$$R_j = \sum_{i=1}^{n} w_i r_{ij} \quad (4)$$

r_{ij} is the correlation coefficient between the ith customer requirement and the jth functional requirement, j=1,2,...,m, and m is the number of functional requirements.

The weights and ranking of the functional requirements derived are shown in Table 4.

Table 4: Functional requirement weights and ranking

Items	Functional Requirements	R_j	Items	Functional Requirements	R_j
1	F_2 Product picture	1.0877	10	F_4 Logistics information	0.5115
2	F_{16} Product details	0.9985	11	F_{15} After Sales Service	0.4335
3	F_{17} Chilled and preserved	0.8812	12	F_8 Merchant Information	0.3965
4	F1 Comments	0.8457	13	F_3 Production date	0.3845
5	F_{13} Discount information	0.7717	14	F_{10} Price information	0.3781
6	F_5 Cart	0.6401	15	F_{14} Customer Service	0.3754
7	F_{11} Product recommendation	0.6002	16	F_7 Brand information	0.3060
8	F_{12} Product composition	0.5985	17	F_9 Portion information	0.2691
9	F_6 Delivery time	0.5696			

Based on the sorting of functional requirements, corresponding interface designs were carried out, and a system prototype was developed for further testing of the system's usability. The system interface is shown in Figure 1.

4. Satisfaction testing of a fresh product e-commerce platform based on user online reviews

This time, 10 fresh food e-commerce users were invited for usability testing [15]. According to Szymznski and Hise, who defined online shopping customer satisfaction as the evaluation of customers' experience after using the Internet to consume on shopping sites and proposed the influencing factors of online shopping customer satisfaction [16], this user satisfaction test will investigate users' feelings in seven aspects: visual experience, interactive experience, platform information quality, product quality

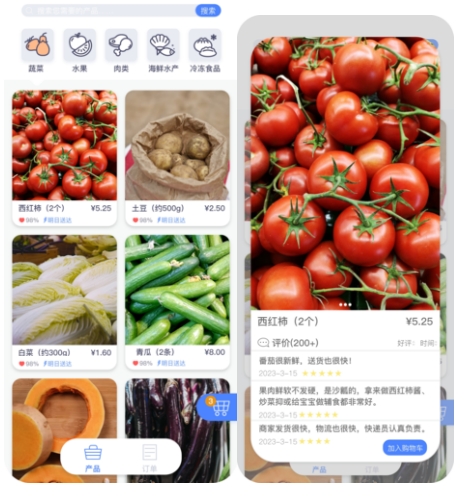


Figure.1. Interface design.

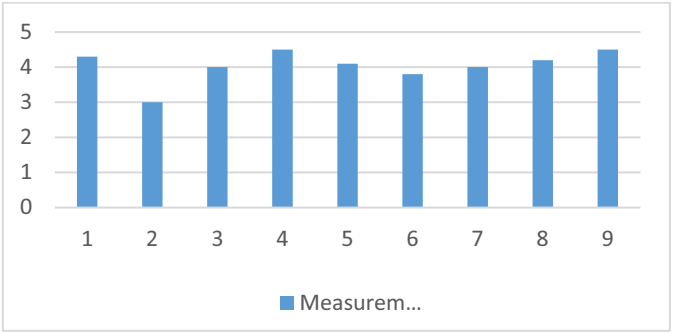
perception, risk perception, willingness to continue using and overall evaluation. As shown in Table 5, this test was conducted by using the prototype fresh food e-commerce platform offline and distributing questionnaires [17] [18]. The test indicators are shown in Table 5. The test results are shown in Table 6.

Table 5: User satisfaction measurement indicators

Evaluation Indicators	Measurement	Score
Visual Experience	1Interface style is recognizable	1 2 3 4 5
Interaction Experience	2Interface display content is clear and concise	
Platform Information Quality	3Simple operation, easy to use	
Product quality perception	4Functional navigation is clear and smooth	
Risk Perception	5Comprehensive and rich information	
	6High information reliability	
Willingness to continue to use	7Convenient logistics	
	8Good product packaging, the product is not easy to damage	
Overall Evaluation	9Product is not fresh	

The test results show that the overall satisfaction of users with the fresh product e-commerce platform is high and basically meets the needs of users. The fresh product e-commerce platform brings users a good interactive experience. Through the optimized design of the fresh product e-commerce platform, users can get a lot of reliable information, which reduces their risk perception and improves their user experience, and enhances their willingness to use it continuously.

Table 6: Results of user satisfaction test



5. Conclusion

In this paper, the customer requirements were summarized by filtering the user online comments. Then, through the KANO-QFD method, the weights of the requirements were derived, and then these requirements were transformed into product features, and the priority order of each feature was used as the basis for the architectural design of the fresh food e-commerce platform. Finally, the interface prototype was tested for user satisfaction, which was high. This further proved the feasibility and rationality of the interface design of the fresh product e-commerce platform based on users' online reviews. It improves the user experience of the fresh products e-commerce platform from the perspective of interface design, and also provides a reference for other types of product design.

6. Discuss

6.1. Limitation

First, due to the limited staff of the research team, only one fresh product e-commerce platform's user online comments were analyzed, which has certain limitations. Secondly, the sample size of the questionnaire is small, which has some influence on the accuracy of the experimental results. Finally, the classification of user needs is not deep enough, and further distinctions should be made in the process of summarizing user needs to improve the accuracy when judging the types of user needs.

6.2. Future work

More user requirements of fresh product e-commerce platforms will be collected, and further analysis of different fresh products e-commerce models combined with user comments will be conducted to design more targeted products and provide better services to users. The number of KANO questionnaires will be further expanded in the future to obtain more accurate types and weights of user needs. We will obtain a larger amount of user review data and consider more wordings in the subdivision and merging of user reviews in order to obtain a more comprehensive user demand.

References

[1] Shanghai Airui Market Consulting Co., Ltd. Research Report on China's Smart Vegetable Market Industry. *Airy series consulting report*, 2021 (05): 28.

[2] Dianfeng Zhang, Zifan Shen, Yanlai Li. Requirement analysis and service optimization of multiple category fresh products in online retailing using importance-Kano analysis. *Journal of Retailing and Consumer Services*, 2023 (72).

[3] Haojie Cong, Hao Ding, Guoqing Wang, Xiaokun Wang, Lingxin Chen. Smartphone-assisted multicolor hypoxanthine sensing for on-site freshness assessment of aquatic products. *Sensors and Actuators B: Chemical*, 2023(379).

[4] Zhengang Zhang, Taiye Luo. Product Requirement Analysis Based on Online Comment Data Mining and Kano Mode. *Management Review*, 2022,34(11):109-117.

[5] Eunil Park. Motivations for customer revisit behavior in online review comments: Analyzing the role of user experience using bigdata approaches. *Journal of Retailing and Consumer Services*, 2019 (51):14-18.

[6] Sangkil Moon, Nima Jalali, Sunil Erevelles. Segmentation of both reviewers and businesses on social media. *Journal of Retailing and Consumer Services*. 2021 (61).

[7] Yingmei Cang, Duchun Wang， A comparative study on the online shopping willingness of fresh agricultural products between experienced consumers and potential consumers. *Sustainable Computing: Informatics and Systems*, 2021 (30).

[8] Bo Feng，Exploration of Layout Design in App Interface Design Based on User Experience: Taking Miaoden App as an Example. *Decoration*, 2021 (339): 134-135.

[9] Yuqing Zhao, Pingnan Ruan, Xiaohong Liu, Xiaohong Shan. Research on User Satisfaction Evaluation Based on Online Comment. *Management Review*, 2020 (32): 179-189.

[10] Zhengqing Luo, Zhigang Fang. Common Customer Satisfaction Research Models and Their Advantages and Disadvantages Analysis. *Journal of Guizhou College of Finance and Economics*, 2002 (06):14-17.

[11] Yongting Ceng. *Fuzzy quality function expansion.* Shanghai Science and Technology Literature Press, 1999.

[12] Kurt, Matzler, Hans.H, Hinterhuber, *"How to make product development projects more successful by integrating Kano's model of customer satisfaction into quality function deployment,"* Technovation, 1998.

[13] Limin Duan, Huan Huang. Integration and application of Kano's model into quality function development. *Journal of Chongqing University*, 2008 (31): 515-519.

[14] Fengcai Ma, Chunyue Li. A Study on the Measurement of Consumer Satisfaction with Selling Fresh Products on E-commerce Platforms: Analysis Based on JD Fresh Online Comments. *Price Theory and Practice*, 2020(05):117-120.

[15] J. Nielsen. *Why You Only Need to Test with 5 Users*, Weblog Measuring Usability, 2011.

[16] Szymanski D M, Hise R T.E. Satisfaction: an initial examination. *Journal of retailing*, 2000 (76): 309-322.

[17] Siyuan Wan, Yun Deng, Jiazhen Wei, Ya Ma, Hao Fang, Shan Qian. Empirical Study on the Elements of Flow Experience in Mobile Application Platforms from the Perspective of Calligraph. *Packing Engineering*, 2022 (43): 75-82.

[18] Xiujuan Li, Zhihao Liu. Research on the willingness of fresh e-commerce app users to continue using it. *Modern Marketing (Later Issue)*, 2023 (02):161-163.