

## AN EVALUATION OF MOBILE BANKING USER INTERFACE AND USER EXPERIENCE USING THE FUZZY KANO METHOD: EVIDENCE FROM BCA MOBILE AND PERMATA ME USERS

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### Abstract

This study aims to evaluate general mobile banking user interface (UI) and user experience (UX) quality using BCA Mobile and Permata ME as representative applications of digital banking services in Indonesia through the Fuzzy Kano approach, which is capable of accommodating uncertainty and subjectivity in user assessments. This study involved 95 active users in Medan City. A total of 20 application features were evaluated based on levels of satisfaction (delight) and dissatisfaction (disgust) and then classified into Must-be, One-dimensional, and Attractive quality attributes. The analysis was conducted in an aggregate manner to capture overall user expectations toward mobile banking applications rather than to compare competitive superiority between the two platforms. The results indicate that the feature “Clear Icons” has the highest priority in the Must-be category, “Well-Organized Transaction History” is the most dominant feature in the One-dimensional category, and “Two-Step Verification for Large Transactions” ranks highest in the Attractive category. These findings suggest that most mobile banking user satisfaction is driven by features with a linear relationship between performance and satisfaction, while additional security features function as satisfaction enhancers. From an academic perspective, this study strengthens the application of the Fuzzy Kano method in evaluating mobile banking UI/UX by emphasizing aggregated user perceptions across multiple applications. Practically, the findings provide guidance for prioritizing feature development to enhance customer satisfaction and loyalty in mobile banking services.

**Keywords:** *Mobile Banking; User Interface; User Experience; Fuzzy Kano; Digital Banking Applications.*

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## 1. INTRODUCTION

The development of digital technology has driven significant transformation in the banking sector, especially through the use of mobile banking services. The presence of mobile banking applications allows customers to carry out financial transactions practically and efficiently without space and time limitations, thus becoming an important part of the financial activities of modern society [1]. This digital transformation encourages banks to not only provide transaction functions, but also ensure the quality of User Interface (UI) and User Experience (UX) that are able to support the usability, convenience, and effectiveness of using applications. A well-designed UI and UX have been proven to have an effect on the satisfaction and loyalty of users of digital banking services [2].

In Indonesia, major banks such as Bank Central Asia (BCA) and Bank Permata have developed their respective mobile banking applications, namely BCA Mobile and Permata ME, as a form of adaptation to changes in customer behavior. Both applications offer a wide range of financial features, from fund transfers to digital payments, aimed at improving the efficiency of banking services [3]. However, the level of user satisfaction is not only determined by the completeness of the features, but also by the ease of use, clarity of the interface, and the consistency of the interface design. Some user reviews indicate that the mobile banking app still faces issues with visuals, navigation, and overall user experience [4].

Several studies emphasize that effective UI and UX evaluation should take into account user diversity rather than treating users as a homogeneous group. In this context, user-centered approaches typically

involve mapping user segments based on demographic characteristics and their perceptions of application interfaces and experiences, enabling developers to better understand the diverse needs and expectations of users [5].

However, this study focuses on capturing aggregate user perceptions of mobile banking applications rather than conducting demographic-based segmentation analysis. This approach is adopted to obtain a general evaluation of mobile banking UI/UX attributes across representative applications.

In addition to the usability aspect, the issue of transaction security is an important concern in mobile banking services. The increasing cases of cybercrime, such as phishing, show that the digital banking system requires a strong security mechanism that is still easy to understand by users so as not to reduce the convenience of transactions [6]. A number of previous studies have examined the quality of UI and UX in mobile banking applications, including the BCA Mobile application, using various evaluation methods. The results of the study show that although the usability level of the application is relatively good, there are still some weaknesses in the aspects of visual design and consistency of the interface [7]. However, studies that comprehensively evaluate mobile banking UI and UX by incorporating multiple applications as reference cases to capture general user expectations are still limited. In addition, the use of the Fuzzy Kano method in analyzing user satisfaction with mobile banking features is also still rarely applied, thus opening up opportunities for further research in this field [8].

Based on the identified research gap, this study focuses on evaluating the quality of mobile banking User Interface and User Experience using BCA Mobile and Permata ME as representative applications by applying the Fuzzy Kano method. This approach is used to identify and prioritize app features based on user satisfaction and dissatisfaction levels. The results of the research are expected to make a practical contribution as evaluation material and recommendations for banking application developers in improving the quality of mobile banking services that are more oriented to user needs [9].

This study does not aim to compare the superiority of BCA Mobile and Permata ME. Instead, both applications are used as representative cases of widely used mobile banking platforms in Indonesia to obtain a more comprehensive understanding of general user expectations toward mobile banking UI/UX. Using multiple applications as reference cases helps reduce application-specific bias and enhances the generalizability of the findings.

Theoretically, this study extends the application of the Fuzzy Kano model in the context of mobile banking UI/UX evaluation by emphasizing aggregated user perceptions across multiple applications. Methodologically, this research offers an aggregate evaluation framework using the Fuzzy Kano approach

to identify and prioritize mobile banking quality attributes, which has been rarely discussed in previous studies.

This study contributes to the literature in three ways. First, it provides an aggregate evaluation of mobile banking user interface and user experience attributes using the Fuzzy Kano model. Second, it extends prior UI/UX studies by incorporating multiple mobile banking applications as reference cases to reduce application-specific bias. Third, the findings offer practical insights for prioritizing UI/UX improvement strategies in digital banking services.

## 2. RESEARCH METHOD

This study adopts an evaluative research design with an aggregate analysis approach. BCA Mobile and Permata ME are used as representative cases of widely used mobile banking applications in Indonesia to evaluate general user interface (UI) and user experience (UX) quality attributes. The study does not aim to compare the superiority or performance differences between applications, but to identify and prioritize mobile banking features based on aggregated user perceptions using the Fuzzy Kano method.

Data collection was conducted through literature review, interviews, and direct observation to identify relevant mobile banking user interface (UI) and user experience (UX) features. The literature review was used to strengthen the theoretical foundation and to identify commonly evaluated attributes in previous mobile banking studies. Interviews and direct observations were carried out to capture practical insights into user interactions with mobile banking applications, including BCA Mobile and Permata ME. The identified features were consolidated into a single list to avoid redundancy and were grouped according to the mobile banking business process.

Based on the identified features, a questionnaire was developed using the Fuzzy Kano method. The questionnaire consisted of functional and dysfunctional questions for each feature, with five response options: like, expect, neutral, tolerate, and dislike. Prior to distribution, a readability test was conducted to ensure clarity and comprehension of all questionnaire items. The questionnaire was then distributed online using Google Forms.

This study employed purposive sampling, targeting respondents who are active users of mobile banking applications, specifically BCA Mobile and Permata ME. The population consisted of 400 active mobile banking users. The sample size was determined using the Slovin formula with a margin of error of 9%, resulting in a minimum sample size of 95 respondents. This sampling approach was considered appropriate to ensure that respondents had sufficient experience in using mobile banking applications [10].

The collected questionnaire data were analyzed using the Fuzzy Kano method. Each feature was classified into quality attributes, namely Must-be, One-dimensional, and Attractive, based on aggregated

user satisfaction and dissatisfaction scores. The analysis focused on identifying priority features that influence user satisfaction in mobile banking applications. No comparative statistical test, such as an independent sample t-test, was applied, as the study does not aim to examine differences between applications but rather to evaluate overall user expectations toward mobile banking UI/UX attributes.

### 3. RESULTS AND DISCUSSION

This section presents the results of the Fuzzy Kano analysis based on aggregated user perceptions of mobile banking applications. The results are discussed to explain the classification of UI/UX features into quality attributes and to interpret their implications for feature prioritization and user satisfaction.

The collected questionnaire data were analyzed using the Fuzzy Kano approach. Respondents' assessments were first normalized to ensure consistency of measurement and comparability across features. Perception measurements were conducted using a five-level Likert scale to represent levels of satisfaction and dissatisfaction. Prior to analysis, the research instrument was tested for validity to ensure that the questionnaire accurately measured the intended constructs [11], [12]. This data is further normalized as described in Table 1 and Table 2 below:

Table 1. Example of attitude values given by respondents (before normalization)

Category	S	H	N	T	TS
Functional	8	5	2	0	0
Dysfunctional	0	0	3	6	1

Table 2. Example of attitude values given by respondents (after normalization)

Category	S	H	N	T	TS
Functional	0.53	0.33	0.13	0	0
Dysfunctional	0	0	0.30	0.6	0.1

The normalization process was performed by calculating the proportion of each response choice relative to the total number of responses, resulting in decimal values. These values were then arranged into fuzzy matrices and processed using matrix multiplication. The multiplication of functional and dysfunctional matrices produced a 5x5 ordered matrix, which was subsequently used to classify each feature into Kano quality categories, namely Must-be (M), One-dimensional (O), Attractive (A), Indifferent (I), Reverse (R), and Questionable (Q).

An example of the matrix multiplication form in equations (1) and equations (2) is shown as follows:

$$[SHNTTS]^T_{fungsional} * [SHNTTS]_{disfungsional} \quad (1)$$

$$= \begin{bmatrix} QAAA0 \\ RIIIM \\ RIIIM \\ RIIIM \\ RRRRQ \end{bmatrix}$$

$$[0.53 \ 0.33 \ 0.13 \ 0 \ 0]^T * \begin{bmatrix} 0 & 0 & 0 & .3 & 0.6 & 0.1 \\ 0 & 0 & 0.15 & 0.31 & 0.05 \\ 0 & 0 & 0.09 & 0.19 & 0.03 \\ 0 & 0 & 0.03 & 0.07 & 0.01 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \quad (2)$$

Following matrix multiplication, a defuzzification process was conducted to convert fuzzy values into binary form using a threshold value of 0.4. Membership values below 0.4 were converted to 0, while values equal to or above 0.4 were converted to 1. An illustration of the defuzzification results is shown Table 3.

Table 3. Defuzzification

Sebelum didefuzikasi						Setelah didefuzikasi					
M	O	A	I	R	Q	M	O	A	I	R	Q
0.21	0.41	0.24	0.12	0.01	0.01	0	1	0	0	0	0

The final classification of features was determined by summing the category values obtained from the defuzzification process. Based on the principle proposed by Lee and Huang [13], the final Kano category of each feature was determined according to the highest membership degree. In cases where two categories had equal values, category priority was applied in the following order: Must-be > One-dimensional > Attractive > Indifferent.

After classification, feature prioritization was performed by calculating user perceptions of satisfaction (delight) and dissatisfaction (disgust). These values were obtained by summing the scores of each Kano category for every feature, as expressed in Equations (3) and (4).

$$Customer\ Delight = \frac{A + O + R}{(M + O + A + I + R + Q)} \quad (3)$$

$$Customer\ Disgust = \frac{A + O}{(M + O + A + I + R + Q)(-1)} \quad (4)$$

The priority level of each feature was then determined using a range score, calculated as the difference between delight and disgust scores, as shown in Equation (5). A higher range score indicates a higher priority level for feature improvement.

$$Range\ score = \text{delight score} - \text{disgust score} \quad (5)$$

The twenty identified features were subsequently grouped into three main Kano quality attributes: Must-be, One-dimensional, and Attractive.

#### Features in the Must Be quality attribute category

Features classified under the Must-be quality attribute represent basic requirements that users implicitly expect to be present in mobile banking applications. Although the presence of these features does not significantly increase satisfaction, their absence may lead to strong dissatisfaction. Based on the priority analysis, the "Clear Icons" feature obtained the highest rank within the Must-be category, indicating its critical role in ensuring intuitive navigation and reducing user confusion. Other features in this category include easy access to the home menu

and multilingual support. The priority ranking of Must-be features is presented in Figure 1.

Table 4. Must be quality attribute category feature rating

No.	Feature	MAIN	Delight	Disgust	Range
16	Clear icons	0.32	-0.70	1.10	1.10
17	“Back to Home” feature is easily accessible	0.28	-0.70	0.98	0.98
20	Multilingual support	0.33	-0.53	0.86	0.86

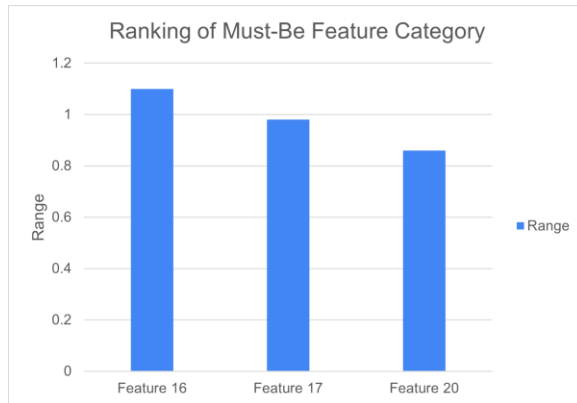


Figure 1. The ranking of the feature category must be

### Features in the One-Dimensional category

One-dimensional quality attributes demonstrate a linear relationship between feature performance and user satisfaction. Improvements in these features directly enhance satisfaction, while poor performance may cause dissatisfaction. The results indicate that “Organized Transaction History” achieved the highest priority ranking within this category. This feature enables users to efficiently review and manage transaction records, supporting financial monitoring and transparency. Other important One-dimensional features include smooth animations, QR code payments, instant transactions, fast loading time, intuitive menus, and automated financial reports. These findings confirm that performance-related attributes are dominant factors influencing mobile banking user satisfaction [14], [15], [16], [17].

Table 5. One-Dimensional category feature ranking

No	Feature	MAIN	Delight	Disgust	Range
2	Organized transaction history	0.79	-0.76	1.55	1.55
19	Smooth animations	0.71	-0.77	1.49	1.49
7	QR code payment	0.74	-0.73	1.46	1.46
1	Instant transactions	0.73	-0.69	1.42	1.42
10	Quick search	0.80	-0.62	1.42	1.42
9	Fast loading	0.75	-0.66	1.41	1.41
13	Automated financial reports	0.67	-0.73	1.40	1.40

6	Online customer service	0.68	-0.71	1.39	1.39
8	Automatic payments (subscriptions)	0.66	-0.68	1.35	1.35
11	Intuitive menu	0.76	-0.59	1.35	1.35
4	Real-time transaction notifications	0.72	-0.61	1.33	1.33
14	Balance peek (view balance without logging in)	0.62	-0.60	1.22	1.22
18	Minimalist layout	0.66	-0.50	1.16	1.16

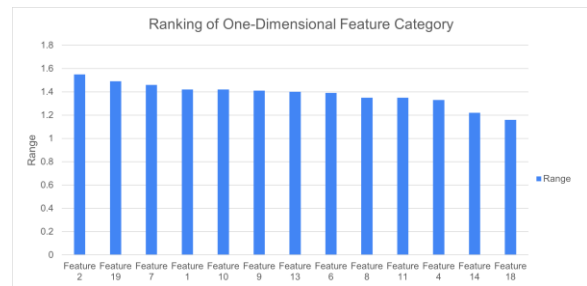


Figure 2. Ranking of One-Dimensional category features

### Features in the Attractive category

Attractive quality attributes are features that significantly enhance user satisfaction when present but are not explicitly expected by users. The analysis shows that “Two-step Verification for Large Transactions” ranked highest within this category. This feature provides additional security assurance and increases user confidence, particularly for high-value transactions. Other Attractive attributes include customizable themes, biometric login, and small transactions without a PIN. Although these features are not mandatory, their presence contributes positively to overall user experience and perceived application value [18].

Table 6. Attractive category feature ranking

No	Feature	MAIN	Delight	Disgust	Range
5	Two-step verification for large transactions	0.57	-0.21	0.78	0.78
12	Customizable theme (dark/light mode)	0.62	-0.10	0.73	0.73
15	Small transactions without a PIN	0.41	-0.06	0.48	0.48
3	Biometric login (fingerprint/face recognition)	0.28	-0.06	0.34	0.34

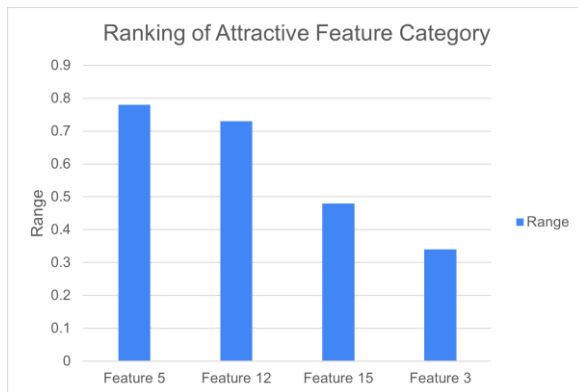


Figure 3. Ranking of features in the attractive category

Overall, the findings indicate that mobile banking user satisfaction is predominantly influenced by One-dimensional attributes, highlighting the importance of consistent performance, efficiency, and usability. Security-related features tend to function as Attractive attributes, serving as satisfaction enhancers rather than basic requirements. These results are consistent with previous studies emphasizing the critical role of usability and performance in digital banking environments [14], [15], [16], [17], [18].

From an academic perspective, the results demonstrate that the Fuzzy Kano method is effective in capturing nuanced user perceptions that are subjective and uncertain. By applying an aggregate analysis across representative mobile banking applications, this study provides insights into general user expectations toward mobile banking UI/UX without focusing on application-specific superiority. The findings can serve as a reference for mobile banking developers in prioritizing feature improvements and designing user-centered digital banking services.

#### 4. CONCLUSION

This study evaluates mobile banking user interface (UI) and user experience (UX) quality based on aggregated user perceptions using the Fuzzy Kano method, with BCA Mobile and Permata ME serving as representative applications. The results show that twenty evaluated features are classified into three main quality attributes: Must-be, One-dimensional, and Attractive. The dominance of One-dimensional attributes indicates that most mobile banking features exhibit a linear relationship between performance and user satisfaction. This finding highlights the importance of optimizing performance-related features to maintain and enhance user satisfaction.

From a theoretical perspective, this study strengthens the application of the Fuzzy Kano model in mobile banking UI/UX evaluation by emphasizing aggregated user perceptions across multiple applications rather than direct application comparison. This approach contributes to a more generalizable understanding of user expectations in digital banking services. From a managerial perspective, the findings

of this study provide practical guidance for mobile banking developers, product managers, and UI/UX designers in prioritizing feature development. The results indicate that Must-be attributes should be fulfilled as a baseline to prevent user dissatisfaction, while One-dimensional attributes require continuous optimization due to their direct impact on user satisfaction. Attractive attributes can be selectively developed as value-added features to enhance perceived service quality and application competitiveness. These findings can assist managerial decision-making in allocating development resources more effectively and aligning UI/UX improvement strategies with actual user expectations. Future research may conduct application-level comparative analysis using statistical testing to further explore platform-specific differences.

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