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ASSESSING USER SATISFACTION AND ALTERNATIVE DESIGN RECOMMENDATION OF MOBILE BANKING APPLICATIONS

Andang Wijanarko[1*]; Bagus Mirzana[1]; Aan Erlansari[1], Yudi Setiawan[1]

Department of Information Systems[1]
Universitas Bengkulu, Indonesia[1]
https://ft.unib.ac.id/si/[1]
andang@unib.ac.id*, bagusmirzana@gmail.com, aan_erlanshari@unib.ac.id, ysetiawan@unib.ac.id

(*) Corresponding Author
(Responsible for the Quality of Paper Content)

Abstract—*Advances in information technology in the banking sector have led banking institutions to continuously innovate and improve their services. One such service is the emergence of mobile-based banking applications. Bank Bengkulu has introduced a mobile-based banking application, but it has received poor ratings and negative feedback from its users. This study aims to evaluate user satisfaction with the Bengkulu mobile banking application using the End User Computing Satisfaction (EUCS) method, then improve user satisfaction by redesigning the application using the Double Diamond method, and re-evaluate the results of the application redesign using the System Usability Scale (SUS) method and sentiment analysis using Natural Language Processing (NLP) with the IndoBERT model. The results show that user satisfaction with the Bengkulu mobile banking application was 2.77 when measured using the EUCS method. This measurement falls into the 'adequate' category but is very close to the 'dissatisfied' category. After the application redesign, user satisfaction improved, as indicated by the evaluation of users using the SUS method with a score of 87.975, which falls into the 'excellent' category. The results of qualitative user satisfaction measured using sentiment analysis methods show that there were 75 positive sentiments, 22 neutral sentiments, and only 3 negative comments. The results of the study show that there was a notable improvement in user satisfaction after the Bengkulu Bank application was redesigned.*

Keywords: *EUCS, Mobile Banking, Natural Language Processing (NLP), Sentiment Analysis, User Satisfaction.*

Intisari— *Kemajuan teknologi informasi di sektor perbankan telah membuat institusi perbankan terus berinovasi dan meningkatkan layanan mereka. Salah satu layanannya adalah munculnya aplikasi perbankan berbasis mobile. Bank Bengkulu telah memperkenalkan aplikasi perbankan berbasis mobile, namun aplikasi tersebut menerima penilaian buruk dan umpan balik negatif dari para penggunanya. Penelitian ini bertujuan untuk mengevaluasi kepuasan pengguna terhadap penggunaan aplikasi mobile bank Bengkulu menggunakan metode End User Computing Satisfaction (EUCS), kemudian meningkatkan kepuasan pengguna melalui redesain aplikasi tersebut menggunakan metode Double Diamond, serta mengevaluasi kembali hasil redesain aplikasi tersebut menggunakan metode System Usability Scale (SUS) dan metode sentimen analisis menggunakan Natural Language Processing (NLP) dengan model IndoBERT. Hasil penelitian menunjukkan bahwa kepuasan pengguna aplikasi mobile bank Bengkulu berada di angka 2,77 setelah diukur menggunakan metode EUCS. Hasil pengukuran tersebut masuk ke dalam kategori "adequate" atau "cukup," namun sangat dekat ke kategori "dissatisfied" atau tidak puas. Setelah redesain aplikasi dilakukan, tingkat kepuasan pengguna menjadi lebih baik, ditunjukkan dengan evaluasi kepada pengguna menggunakan metode SUS dengan skor 87,975 dan masuk dalam kategori "excellent." Hasil dari kepuasan pengguna secara kualitatif yang diukur menggunakan metode sentimen analisis menunjukkan terdapat 75 sentimen positif, 22 netral, dan hanya 3 komentar negatif. Hasil penelitian menunjukkan terjadi peningkatan signifikan dari aspek kepuasan pengguna setelah dilakukan redesain aplikasi bank Bengkulu.*

Kata Kunci: *EUCS, Mobile Banking, Natural Language Processing (NLP), Analisis Sentimen, Kepuasan Pengguna.*

INTRODUCTION

The financial sector's digital transformation has fundamentally altered the interaction between banking institutions and their customers. The increasing demand for rapid, accessible, and user-friendly services has prompted banks globally to adopt technology-driven innovations, notably the implementation of mobile banking applications [1], [2]. Mobile banking applications have transitioned from a supplementary service to a fundamental platform that facilitates daily financial transactions and meets the needs of individuals. As user expectations for digital experiences in mobile applications increase, banks and financial institutions must continually enhance the quality of their digital services, focusing on usability and user satisfaction [3].

To maintain competitiveness, numerous banks and financial institutions have implemented mobile banking services in response to emerging challenges. Bank Bengkulu, a regional bank in Indonesia, has introduced a mobile banking application to facilitate online transactions for its customers. The app allows users to check balances, transfer funds, and pay bills. Nonetheless, the availability of digital services does not ensure success if they do not align with users' needs and expectations [4]. This study examines the user experience of Bank Bengkulu's mobile banking application through a single case analysis. The case study approach is frequently employed in information system research that emphasizes usability and user experience, facilitating a more in-depth examination of user context and characteristics.

The mobile banking application of Bank Bengkulu faces considerable challenges in customer acceptance, as indicated by its low ratings of 4 out of 5 on both the Google Play Store and App Store, accompanied by numerous negative user reviews. Common criticisms include a non-intuitive user interface, subpar application performance, unclear navigation, and inconsistent functionalities. The challenges impact service efficacy and pose risks to user retention, customer loyalty, and the institution's reputation in the digital age. User satisfaction is an essential consideration in this context. User satisfaction functions as an indicator of an information system's effectiveness and a critical element in fostering the ongoing use of digital banking services [5]. Hence, an analytical and evidence-based approach is crucial for evaluating user satisfaction and identifying opportunities for improvement.

This study aims to evaluate user satisfaction with Bank Bengkulu's mobile banking application using the End-User Computing Satisfaction (EUCS) model, which includes five key dimensions: content, accuracy, format, ease of use, and timeliness. The EUCS approach was chosen to evaluate user satisfaction because of its reliability in assessing user interfaces from the user's perspective [6]. The application interface was updated using the Double Diamond framework, a user-centric design methodology that includes four stages: Discover, Define, Develop, and Deliver [7]. The application redesign utilized Nielsen and Shneiderman's usability criteria to ensure that the interface quality conformed to established best practices in user interface and user experience design [8].

The evaluation of the redesign results was conducted using the System Usability Scale (SUS) as a quantitative measure of system usability [9]. This study utilized a qualitative methodology, employing sentiment analysis based on Natural Language Processing (NLP) with the IndoBERT model to examine users' perceptions and reactions to the new application design [10]. The combination of quantitative and qualitative evaluations provides a comprehensive understanding of the effectiveness of the implemented solution.

It is essential to clarify that the contribution of this study does not involve the proposal of a new usability evaluation model. Rather, the methodological contribution is evident in the structured evaluation workflow that integrates problem identification, design intervention, and post-intervention validation within a unified framework. In contrast to prior research that typically employs satisfaction measurement, usability evaluation, or sentiment analysis in isolation, this study establishes a traceable relationship among user dissatisfaction indicators identified using the EUCS, design decisions derived from the Double Diamond process, usability outcomes assessed through the SUS, and user perceptions obtained through sentiment analysis.

This integrated workflow serves as a methodological reference for studies focused on redesign in mobile banking and other digital service contexts. Eventually, this study offers practical and methodological contributions to the improvement of digital banking services, particularly in Bank Bengkulu's mobile banking application, through the integration of user satisfaction measurement techniques, user-centered design, and post-redesign evaluation, all aimed at enhancing user experience.

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Literature Review

This research analyzes users of mobile banking applications, with a particular emphasis on customers of Bank Bengkulu as the main user demographic. Research [1], [4] [11] analyzes various perspectives on the adoption of digital banking services, including user attitudes and common challenges in implementation. The challenges include issues related to system reaction time, non-intuitive interfaces, security vulnerabilities, and design inconsistency, all of which can negatively impact user satisfaction and loyalty.

These findings highlight the importance of creating systems that can overcome these challenges to improve user experience and retention. Recent research demonstrates a significant rise in mobile banking adoption in the Indonesian banking sector [2], [11], [12]. Local user requirements often diverge from the standardized designs typically utilized. This requires the adaptation of application designs to fulfill the specific needs from clients within a particular region or segment. For Bank Bengkulu, personalization is crucial for improving service quality and addressing negative perceptions stemming from previous user experiences.

Previous studies have extensively explored the development of information systems in the banking sector. For instance, [13] restructured an e-commerce interface according to heuristic principles to enhance user experience, whereas [14], [15], [16] created and assessed a microfinance application designed for the unique attributes of a particular user community. These studies demonstrate that the effectiveness of digital systems relies on a user-centered design approach adapted to the specific context of use. In the research related to interface design, the EUCS model is often used to evaluate user satisfaction based on dimensions such as content, accuracy, format, ease of use, and timeliness [17].

Research [17], [18] shows that the use of EUCS is effective in identifying problem areas in mobile applications and web-based applications, which can then serve as a basis for design improvements. Additionally, the Double Diamond method has been widely used in user interface and user experience development due to its clear stages of problem exploration and solution development, which have proven to enhance the relevance of design to user needs [7].

The EUCS model is frequently employed in interface design research to assess user satisfaction across dimensions including content, accuracy, format, ease of use, and timeliness [17]. Research [17], [18] indicates that the use of EUCS effectively identifies problem areas in mobile and web-based applications, providing a foundation for design improvements. The Double Diamond method is extensively utilized in user interface and user experience development, owing to its distinct stages of problem exploration and solution development, which effectively enhance design relevance to user needs [7].

The assessment of an application redesign's success relies on both technical metrics and user perceptions and responses. Research [14], [19] highlights the significance of integrating quantitative assessments, such as the System Usability Scale (SUS), with qualitative evaluations via sentiment analysis to achieve a more thorough understanding. Recent studies [20], [21] demonstrate that sentiment analysis utilizing Natural Language Processing (NLP), especially through language models like IndoBERT, can uncover user perception patterns that quantitative surveys may overlook.

This study examines the satisfaction level of the Bank Bengkulu mobile banking application through the EUCS framework, while also incorporating a redesign process based on the Double Diamond method, followed by a post-redesign evaluation using the SUS and sentiment analysis through NLP techniques. This approach aims to produce design recommendations that fulfill usability standards, align with user needs and expectations, and improve satisfaction in application usage.

This study specifically examines the aspects of usability and user satisfaction. This study does not evaluate other critical technical dimensions in banking systems, including transaction security, system performance, network reliability, scalability, and regulatory compliance, as these necessitate a distinct technical approach. This study examines the human-system interaction elements pertinent to user experience in mobile banking services.

MATERIALS AND METHODS

This study was carried out through a series of structured stages, including initial evaluation, redesign process, and post-implementation evaluation. Figure 1 illustrates the research flowchart. The research comprises six primary stages: literature review, initial satisfaction assessment utilizing the EUCS, redesign and development through the Double Diamond method, usability evaluation employing the SUS, sentiment analysis via NLP, and interpretation of results to formulate recommendations.

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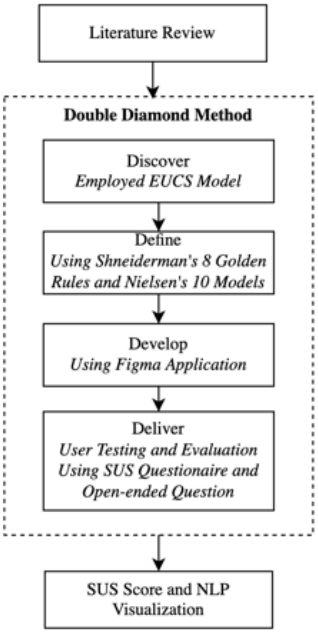

Source: (Research Results, 2025)
Figure 1. Research Methodology

Determination of Research Subjects

. The research subjects were selected purposively, with the criteria for respondents being Bank Bengkulu customers who had utilized the mobile banking application a minimum of three times within the past three months. The minimum sample size was determined using the Lemeshow formula, incorporating a 10% margin of error, which indicated a requirement of at least 100 respondents [22]. This sample was deemed adequate to represent the target population of active application users. The respondents were restricted to individuals actively utilizing Bank Bengkulu's mobile banking application. This consideration was grounded in the research objective, which aimed to enhance user experience and retention, necessitating respondents with baseline experience prior to and following the redesign. New users or prospective users could not offer comparative assessments due to a lack of historical experience with the previous interface.

EUCS Data Collection

Initial assessments of user satisfaction utilized the End-User Computing Satisfaction (EUCS) model, comprising five dimensions: content, accuracy, format, ease of use, and timeliness. The EUCS questionnaire instrument was translated into Bahasa Indonesia and structured as a 5-point Likert scale with the following format:

a. Score 5. Strongly Agree (SA)
b. Score 4. Agree (A)
c. Score 3. Neutral (N)
d. Score 2. Disagree (D)
e. Score 1. Strongly Disagree (SD)

The questionnaire was distributed to respondents via Google Forms to facilitate distribution and data collection. Respondents were asked to use the Bank Bengkulu mobile banking application first, then fill out the questionnaire based on their usage experience.

Table 1. EUCS Testing Instrument (Source: [6], [23] [24], [25])

Instrument	Question Item	Code
Content	Is the information provided by the application correct and according to your needs?	C1
	Does the information content provided meet needs?	C2
	Does the application provide exactly the reports you need	C3
	Does the application provide complete information?	C4
Accuracy	Does the application have a consistent interface and never have errors when used?	A1
	Is the application accurate?	A2
	Does the application provide output that corresponds to user input?	A3
Format	Is the use of color combinations in the application appropriate and in line with the institution's identity?	F1
	Is the application capable of providing services according to needs?	F2
	Is the application interface easy to understand and operate?	F3
	Is the application well structured so that it is easy to use?	F4
Ease of use	Is the application easy to use?	E1
	Does the application provide comprehensive instructions for use?	E2
	Is the application fast and accurate in providing output and information from user requests?	E3
	Is the system user-friendly?	E4
Timeliness	Is the system able to provide the information you need promptly?	T1
	Does the system provide up-to-date information?	T2

Source: (Research Results, 2025)

Redesign Using Double Diamond

Based on the EUCS evaluation results, a redesign process was carried out using the Double Diamond method [7], which consists of four stages:

1. **Discover**: in-depth exploration of problems and user needs through EUCS data analysis and user reviews on the Play Store and App Store.
2. **Define**: creation of a new design concept by applying Nielsen's Ten Usability Heuristics and Shneiderman's Eight Golden Rules.

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3. **Develop**: creation of a new interface prototype using the Figma design tool.
4. **Deliver**: This prototype was published on a testing platform so that it can be accessed directly by respondents for the next evaluation stage.

SUS Data Collection

After the new design was completed, an evaluation was conducted using the System Usability Scale (SUS). The SUS instrument consists of 10 statements with a 5-point Likert scale [5] with the following format:

a. Score 5. Strongly Agree (SA)
b. Score 4. Agree (A)
c. Score 3. Neutral (N)
d. Score 2. Disagree (D)
e. Score 1. Strongly Disagree (SD)

Respondents were asked to try out the redesigned application prototype and then fill out the SUS questionnaire. The SUS scores were then interpreted based on standard categories such as Poor, Good, and Excellent.

Table 2. SUS Testing Instrument (Source: [22])

No	Question Item
1	I think that I would like to use this system frequently
2	I found the system unnecessarily complex
3	I thought the system was easy to use
4	I think that I would need the support of a technical person to be able to use this system
5	I found the various functions in this system were well integrated
6	I thought there was too much inconsistency in this system
7	I would imagine that most people would learn to use this system very quickly
8	I found the system very cumbersome to use
9	I felt very confident using the system
10	I needed to learn a lot of things before I could get going with this system

Source: (Research Results, 2025)

The evaluation of the new design utilized a high-fidelity prototype that was not fully integrated with backend services or actual transaction systems. This method is frequently employed in the initial phases of assessing UX-oriented interface designs and is advocated in HCI research, as it enables users to engage with functions in a realistic manner without the necessity of comprehensive operational infrastructure. Additionally, prototype-based evaluation can mitigate implementation risks and alleviate development burdens during the initial phases, as evidenced by prior UX research. While the evaluation utilized a high-fidelity prototype instead of a fully operational banking application, the prototype effectively mirrored the primary user interaction flows, navigation structure, information hierarchy, and transaction scenarios found in the actual system. Consequently, the usability assessment concentrated on interaction quality, interface consistency, learnability, and perceived ease of use, which are fundamental dimensions of usability evaluation. Aspects related to backend integration, including transaction processing speed, network latency, and operational reliability, are not included in this evaluation and warrant further investigation through future field implementation studies.

It should be emphasised that this study does not directly compare EUCS and SUS scores, as the two instruments measure different constructs and use different measurement scales. The EUCS was used in the initial stage to identify the level of user satisfaction with the application currently in use, along with the dimensions requiring improvement. These findings then form the basis for the redesign process using the Double Diamond approach. Once the redesign process is complete, the SUS is used to evaluate the usability of the proposed design. Consequently, the improvement referred to in this study is not based on a numerical comparison between EUCS and SUS scores, but rather on the continuous relationship between problem diagnosis, design intervention, and usability evaluation following the redesign.

Sentiment Analysis Using NLP

To complement the quantitative evaluation, sentiment analysis was conducted on respondents' comments and feedback after trying out the new design. The sentiment analysis process was carried out using Natural Language Processing (NLP) techniques with the IndoBERT model. The data source for sentiment analysis comes from natural user feedback. Variations in comment quality, such as length, level of detail, and clarity, are common characteristics of user-based textual data. Therefore, a pre-processing step is performed to reduce noise, including text normalization, removal of non-text characters, and removal of irrelevant words. This study employs IndoBERT not to advance NLP model development, but as an evaluative tool to elucidate user perceptions from a qualitative standpoint. IndoBERT functions as an auxiliary instrument in the data triangulation process rather than as a primary methodological contribution. This study did not perform retraining or model validation processes, as IndoBERT was utilized as an evaluative tool to assist in user perception analysis rather than to aid in the development of NLP models.

Therefore, the aim of integrating IndoBERT in this study was not to create or enhance a

sentiment classification model but to facilitate the triangulation of usability findings derived from EUCS and SUS evaluations. Consequently, a pre-trained IndoBERT model was utilized without further fine-tuning or comparative testing of models. This decision was made because the study focuses on user experience evaluation and interface redesign, rather than on the development of natural language processing models. Thus, the NLP component should be viewed as a supplementary analytical tool rather than the main methodological contribution of this research.

RESULT AND DISCUSSION

Discover

At this stage, initial measurements were taken using the EUCS method to determine the user satisfaction level of Bank Bengkulu's mobile banking application before redesigning it. Questionnaires were distributed to 100 respondents via Google Forms based on the Lemeshow formula [22]. The research instrument has undergone validity and reliability testing to ensure the quality of the measurements. Validity testing was conducted using Pearson's correlation between item scores and total scores. The results of the testing showed that all items in the instrument had a correlation coefficient greater than the table r value (r > 0.195), and so all items were deemed valid. Reliability testing was conducted using Cronbach's Alpha to measure the internal consistency of the instrument. The results of the testing showed that the Cronbach's Alpha value for the EUCS instrument was above the recommended minimum threshold (α > 0.60). Consequently, the instrument possesses a very high level of reliability and is suitable for use in this study.

Table 3. Input Data From EUCS Respondents

Instrument	Likert Scale				
	SD	D	N	A	SA
Content	38	107	162	77	16
Accuracy	43	86	111	50	10
Format	40	115	156	71	18
Ease of use	46	125	139	69	21
Timeliness	20	69	72	35	4

Source: (Research Results, 2025)

To determine the level of user satisfaction, the researcher used the theory set by Kaplan and Norton with the following levels of satisfaction [26].

$$RK = \frac{JSK}{JK} \quad (1)$$

Information:
RK = Average Satisfaction
JSK = Total Score Questionnaires
JK = Number of Questionnaires

Table 4. Level of User Satisfaction Based on Kaplan and Norton

Range	Category
1 – 1.79	Very Dissatisfied
1.80 – 2.59	Dissatisfied
2.60 – 3.39	Doubt
3.40 – 4.91	Satisfied
4.20 – 5	Very Satisfied

Source: (Research Results, 2025)

For example, this is the user satisfaction level on the "content" variable by using the Kaplan and Norton formula.

$$RK = \frac{(98 * 1) + (107 * 2) + (162 * 3) + (77 * 4) + (16 * 5)}{98 + 107 + 162 + 77 + 16}$$

$$RK = 2{,}81$$

Table 5. The Results of EUCS Analysis

Instrument	Average Satisfaction	Category
Content	2.81	Doubt
Accuracy	2.66	Doubt
Format	2.78	Doubt
Ease of use	2.73	Doubt
Timeliness	2.67	Doubt
Average Satisfaction	**2.77**	

Source: (Research Results, 2025)

The analysis results on table 2 show an average satisfaction level of 2.77. Based on the interpretation category, this score falls within the "Doubt" range but is only 0.18 points away from the "Dissatisfied" category (2.59 points). All aspects measured were consistently at almost the same level and fall into the same category, namely "Doubt." This indicates that users were not yet fully satisfied with the application, and there is significant room for improvement in all dimensions, especially in the accuracy aspect, which has the lowest score. The findings corroborate research [18], [27] indicating that user satisfaction is a pivotal factor in the adoption of mobile banking applications and should be prioritized in design enhancements.

Define

The define stage involved the redesign of the Bank Bengkulu application, addressing the shortcomings identified in the prior stage. The redesign of recommendations for enhancing the interface of Bank Bengkulu's mobile banking application was guided by a combination of Shneiderman's and Nielsen's principles. These rules served as a reference for design planning and were utilized to identify suitable features and

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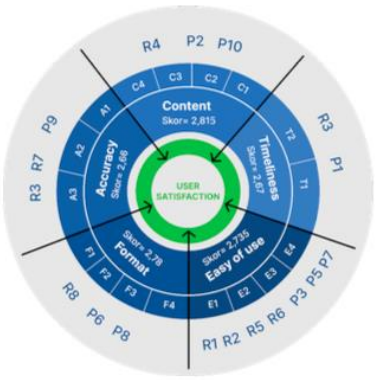
enhancements for each usability issue within the application.

Table 6. Shneiderman's Eight Golden Rules and Nielsen's Ten Models

Schneiderman's Eight Golden Rules	Nielsen's Ten Models
Strive for consistency (R1)	Visibility of System Status (P1)
Enable Frequent Users to Use (R2)	Match Between System and The Real World (P2)
Offer Informative Feedback (R3)	User Control and Freedom (P3)
Design Dialogs to Yield Course (R4)	Consistency and Standards (P4)
Prevent Errors (R5)	Error Prevention (P5)
Permit Easy Reversal of Actions (R6)	Recognition Rather than Recall (P6)
Keep User in Control (R7)	Flexibility and Efficiency of Use (P7)
Reduce Short-term Memory Load (R8)	Aesthetic and Minimalist Design (P8)
	Help Users Recognize, Diagnose, and Recover from Errors (P9)
	Help and Documentation (P10)

Source: (Research Results, 2025)

The following is a diagram interpreting the implementation of Nielsen's Ten Usability and Schneiderman's Eight Golden Rules for improving user satisfaction in each EUCS dimension.



Source: (Research Results, 2025)
Figure 2. Problem Solution Mapping Based on Shneiderman's Eight Golden Rules and Nielsen's Ten Models

Shneiderman's rules (R) focus on improving interface design that is immediately visible and noticeable to users. Rules such as consistency (R1), feedback (R4), and error prevention (R5) will directly target low EUCS aspects such as accuracy (2.66) and ease of use (2.73) by making applications more predictable, secure, and responsive. Meanwhile, Nielsen's Heuristics (P) provide a framework for evaluating more fundamental and systemic usability issues. Heuristics such as the match between the system and the real world (P2) and aesthetic and minimalist design (P8) can help diagnose and fix root problems in the Format (2.78) and Content (2.81) aspects, for example, by simplifying the display and ensuring that the language used is easy to understand. In other words, Shneiderman's rules provide a practical framework for enhancing direct user interaction, whereas Nielsen's heuristics function as diagnostic tools for uncovering and addressing fundamental usability problems. The integration of these two models guarantees that UI enhancements are both meaningful and effective, leading to an increase in user satisfaction from a state of uncertainty to a more positive experience [8].

Develop

A focused design guide is essential for establishing the style and direction of user interface design. System design offers a framework to ensure consistency in application design, facilitating user comprehension of the application's flow. In addition, the Develop stage emphasizes the creation of visual interface elements while also translating EUCS findings and applying Nielsen and Shneiderman's principles into concrete, measurable design modifications. At this stage, the components and interaction flows of the application were being redesigned to specifically address the primary weaknesses identified in Accuracy (2.66), Ease of Use (2.73), and Format (2.78). The table below elucidates the correlation among the findings, the design principles utilized, and the implemented solutions in the design.

Table 7. Design Changes

EUCS Issues	Applied Design Principles	Design Changes
Low accuracy (2.66)	Error Prevention, Informative Feedback	• Implementing input confirmation prior to transaction processing. • Enhancing real-time transaction status visibility through the use of color indicators and icons. • Enhancing error messages to deliver actionable insights.
Inconsistent Format (2.78)	Consistency and Standards	• Standardize the header–content–footer structure on all pages. • Align button sizes, spacing between elements, and transaction card styles.
Low ease of use (2.73)	Match with Real World, Recognition	• The menu is streamlined into three primary categories: Account, Transactions, and Services.

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EUCS Issues	Applied Design Principles	Design Changes
Timeliness (2.67)	Visibility of System Status	• Incorporating representative icons to facilitate user recognition of functions without the need for extensive text. • Implement a progress indicator for every page load. • Show a placeholder during the processing phase.

Source: (Research Results, 2025)

System design encompasses various elements, such as typography guidelines, color schemes, icon sets, and components including button styles, navigation, input fields, and headers [28], [29].

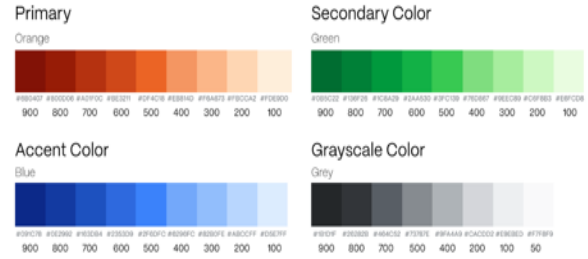
1. Typography

PP Mori was selected as the typeface for the redesign of Bank Bengkulu's mobile banking application due to its suitability for interfaces necessitating a modern and minimalist aesthetic.

Source: (Research Results, 2025)
Figure 3. Typography

2. Color

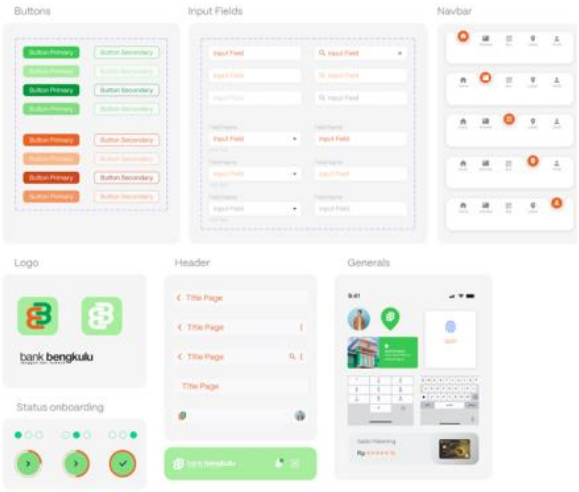
The main colors of orange and green are the colors of Bank Bengkulu's identity. These colors are found in the Bank Bengkulu logo and are also frequently used in campaigns and the Bank Bengkulu building's identity. The accent colors are generated from the main colors.



Source: (Research Results, 2025)
Figure 4. Color Guide for Bank Bengkulu's Mobile Banking Application

3. Components

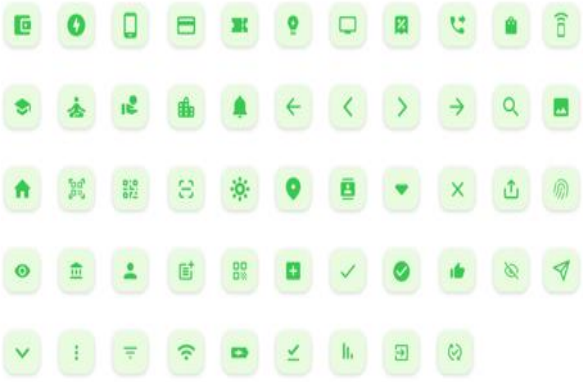
Components contain several elements that are important for application interface design. Components enable more consistent designs and provide a deeper understanding of application design guidelines.



Source: (Research Results, 2025)
Figure 5. Components Sample

4. Iconography

The selection of icons was tailored to existing design requirements. Icons play an important role in application interface design because they provide users with a quick understanding using symbols. Icons were selected based on our preferences and a collection of icon elements that suit the application's design requirements.



Source: (Research Results, 2025)
Figure 6. Iconography Sample

5. Wireframe (Low Fidelity)

The wireframing stage is an important process in designing user interfaces, as it provides guidance in designing an interface [29].

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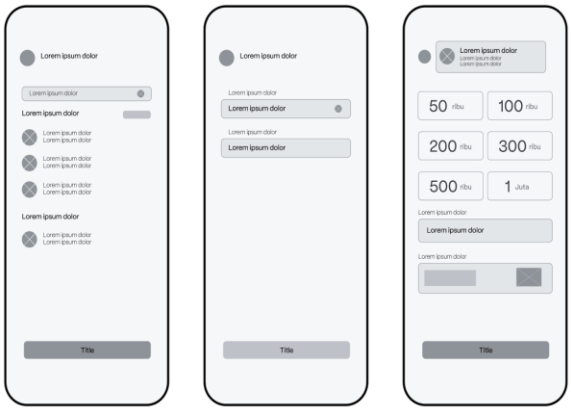
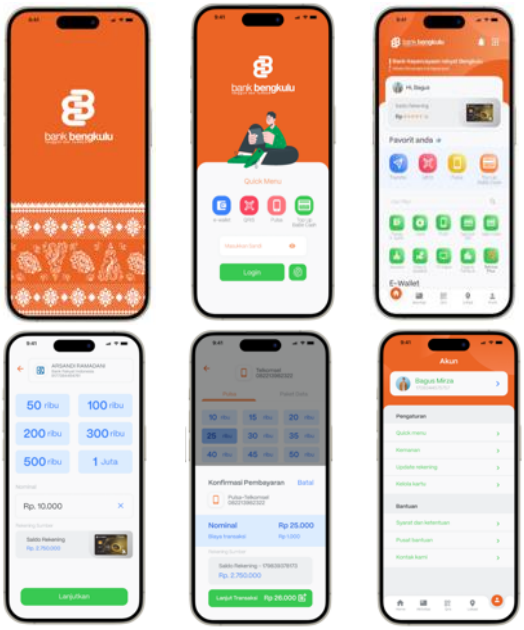


Source: (Research Results, 2025)
Figure 7. Wireframe Sample

Wireframes provide guidance on how the design should be created, such as the layout of elements, including images, buttons, icons, and text on each page of the application.

6. High Fidelity User Interface

The Hi-Fidelity UI creation stage is the process of executing the wireframe design that was previously created as a guide. This stage not only designs the interface from the existing application design in the wireframe but also creates a flow of how the design is used in actual application use. The following is the result of the Hi-Fidelity UI design that has been created, which is the result of the redesign of the Bank Bengkulu mobile banking application.



Source: (Research Results, 2025)
Figure 8. High Fidelity Sample

Deliver

At this stage, the results of the redesign of Bank Bengkulu's mobile banking application were tested using the SUS method. This stage began with the use of the redesigned Bank Bengkulu mobile banking application by 100 respondents. Following that, the respondents would complete a questionnaire with closed-ended statements according to the SUS questionnaire template. In addition, they have written down their critiques, suggestions, or evaluations of their experience using the redesigned Bank Bengkulu application for further processing in the next stage.

The research instruments were tested for validity and reliability prior to data collection. A validity test using Pearson's correlation coefficient indicated that all items were valid (calculated r > table r of 0.195), whilst the reliability test yielded a Cronbach's Alpha value above the minimum threshold ($\alpha > 0.60$). Consequently, the instruments were deemed valid and reliable.

The rules for using SUS are as follows: for each item in odd-numbered questions, the score is obtained by subtracting 1 from the respondent's answer value. For items in even-numbered questions, the score is obtained by subtracting the respondent's answer from 5 [22].

Table 4. Summary of SUS Score Calculation

R	Calculated Score		R	Calculated Score	
	Total	Score (x)		Total	Score (x)
1	35	87.5	51	35	87.5
2	30	75	52	36	90
3	38	95	53	38	95
4	29	72.5	54	37	92.5
5	33	82.5	55	38	95
6	33	82.5	56	36	90
7	28	70	57	37	92.5
8	35	87.5	58	37	92.5
9	35	87.5	59	37	92.5
10	34	85	60	38	95
11	34	85	61	38	95
12	37	92.5	62	36	90
13	38	95	63	34	85
14	36	90	64	34	85
15	35	87.5	65	36	90
16	35	87.5	66	37	92.5
17	36	90	67	37	92.5
18	37	92.5	68	38	95
19	37	92.5	69	35	87.5
20	36	90	70	38	95
21	33	82.5	71	36	90
22	37	92.5	72	37	92.5
23	38	95	73	35	87.5
24	33	82.5	74	20	50
25	38	95	75	33	82.5
26	35	87.5	76	35	87.5
27	33	82.5	77	36	90
28	37	92.5	78	32	80
29	37	92.5	79	33	82.5
30	36	90	80	21	52.5
31	25	62.5	81	32	80
32	37	92.5	82	34	85

R	Calculated Score		R	Calculated Score	
	Total	Score (x)		Total	Score (x)
33	35	87.5	83	36	90
34	38	95	84	37	92.5
35	36	90	85	34	85
36	38	95	86	35	87.5
37	34	85	87	37	92.5
38	35	87.5	88	35	87.5
39	37	92.5	89	38	95
40	37	92.5	90	37	92.5
41	37	92.5	91	34	85
42	38	95	92	37	92.5
43	35	87.5	93	33	82.5
44	35	87.5	94	38	95
45	37	92.5	95	35	87.5
46	37	92.5	96	33	82.5
47	34	85	97	38	95
48	37	92.5	98	38	95
49	35	87.5	99	36	90
50	35	87.5	100	32	80

Source: (Research Results, 2025)

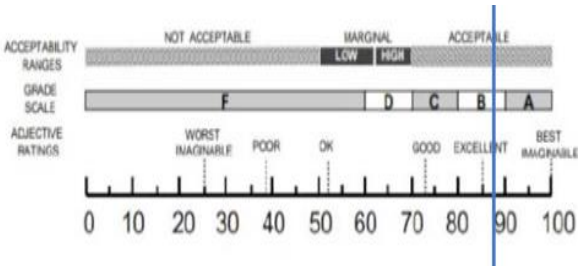
The SUS score was obtained by summing the scores of each answer multiplied by 2.5. The average SUS score was calculated by summing all scores and dividing by the number of respondents.

$$X = \frac{\Sigma x}{n} \quad (2)$$

$$X = \frac{8797.5}{100}$$

$$X = 87.97$$

Information:
X = SUS Average
Σx = Total SUS Score
n = Respondent



Source: (Research Results, 2025)
Figure 9. Final SUS Score

The average SUS score obtained was 87.97. Based on the SUS Score rating chart in Figure 9, it can be concluded that the results of the redesign of the Bank Bengkulu mobile banking application were rated excellent with acceptability ranges that were acceptable. The initial EUCS score was 2.77, categorizing it as "Doubt" and nearing the "Dissatisfied" threshold of 2.59. The primary result indicated that Accuracy represented the lowest dimension, with a value of 2.66. The low scores in Format and Ease of Use suggest navigation challenges and design inconsistencies.

Following the redesign informed by the Double Diamond framework and Nielsen–Shneiderman heuristics, the SUS evaluation yielded as Excellent. The increase demonstrated that the design modifications enhanced both the visual aesthetics and the user experience substantially. The analysis of scores pre- and post-redesign utilized the standard interpretation of the EUCS and SUS instruments, which are commonly employed in usability research to evaluate variations in user perceptions. The SUS instrument offers a categorical classification (Poor–Excellent), eliminating the need for inferential testing to facilitate the practical interpretation of score improvements. Consequently, this study's analysis is both evaluative and descriptive, aligning with the characteristics of design intervention-based usability research.

This study does not employ inferential statistical tests such as the paired t-test or the Wilcoxon signed-rank test, as the approach adopted is evaluative and descriptive in the context of usability testing. The SUS instrument is specifically designed to provide practical interpretations based on absolute scores and categories, meaning that improvements in usability can be interpreted directly without the need for statistical significance tests. Although the results obtained in the SUS rating were excellent, every design certainly requires feedback from respondents after undergoing the testing process [22]. Furthermore, a sentiment analysis was conducted on user comments regarding the application redesign using NLP with the IndoBERT model.

In this study, the model was used as a classification tool without any additional fine-tuning, thus functioning as a black-box classifier. Nevertheless, this approach remains relevant for obtaining a general overview of user perceptions quickly and efficiently, particularly during the design evaluation phase. The IndoBERT model used to measure sentiment was indobenchmark/indobert-base-p2, downloaded from the Hugging Face Transformers library. The stages of sentiment analysis in this study are shown in Figure 10.

Sentiment analysis relies on user-generated comments, thus the volume of data is affected by users' propensity to offer feedback. Variations in the quantity and quality of comments are prevalent features in research based on natural sentiment data and may lead to perception bias. Additional research may enhance the dataset's size or employ

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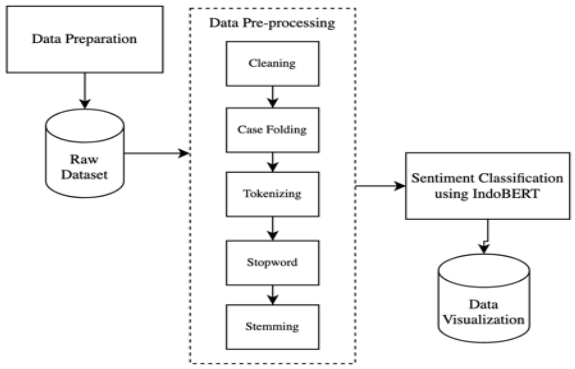
controlled experiments to acquire more organized sentiment data.



Source: ([30], [31])

Figure 10. Sentiment Analysis Process

1. Data Preparation. During the SUS data collection, the questionnaire also included open-ended questions for users to provide their opinions and comments on the redesign offered by us. As a solution to improve user satisfaction, the comments and opinions obtained were then compiled into a .csv format, which will be processed for the preprocessing process.

2. Data Pre-processing. This stage was carried out to produce clean data, case folding, tokenization, stop word removal processes, and stemming [30], [31].
   a. Cleaning. The collected data still contains noise such as characters, punctuation marks, symbols, and so on. Therefore, the cleaning process removes unnecessary characters [30], [31].
   b. Case Folding. This process involves standardizing the text by changing all capital letters to lowercase letters [30], [31].

Table 5. Case Folding (Dataset in Indonesian)

0	redesain ini sudah sangat bagus dan mudah untuk…
1	desain lebih modern kekinian, nyaman digunakan…
2	menurut saya aplikasi ini sudah lumayan mudah…
3	menarik
4	mantap bagus
…	…
101	sudah jauh lebih unggul
102	lebih terstruktur
103	lebih mudah dipahami
104	fitur lebih lengap\n
105	lebih simple dan mudah digunakan

Source: (Research Results, 2025)

   c. Tokenizing. Tokenization is a process in Natural Language Processing (NLP) that involves breaking text down into small units called tokens. These tokens are then used as input for models [30], [31]

Table 6. Tokenizing Process (Dataset in Indonesian)

0	redesain ini sudah sangat bagus dan mudah untuk…	positive
1	desain lebih modern kekinian, nyaman digunakan…	positive
2	menurut saya aplikasi ini sudah lumayan mudah…	positive
3	menarik	positive
4	mantap bagus	positive
…	…	…
101	sudah jauh lebih unggul	positive
102	lebih terstruktur	positive
103	lebih mudah dipahami	positive
104	fitur lebih lengap\n	positive
105	lebih simple dan mudah digunakan	positive

Source: (Research Results, 2025)

   d. Stop Word
   The stop word process involves removing words that have no meaning, such as conjunctions and irrelevant vocabulary [30], [31]

Table 7. Stop Word Process (Dataset in Indonesian)

0	[redesain, bagus, mudah, dimengerti]
1	[desain, modern, kekinian, nyaman, alur, nya,…
2	[aplikasi, lumayan, mudah, era, tpi, tdk, bny…
3	[menarik]
4	[mantap, bagus]
…	…
101	[unggul]
102	[terstruktur]
103	[mudah, dipahami]
104	[fitur, lengkap]
105	[simple, mudah]

Source: (Research Results, 2025)

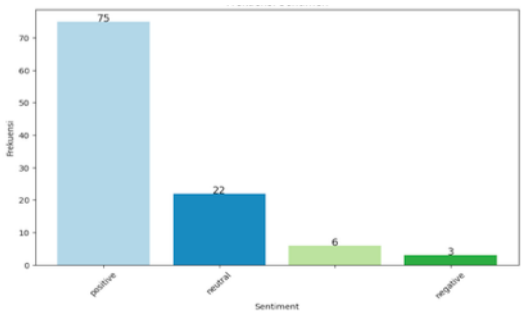
   e. Stemming. Stemming is the process of finding the root of words in a text, such as removing affixes from a word [30], [31].

Table 8. Stemming (Dataset in Indonesian)

0	redesain bagus dan mudah erti	positive
1	desain modern kini nyaman alur nya mudah erti …	positive
2	Aplikasi lumayan mudah era tpi tidk bnyk orng …	positive
3	tarik	positive
4	mantap bagus	positive
…	…	…
101	unggul	positive
102	terstruktur	positive
103	Mudah paham	positive
104	fitur lengkap	positive
105	Simple mudah	positive

Source: (Research Results, 2025)

3. IndoBERT Implementation. This stage was used to find new data classifications in the form of positive, neutral, and negative labels. The labelling process was carried out automatically using the IndoBERT model. Labelling for sentiment using the IndoBERT model is "Positive," "Neutral," and "Negative."



Source: (Research Results, 2025)
Figure 15. Sentiment Analysis Classification

The frequency of positive sentiment was the highest at 75 data points. Meanwhile, the frequency of neutral data was 22 data points, and the frequency of negative sentiment was 3 data points, with 6 data points missing or unknown. Additionally, classification data is converted into visual representations based on the frequency of words that commonly appear in user reviews during the evaluation stage. Word visualisations are displayed as word clouds, with the aim of providing a visual representation of words that commonly appear and are frequently used.

Source: (Research Results, 2025)
Figure 13. Word Cloud Visualization

The sentiment analysis results indicate that positive user sentiment encompasses aesthetic considerations and explicitly highlights enhancements in navigation ease, information clarity, and responsiveness. The number of negative comments was limited to three, representing a proportion of 3.16% relative to the total respondents. The new design fulfills user expectations, facilitates ease of learning, and enhances the clarity of transaction task completion. The sentiment analysis in this study is not intended as a stand-alone evaluation, but rather as a complement to the usability measurement results using the SUS.

Whilst the SUS provides a quantitative picture of the level of user acceptance of the redesigned interface, the sentiment analysis using IndoBERT provides a qualitative context regarding the reasons behind those ratings. Comments classified as positive sentiment indicate that the improvement in usability is not only reflected in high SUS scores but is also supported by users' perceptions of ease of navigation, clarity of information, interface consistency, and ease of use. Consequently, the results of the sentiment analysis serve as a form of triangulation that reinforces the interpretation of the usability evaluation results, ensuring that the research conclusions are based not only on quantitative data but also on direct user feedback.

Limitation and Future Work

This study demonstrates a notable enhancement in user experience achieved through a Double Diamond-based redesign process, complemented by a layered evaluation utilizing EUCS, SUS, and sentiment analysis with IndoBERT. Nonetheless, several limitations warrant consideration:

1. Testing based on high-fidelity prototypes. The assessment was carried out utilizing a Figma prototype that lacked integration with the actual backend. Consequently, technical performance variables including loading time, connection stability, API performance, and transaction latency were not assessed. The user experience within the application may vary.
2. The respondents were restricted to individuals actively using the application. New users were excluded from the analysis. Good design must facilitate the onboarding process for new users unfamiliar with the system.
3. Sentiment analysis is influenced by the quantity and length of comments. IndoBERT demonstrates enhanced classification capabilities; however, the quality of insights remains contingent upon the diversity of respondents' comments. Brief or generic remarks may restrict the thoroughness of analysis.

The identified limitations provide a foundation for enhancements in future research. Despite these limitations, the study's results indicate that enhancements in interface design influence user perception, especially regarding

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retention and comfort in mobile banking applications.

CONCLUSION

This study aims to evaluate and improve user satisfaction on Bank Bengkulu's mobile banking application through the End-User Computing Satisfaction (EUCS) approach, System Usability Scale (SUS), and sentiment analysis based on Natural Language Processing (NLP) using the IndoBERT model. The study's results indicate that initial user satisfaction was notably low, reflected by an average EUCS of 2.77, categorized as Doubt. This was particularly evident in the dimensions of Accuracy (2.66), Ease of Use (2.73), and Format (2.78). A problem-driven redesign that applied Nielsen and Shneiderman principles to address EUCS issues led to substantial improvements. An evaluation conducted post-redesign utilizing the System Usability Scale (SUS) resulted in a score of 87.97, categorized as Excellent.

This score suggests that the new design is perceived as user-friendly, consistent, and enhances the overall user experience. Additionally, the IndoBERT sentiment analysis corroborated the quantitative findings, revealing 75 positive comments, 22 neutral comments, and merely 3 negative comments. The qualitative findings demonstrate a consistent enhancement in user experience, specifically regarding navigation, information clarity, and visual aesthetics. Therefore, the use of IndoBERT in this study is not intended to develop a new sentiment classification method, but rather to complement the usability evaluation through an analysis of user perceptions, thereby providing a more comprehensive understanding of the effectiveness of the proposed design.

This study not only enhances the practical aspects of the Bank Bengkulu mobile banking application but also advances the literature on information systems and user experience. It presents a structured redesign evaluation workflow that integrates satisfaction diagnosis, user-centered redesign, usability validation, and perception analysis. The proposed workflow may act as a reference for future studies focused on redesign in digital service systems, where it is crucial to understand the relationship between user dissatisfaction, design intervention, and post-implementation evaluation. Consequently, this research contributes beyond an individual organizational case, offering methodological insights for enhancing usability in comparable digital contexts.

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