The Indonesian Journal of Computer Science
www.ijcs.net
Volume 14, Issue 1, February 2025
https://doi.org/10.33022/ijcs.v14i1.4622

Improving the Usability and User Experience of a Ticketing and Knowledge Base Web Application: A Case Study of the ESDM 136 Contact Center

Ridwan Afandi[1], Harry Budi Santoso[2]
ridwan.afandi@ui.ac.id[1], harrybs@cs.ui.ac.id[2]
[1,2]Faculty of Computer Science, Universitas Indonesia

Article Information

Received : 8 Jan 2025
Revised : 29 Jan 2025
Accepted : 7 Feb 2025

Keywords

Public Innovation Service, The Post-Study System Usability Questionnaire, The User Experience Questionnaire, Cognitive Walkthrough, User-Centered Design, Shneiderman's Eight Golden Rules

Abstract

The Ministry of Energy and Mineral Resources (MEMR) established the ESDM 136 Contact Center to improve public service accessibility and quality, supported by ticketing and a knowledge-based web application for managing complaints. However, in 2023, the average response time for requests exceeded the SLA, indicating a need to evaluate the application systems to improve service efficiency. This study addresses the poor usability and user experience of the ticketing and knowledge-based web applications, as evidenced by below-average scores on the UEQ and PSSUQ. Utilizing a mixed-methods approach, including usability testing, cognitive walkthroughs, and open-ended questionnaires, this research identified twenty-one usability issues. Eighteen design improvements, guided by user-centered design principles, were implemented in a high-fidelity prototype. Post-improvement PSSUQ evaluations showed significant improvements, with post-intervention scores falling within the "above standard" range for all measured categories and an overall score improvement from 3.17 to 2.51.

A. Introduction

Innovation in public service in Indonesia has become a strategically important issue as the government strives to improve the quality of services, especially amid the rapid development of e-government [1], [2]. E-Government enables the government to optimize the efficiency and effectiveness of public services, including through the development of more accessible e-services for citizens [3], [4]. According to data from The Global Economy in 2023, the quality of public services in Indonesia ranks 97th out of 177 countries. Among Asian countries, Indonesia ranks 30th out of 45 countries, while within ASEAN, it is sixth after Singapore, Brunei, Thailand, Malaysia, and Vietnam [5].

A form of public service innovation within e-government is the contact center, which enables direct interaction between the public and the government for information exchange and complaint handling. These contact centers typically utilize digital communication technologies such as telephones, email, and social media to facilitate public access to services [6], [7]. Over the past two decades, organizations, both public and private, have focused on improving the operational quality of contact centers, which play a significant role in shaping customer perception and satisfaction towards institutions [7]. Many public agencies now adopt contact center technology as the primary channel to facilitate interaction with the public to enhance accessibility and the quality of public service. In the context of e-government, high-quality contact center services are vital in strengthening public trust in public bodies and promoting better and more transparent governance [8].

The Ministry of Energy and Mineral Resources (MEMR) is a government agency responsible for the energy and mineral resources sector and has established the ESDM 136 Contact Center as a public service channel. This service is designed to facilitate the public in accessing information and submitting complaints related to the energy and mineral resource sector. To maintain the standards and quality of contact center services in handling complaints and information requests from the public, a ticketing and knowledge base web application is used to monitor and manage complaints as requested tickets. This application is expected to assist in handling requests according to the service level agreement (SLA) provisions, which are within three working days. However, based on monitoring and evaluation report data from 2023, the average completion time for requests and complaints in 2023 was 5.6 working days, which is below the SLA target.

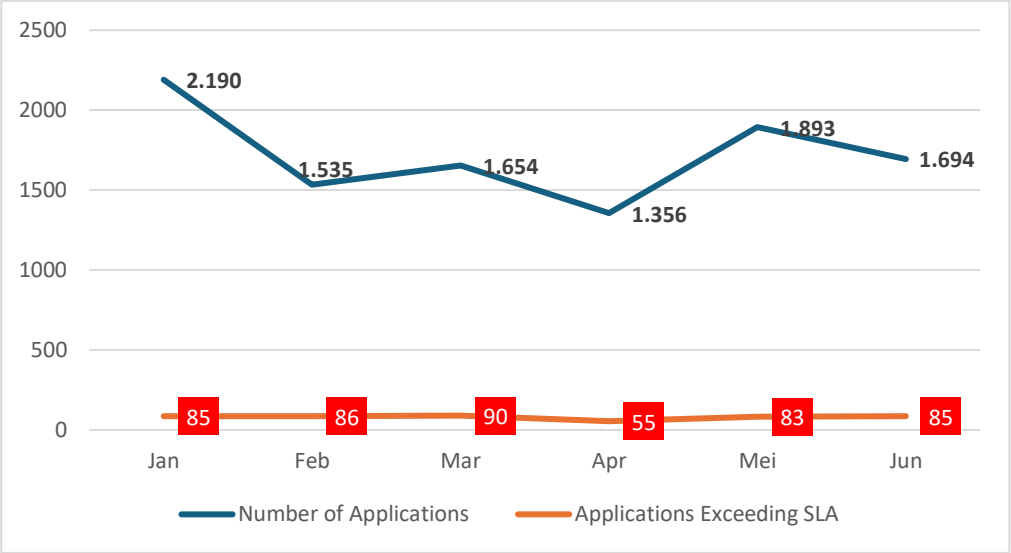

Figure1. Recapitulation of CC ESDM 136 Applications for the Period from January to June 2024

This condition persisted in the first semester of 2024, from January to June 2024, with data showing that 4.7% or 484 out of 10,322 service requests did not meet the SLA (Figure 1). This situation is not ideal for the ESDM 136 in providing services to the public. The Head of the Communication and Public Information Service has recognized that an SLA achievement rate below the standard could serve as an indicator for evaluating the application itself. The ticketing and knowledge base web application has not optimally supported the ESDM 136 contact center services in achieving the expected quality and service standards. Furthermore, since its implementation in 2018, no usability evaluation of the application has been conducted.

Studies indicate that the effectiveness of service delivery at contact centers is closely related to the quality of the information technology underlying the system [9]. Besides the functionality and quality of information, User Experience (UX) also plays an essential role in the effectiveness of information systems. UX that does not meet user expectations can lead to suboptimal system function and even system failure [10]. UX on the web-based ticketing & knowledge base application that does not meet user expectations at the ESDM 136 could contribute to the failure to achieve the desired service quality and standards. Based on this problem formulation, the researcher has formulated three research questions (RQ) as follows:

RQ1. How are the usability and user experience evaluated on the current ESDM Ticketing & Knowledge Base web application?

RQ2. What are the recommended improvements to the user interface design of the ESDM Ticketing & Knowledge Base web application based on the evaluation results?

RQ3. How is the evaluation of the recommended user interface design of the ESDM Ticketing & Knowledge Base web application?

This study aims to conduct a usability and UX evaluation and to develop the design alternative recommendations for the ESDM Ticketing & Knowledge Base web application. It is expected that this study can guide for conducting usability and UX

evaluations; besides, can provide alternative design recommendations for the user interface of the web ticketing & knowledge base application for KESDM.

B. Research Method

This study employs a mixed methods approach, integrating both quantitative and qualitative research methodologies to provide a comprehensive evaluation of the usability and user experience of the ESDM Ticketing & Knowledge Base web application. The research utilized the Post-Study System Usability Questionnaire (PSSUQ), User Experience Questionnaire (UEQ), Open-ended Questions (OEQ), Cognitive Walkthrough (CW), and Task Scenarios within Usability Testing (UT) as research instruments. The research design is illustrated in Table 1, while the research flow is presented in Figure 2. The research method was conducted in three distinct phases.

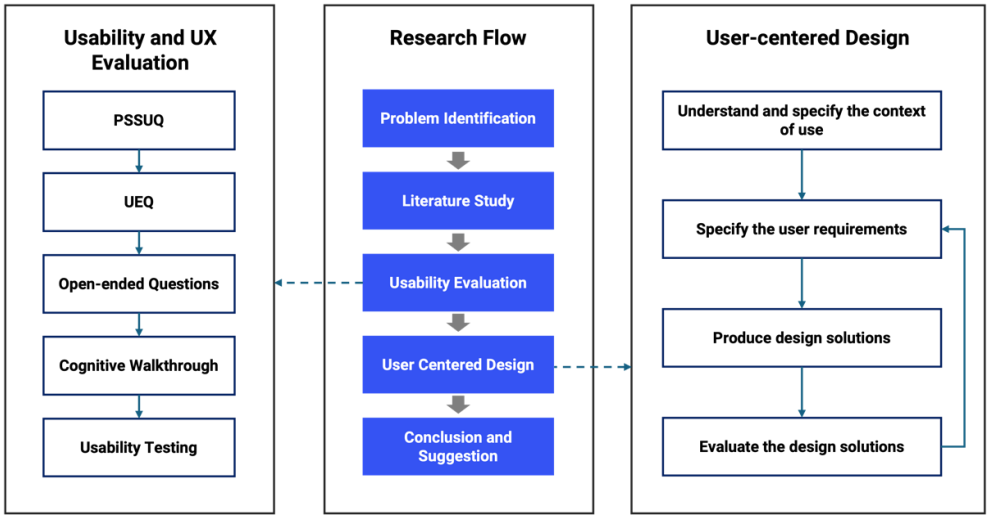

Figure 2. Research flow

The first phase involved a usability evaluation using PSSUQ and UEQ with 26 out of the 30 targeted respondents. During this phase, an analysis of the results from the open-ended questions included with the evaluation questionnaires was also performed to identify issues based on the application usage experiences of all respondents.

Table 1. Research Design

Attributes	Descriptions
Classifications	Mixed method research
Category	Case Study
Paradigm	Evaluative
Purpose	Conduct a usability and UX evaluation and develop the design alternative recommendations for the ESDM Ticketing & Knowledge Base web application.
Results	Proposed alternative design for the ESDM Ticketing & Knowledge Base web application
Data Collection	Cognitive walkthrough, usability testing, UEQ, PSSUQ, Open-ended Questions, and semi-structured interview
Sampling strategy	Purposive sampling

The second phase entailed usability testing with 13 respondents, who volunteered to participate in further testing stages. This phase also included a CW conducted by three evaluators consisting of a UI/UX designer, a web developer, and a contact center practitioner from a public institution. As a result of this phase, recommendations for improvements to the web ticketing and knowledge base interface were generated based on the usability evaluation. The improvements were executed using a user-centered design approach and Shneiderman's Eight Golden Rules. The third phase involved an evaluation of the results from the interface design improvements using the PSSUQ and semi-structured interviews. This final phase aimed to assess the effectiveness of the design changes and gather qualitative feedback from the respondents regarding their experiences with the updated application interface.

Post-Study System Usability Questionnaire (PSSUQ)

PSSUQ is a questionnaire designed to assess the level of user satisfaction with system usability [11]. This measurement tool was developed from an internal IBM project known as SUMS (System Usability Metrics), to evaluate the ease of use and effectiveness of a system in supporting user needs [12]. The items in this instrument evaluate various system attributes, including user-friendliness, simplicity, effectiveness, and user interface. Developed by James R. Lewis at IBM, the questionnaire has undergone revisions resulting in three distinct versions [12]. The items in this instrument evaluate various system attributes, including user-friendliness, simplicity, effectiveness, and user interface. This study will use the third version of the PSSUQ, as referenced in the research by [13]. A complete list of the PSSUQ questionnaire items is displayed in Table 2.

Table 2. Items of PSSUQ Version 3

No	Items of PSSUQ
1	Overall, I am satisfied with how easy it is to use this system
2	It was simple to use this system
3	I was able to complete the tasks and scenarios quickly using this system
4	I felt comfortable using this system
5	It was easy to learn to use this system
6	I believe I could become productive quickly using this system
7	The system gave error messages that clearly told me how to fix problems
8	Whenever I made a mistake using the system, I could recover easily and quickly
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear
10	It was easy to find the information I needed
11	The information was effective in helping me complete the tasks and scenarios
12	The organization of information on the system screens was clear
13	The interface of this system was pleasant
14	I liked using the interface of this system
15	This system has all the functions and capabilities I expect it to have
16	Overall, I am satisfied with this system.

The instrument items generate four distinct scores, one overall and three subscales [12]. Those scores consist of:

- Overall: average response for all of the items
- System Usefulness (SysUse): average response for items 1 to 6
- Information Quality (InfoQual): average response for items 7 to 12
- Interface Quality (IntQual): average response for items 13 to 15

The assessment in the PSSUQ utilizes a Likert scale ranging from 1 to 7, where 1 indicates "strongly disagree" and 7 indicates "strongly agree." In the context of the PSSUQ, lower values reflect more positive outcomes. Table 3 presents the standards for the lower limit, mean, and upper limit for each rating scale in the PSSUQ questionnaire based on PSSUQ norms according to [12].

Table 3. PSSUQ Norms

Category	Lower Limit	Mean	Upper Limit
SysUse	2.57	2.80	3.02
InfoQual	2.79	3.02	3.24
IntQual	2.28	2.49	2.71
Overall	2.62	2.82	3.02

User Experience Questionnaire (UEQ)

UEQ is an established evaluation tool designed to assess user's subjective experiences when interacting with interactive products [14]. Originally developed by [15], the UEQ utilizes a semantic differential scale composed of 26 bipolar statement pairs, which are categorized into six primary dimensions:

1. Attractiveness: This dimension captures users' first impressions and perceptions regarding the overall appeal of the product, offering insights into whether users find the application engaging and enjoyable.
2. Efficiency: This aspect pertains to the application's ability to assist users in completing tasks swiftly and without hindrance, reflecting the extent to which the system facilitates an efficient workflow.
3. Dependability: This dimension evaluates the reliability of the system in providing users with a sense of control, encompassing aspects related to safety and consistency.
4. Perspicuity: This aspect assesses the ease with which users can understand and learn to operate the application.
5. Stimulation: This dimension pertains to the emotional responses elicited in users during their interaction with the application, measuring how effectively the product motivates and inspires users to continue utilizing it.
6. Novelty: This aspect refers to the innovation and unique appeal of the product that differentiates it from comparable offerings.

A significant advantage of the UEQ is its adaptability, allowing for translation into multiple languages and the development of simplified versions tailored to specific contexts. This study will employ the UEQ questionnaire that has been adapted into Indonesian, in alignment with the research conducted by [16].

Cognitive Walkthrough (CW)

CW is a widely used expert-based usability evaluation method, particularly in analyzing the learnability aspects of interactive systems [17]. According to [18], this method was developed to integrate cognitive theory into more practical interface

design and effective evaluation processes. The primary aim of this method is to identify the simplest ways for users to complete specific tasks with minimal or no formal instructions provided [19], making it especially valuable in evaluating information systems intended for novice users. This evaluation focuses on assessing the specific steps that users may take to achieve particular goals, as well as the potential obstacles or errors that may arise during this process [18].

In CW, evaluators play a crucial role in identifying usability issues commonly faced by users [20]. A key advantage of this method is its ability to uncover problems that may not be evident through other evaluation approaches, particularly for users who lack prior experience with the system [17]. Furthermore, CW can be effectively applied in the development of task scenarios to be used in usability testing [20]. In this study, the CW technique is utilized to assist in designing realistic and relevant task scenarios, taking into account how novice users interact with the system.

Task Scenario

One common approach in usability testing is the use of task scenarios, in which users are asked to complete a series of tasks that reflect typical interactions with the system. These task scenarios are designed to mirror real-life situations faced by users, thereby making the evaluation more relevant and effective [21]. The scenarios define a series of concrete steps that represent realistic and pertinent user interactions, aimed at assessing the effectiveness and efficiency of the interface in supporting task completion. According to [21], the primary objective of employing task scenarios is to create a context that allows evaluators to directly observe user behavior and reactions, as well as identify usability issues that may arise during the interaction process.

This instrument consisted of a set of task scenarios performed by participants testing the ESDM Ticketing & Knowledge Base web application, as compiled in Table 4. The Task Scenario instrument was divided into two related parts: the goal and the scenario. The task list was designed to reflect the functionalities of the application, targeting key areas such as the dashboard, ticket submission and management, and the knowledge base. Participants were tasked with navigating the dashboard to access relevant information, submitting tickets for various issues, and searching for solutions within the knowledge base. The output of this instrument was the completion status of the participants, which indicated whether the assigned task scenarios were completed. By analyzing the completion rates and any difficulties encountered, the study aimed to identify usability strengths and weaknesses within the application, ultimately guiding enhancements to improve user experience.

Table 4. Task Scenarios

Task	Goals	Scenario
Create a ticket	A new ticket has been successfully created	You have just received an incoming phone call. Create a new ticket for this report.
Close a ticket	The ticket has been successfully closed	There is a confirmed ticket notification from the unit. Your task is to change the status of the ticket from confirmed to closed.
Search for a ticket	The specified ticket has been successfully located	find the ticket based on the given Ticket ID

Check the details and attachments of a ticket	Questions and the attached files have been successfully reviewed	Review the questions and attachment files in one of the open tickets sourced from email.
Provide an answer confirmation on a ticket	An answer has been successfully added to the ticket	Respond to one of the tickets with an open status
Create a knowledge base	A new knowledge base entry has been successfully created	You are requested to create a new knowledge base entry about the One Price BBM Program
Search the knowledge base	The user has successfully found and opened the intended knowledge base entry	Locate knowledge base information in the electricity subsector related to the submission of NIDI
Update information in the knowledge base	The information in the knowledge base has been successfully updated	You are requested to update the details of the knowledge base regarding the submission of the SLO PLTS.
Change the status of the knowledge base to inactive/active	The status of the knowledge base has been successfully updated	You are requested to change the status of one of the knowledge base entries to inactive
Check the list of open tickets on the dashboard	Participants are aware of the number and list of tickets that remain open	Find and review the list of tickets with an open status
Check the list of confirmed tickets on the dashboard	Participants are aware of the number and list of tickets that have been confirmed	Find and review the list of tickets with a confirmed status
Check the number of open tickets that exceed SLA	Participants have successfully displayed information on tickets that exceed the SLA on the screen	Check how many open tickets have exceeded or are about to exceed the SLA so that they can be addressed promptly
Review and monitor the recap of open, confirmed, and closed tickets based on subsector	Participants have successfully displayed information on the ticket counts per subsector on the screen	Check the number of subsectors with the most tickets in an open status

Shneiderman's Eight Golden Rules of Interface Design

Shneiderman's Eight Golden Rules of Interface Design are essential principles aimed at guiding developers and designers in creating effective, efficient, and user-friendly interfaces [22]. By applying these principles, designers can ensure that the interfaces they create are not only easy to understand but also meet user needs, enhance satisfaction, and reduce user frustration. These eight rules can be seen in Table 5.

Table 5. Shneiderman's Eight Golden Rules of Interface Design

Principles	Descriptions
Strive for consistency	Consistency should be applied to all elements of the design
Enable frequent users to use shortcuts	Experienced users need shortcuts to complete tasks faster
Offer informative feedback	The system should be able to provide feedback in the form of information
Design dialogs to yield closure	Business process workflow in an application is formed sequentially

Offer simple error handling	The system should provide instructions for users to prevent errors
Permit easy reversal of actions	Users are allowed to repeat or delete actions they have performed
Reduce short-term memory load	An interface that is easy to remember or recalls important information
Support internal locus of control	Provide users with control to choose the actions they intend to conduct

User-centered Design (UCD)

UCD is a methodological approach aimed at creating intuitive and easy-to-use products by placing user needs at the forefront of every stage of the design process [23]. This methodology, developed from human-computer interaction, is intended for software developers and designers. UCD can be applied to various systems, objects, or products designed for human use, where the success of the design is measured by user satisfaction and task completion ability [24]. UCD has also been formalized in the ISO 9241-210 standard, which governs human-centered design processes for interactive systems [25]. This standard is the latest version, replacing the previous one (ISO 13407), and describes UCD as an iterative process, as illustrated in Figure 3.

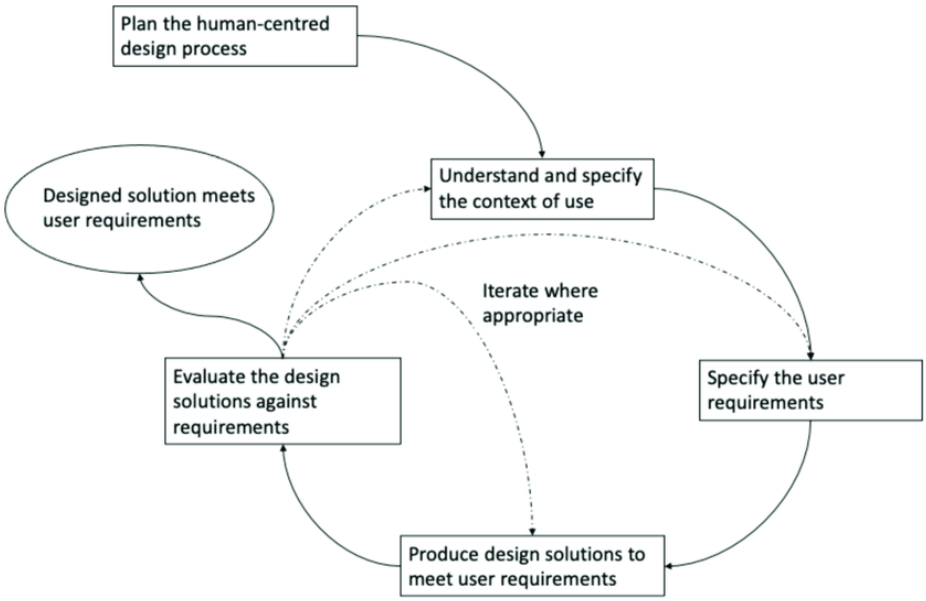

Figure 3. The Iterative Process UCD [25]

The seven UCD processes served as a guiding framework in the evaluation of the ESDM Ticketing & Knowledge Base web application design in this study. The iterative nature of the UCD process facilitated substantial and ongoing improvements and adjustments over time. If the evaluation of the design solutions does not effectively address the specific issues encountered by users, the UCD process will be repeated. This continuous feedback loop ensures that the design evolves in response to user needs, leading to a more effective and user-friendly application that enhances the overall user experience.

Data Collection

This study employs a data collection method consisting of three main stages. The first stage focuses on the initial evaluation of the usability and user experience of the ESDM Ticketing & Knowledge Base web application, using quantitative data collected through an online survey that includes demographic questions and the UEQ and PSSUQ questionnaires, with 26 participants out of a target of 30. The second stage involves usability testing conducted with 13 participants, alongside observations during task scenarios involving three user groups: tier-1 agents, tier-2 technical unit users, and supervisors. CW are conducted with three evaluators, including two technical experts in web design and UI/UX and a contact center practitioner. The final stage assesses the usability of the updated prototype after revisions, involving all usability testing participants and interviews to compare usability and user experience before and after the improvements, with data collected quantitatively using the PSSUQ questionnaire.

Table 6. Methods and Participant Mapping

Method	Participants
Initial evaluation of usability and UX using PSSUQ and UEQ	26 participants
Open-ended questions	26 participants
Usability testing using task scenario	13 participants
Cognitive walkthrough	3 evaluators
Evaluate the design solutions using PSSUQ	13 participants

Data Processing

The data processing method in this study encompasses both qualitative and quantitative data. Quantitative data is collected from the PSSUQ and UEQ questionnaires to evaluate the usability and user experience of the tested application, with analysis conducted using Microsoft Excel. The UEQ uses a rating scale from -3 (very poor) to +3 (very good), while the PSSUQ's original scale (1 to 7) is converted to a new scale ranging from 0 to 100 for easier comparison. Qualitative data sources include open-ended questions, usability testing results, think-aloud methodology, and insights derived from CW conducted with evaluators.

The processing of qualitative data involves stages such as data collection, transcription, segmentation, coding, and thematic analysis using Nvivo 15 and Excel. CW provide an additional layer of qualitative analysis by allowing evaluators to systematically assess and identify potential usability issues based on their expertise and the expected user interactions. The thematic analysis identifies user issues and categorizes them according to usability heuristic principles, with results presented systematically for clear insights. The conclusions address user needs and usability challenges, forming the basis for recommendations for further development of the application interface.

C. Result and Discussion

This section details the results of this study. Quantitative data from the UEQ and PSSUQ questionnaires, along with qualitative data from UT, CW, OEQ, and contextual interviews, are integrated to provide a comprehensive analysiss

Respondent Demography

The usability testing respondents consisted of 13 individuals, representing 50% of the usability questionnaire respondents. Stratification ensured representation from various user categories: tier-1 agents, tier-2 agents, and supervisors. Among these 13 participants, 61.5% were tier-1 agents, 15.4% were tier-2 agents, and 23.1% were supervisors. Educationally, most respondents were bachelor's degree holders (S1), totaling 11, with 2 holding master's degrees (S2). Gender demographics showed a higher female representation, with 8 women and 5 men, reflecting the predominance of female customer service officers at CC ESDM 136. The age distribution had a majority in the 31-40 age range (8 participants), followed by 20-30 years (4 participants) and 41-50 years (1 participant). Experience varied, with an equal number of participants (5 each) having 0–2 years and 6–10 years of experience, and 3 participants with 3–5 years of experience using the web ticketing & knowledge base application. Most participants engaged with the application for 6–8 hours daily (54%), indicating high interaction levels, which offers valuable insights for the usability testing (Figure 4).

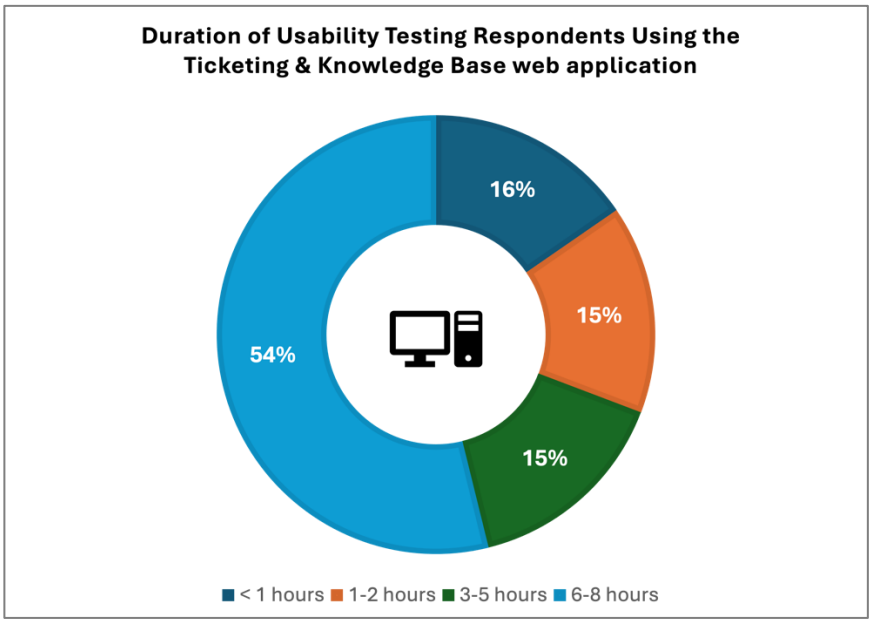

Figure 4. Duration of Use of the Ticketing & Knowledge Base Web Application by Usability Testing Participants

Analysis of Post-Study System Usability Questionnaire (PSSUQ) Results

Table 7 presents the results of the PSSUQ questionnaire calculations for the ESDM Ticketing & Knowledge Base web application. Each question yields a different score depending on the respondents' selected answers, indicating their level of agreement or disagreement with each question posed. The table displays the average scores calculated for each question item presented to the respondents. In

this context, a lower score signifies better performance and greater user satisfaction with the application. The results are compared against the assessment norms of the PSSUQ version 3 and visualized in a line graph, as shown in Figure 5, allowing for a clear interpretation of user feedback and satisfaction levels.

Table 7. PSSUQ Result Comparing to PSSUQ Norms

	PSSUQ Norms			
	SysUse	InfoQual	IntQual	Overall
Lower Limit	2,57	2,79	2,28	2,62
Mean	2,80	3,02	2,49	2,82
Upper Limit	3,02	3,24	2,71	3,02
ESDM Ticketing & Knowledge Base (As-Is)	2,87	3,29	3,46	3,17

However, when compared overall, the scores in each PSSUQ scale (SysUse, InfoQual, IntQual, and Overall) for the ESDM Ticketing & Knowledge Base web application still fall below the standard value (mean). Notably, the interface quality (IntQual) remains the lowest category, with a score of 3.46 compared to the standard value of 2.49. This indicates that there are significant areas for improvement, particularly in enhancing the user interface to meet user expectations and improve overall satisfaction.

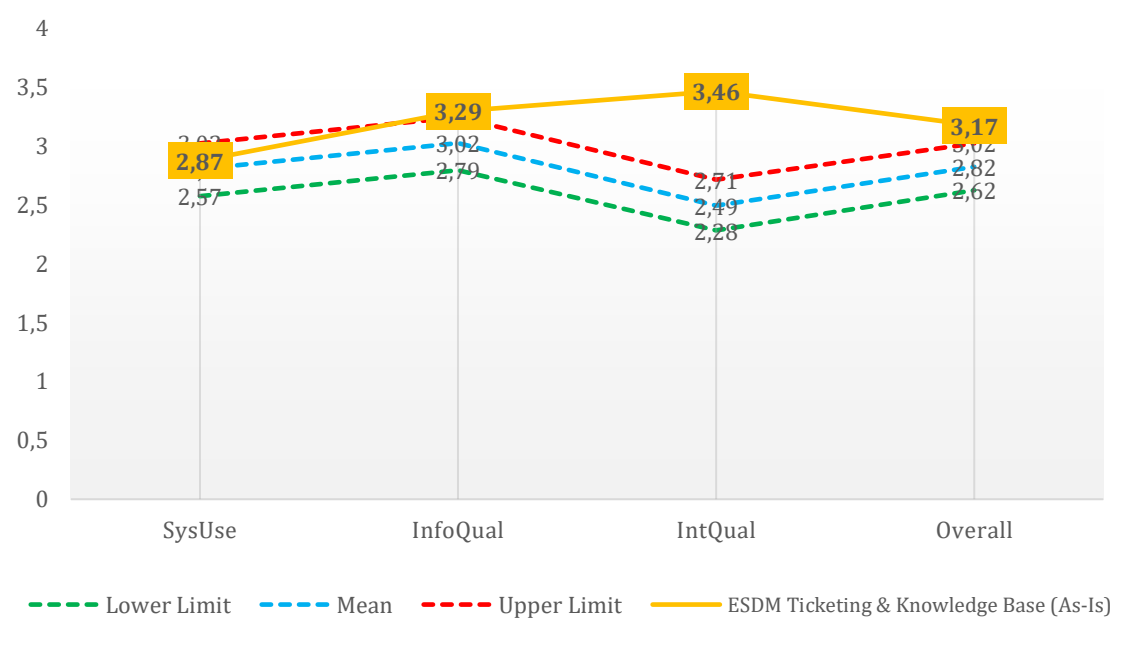

Figure 5. Results of the PSSUQ Evaluation from Usability Testing Participants

Analysis of User Experience Questionnaire (UEQ) Results

The results of the UEQ questionnaire filled out by usability testing participants are presented in Figure 6. The analysis of the questionnaire results shows that the average scores on each scale fall into two categories: "below average" and "bad." The dimensions of Attractiveness and Perspicuity score relatively higher, with values of 0.59 and 0.94, respectively. However, areas such as Dependability (0.58),

Stimulation (0.37), and Novelty (0.08) exhibit significantly lower scores, indicating that users perceive these aspects of the application as needing considerable improvement. The mean score, also highlighted in the graph, serves as a benchmark for overall user satisfaction, further emphasizing the necessity for enhancements to elevate the user experience across all dimensions.

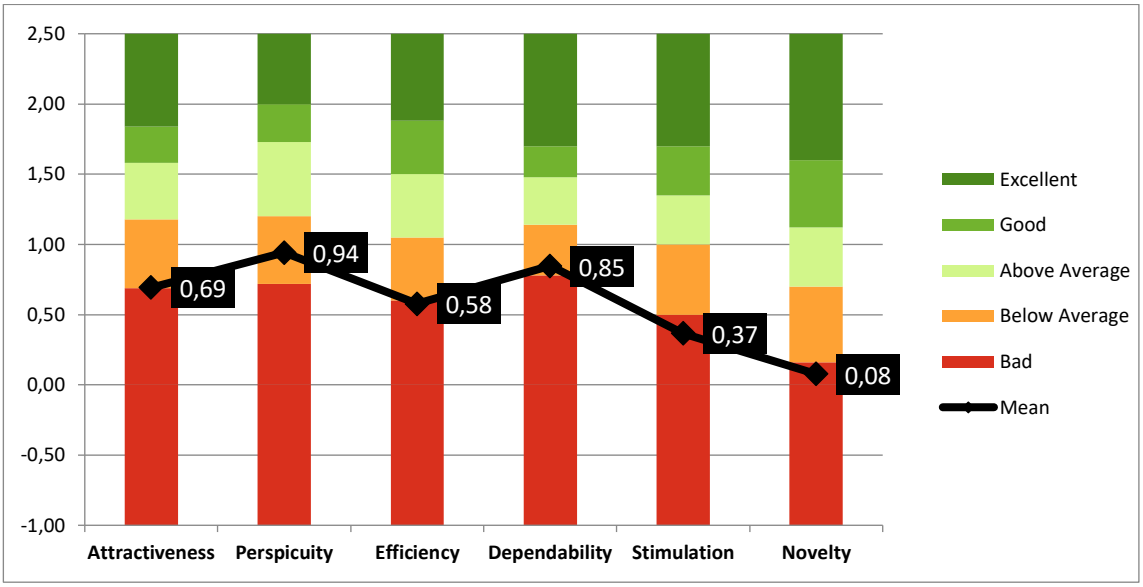

Figure 6. Results of the UEQ Evaluation from Usability Testing Participants

These findings reflect a balanced population of usability testing participants, including both novice users (0–2 years of experience) and experienced users (6–8 years). The results indicate challenges in user experience with the ESDM ticketing & knowledge base web application, particularly for new users, highlighting the need for attention and improvement to enhance the system's usability.

Analysis of Open-ended Questions Results

Qualitative data analysis was conducted using thematic analysis on the responses from open-ended questions included in the UEQ and PSSUQ questionnaires, which were analyzed using NVivo 15 and Microsoft Excel. The thematic analysis involved three stages: open coding, axial coding, and selective coding. During open coding, two independent raters identified key issues from respondent answers and reached a consensus on coding. The open codes formed the basis for axial coding, where they were grouped by conceptual similarities to identify usability themes. A total of 16 usability issues were identified through axial coding.

In the next stage, selective coding mapped these issues into usability guideline categories based on Marenkov's framework. This resulted in six categories relevant to usability evaluation: Accessibility and Compatibility, The Home Page and Search, Page Layout and Navigation, Screen-Based Controls, and Organisation of Information and Content. To ensure accuracy, the categorized issues were validated by an expert in UI/UX development. The distribution of identified problems was expressed in percentages across the usability guideline categories, displayed in Figure 7.

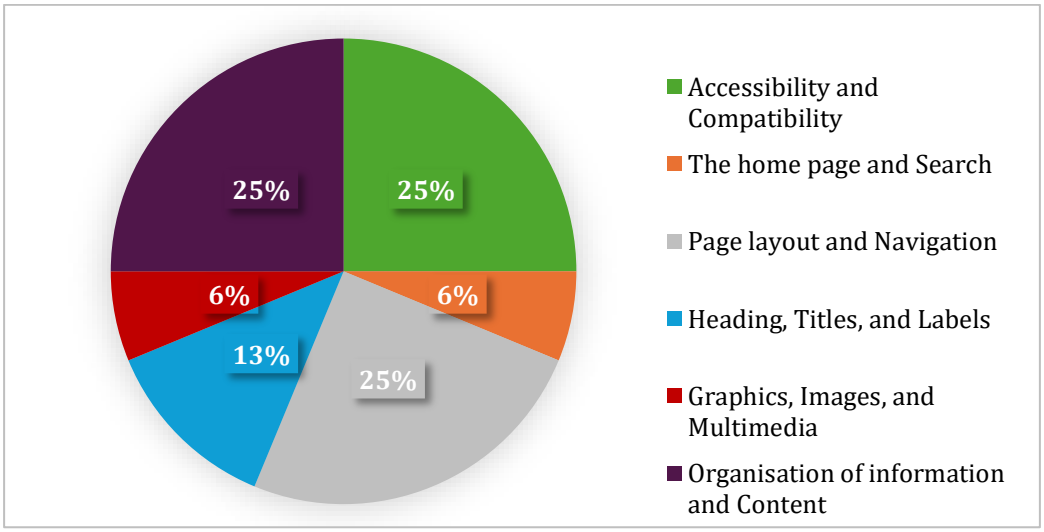

Figure 7. Usability Issues from Open-ended Questions based on Category

Implementation and Analysis of Usability Testing Results

Usability testing was conducted with 13 participants, comprising 12 face-to-face and 1 online participant. A total of 13 task scenarios were completed, divided among three user groups: tier-1 agents (7 scenarios), tier-2 agents (8 scenarios), and supervisors (8 scenarios). The think-aloud technique was used retrospectively, where participants explained their thought processes after completing specific tasks, minimizing distractions during task execution. Participants were considered to have encountered issues if they failed to notice certain elements, made errors in following instructions, or misunderstood established rules. Problems faced by respondents are detailed in Table 8.

Table 8. Usability Testing Results

Participant	Task Scenario													Total
	01	02	03	08	09	11	12	13	14	16	17	18	19	
P1				-	-					-	-	-	-	
P2				-	-					-	-	-	-	
P3				-	-					-	-	-	-	
P4				-	-					-	-	-	-	
P5				-	-					-	-	-	-	
P6				-	-					-	-	-	-	
P7				-	-					-	-	-	-	
P8				-	-					-	-	-	-	
P9	-	-	-									-	-	
P10	-	-	-									-	-	
P11	-	-	-	-	-									
P12	-	-	-	-	-									
P13	-	-	-	-	-									
Task Completed	8	8	7	2	2	13	8	8	11	1	4	1	2	75
Task Failed	0	0	1	0	0	0	5	5	2	4	1	2	1	21

Legend:

	Success and completed
	Not success
-	Not performing tasks

Effectiveness, a key measurement attribute in usability testing, was calculated using the formula:

$$Effectiveness = \frac{number\ of\ task\ completed\ successfully}{total\ number\ of\ task\ undertaken}\ X\ 100\%$$
$$= \frac{75}{96}\ X\ 100\% = 78{,}1\%$$

The average completion rate reached 78.1%, categorizing it as standard according to Sauro (2010), with ideal completion rates above 78%. This finding correlates with the PSSUQ score of 2.88 on the system usability scale (SysUse), nearly matching the standard value of 2.80. Therefore, the usability effectiveness of the ESDM Ticketing & Knowledge Base web application is rated as satisfactory.

Based on the analysis of qualitative data from usability testing, the researcher categorized the identified issues in the ESDM Ticketing & Knowledge Base web application according to components of usability guidelines derived from various standards. The usability issues were grouped into several categories. As illustrated in Figure 8, the analysis results indicate that the most prevalent issues fall under the Scrolling, Paging, and Links category, accounting for 29% of the total issues. This is followed by the Page Layout and Navigation category at 26%. Additionally, issues related to Headings, Titles, and Icons comprise 16%, while the Accessibility and Compatibility category also represents 16%. The majority of respondents reported encountering problems primarily in the Scrolling, Paging, and Links category, highlighting key areas for improvement in the application's usability.

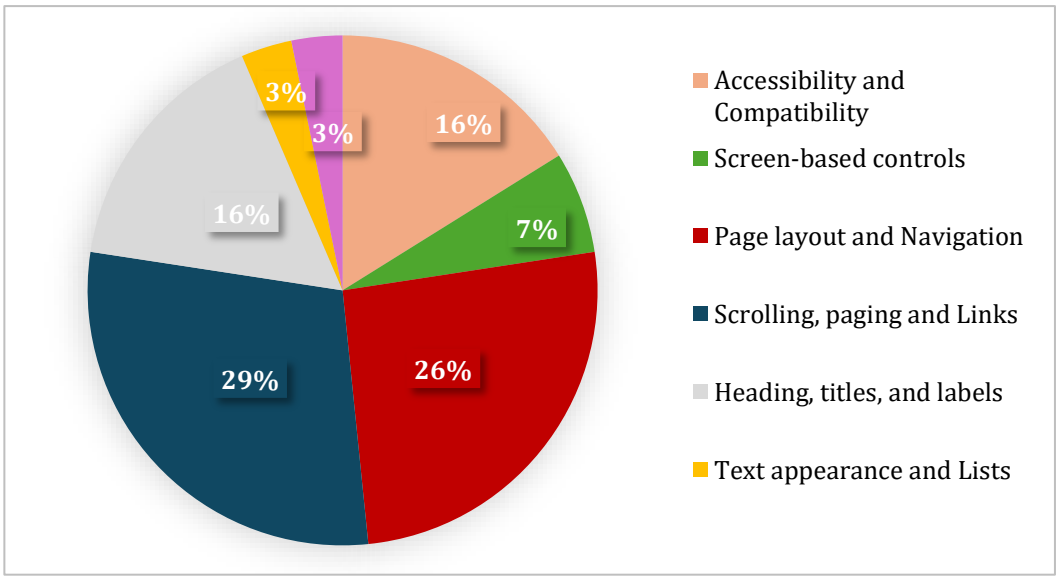

Figure 8. Usability Issues from Usability Testing based on Category

Implementation and Analysis of Cognitive Walkthrough Results

The CW method used for usability evaluation follows the approach introduced by [19] and consists of three phases: preparation, evaluation, and problem analysis. In the preparation phase, a set of task scenarios was developed and evaluated by an evaluator to ensure they were relevant to the application's functions and aligned with user roles. The focus of the task scenarios was on three main modules of the ESDM Ticketing & Knowledge Base application: ticketing, knowledge base, and dashboard. In the evaluation phase, the scenarios were demonstrated online with

three separate evaluators: a contact center practitioner, a web developer, and a UI/UX designer. They assessed potential usability issues based on the scenarios and filled out an evaluation checklist shown in Table 9, derived from [26].

Table 9. Sample Evaluation Checklist for the Task Scenario of Creating a Ticket

		Questions			
Goals	**Actions**	**1. Will the user try to achieve the right effect?**	**2. Will the user notice that the correct action is available?**	**3. Will the user associate the correct action with the effect that the user is trying to achieve?**	**4. If the correct action is performed, will the user see that progress is being made toward the solution of the task?**
(ST01) Create a ticket	1) Open the "Ticket" menu				
	2) Click the "Create Ticket" button				
	3) Click the box under Name/Account				
	4) Enter the Name/Account				
	5) Select the source of a report				

Table 10. Usability Issues from the CW for the Task Scenario of Creating a Ticket

Task	Action	Question number	Evaluator Code	Problem location	Problem description
(ST01) Create a ticket	Click the "Create Ticket" button	3	1	Menu *Ticket*	The "Create Ticket" button is not positioned in the initial focal area for users according to visual hierarchy, causing users to focus more on other buttons or menus.
	Click on "CC BCC" in the Email box.	2	1, 2	Form *Create Ticket*	The "CC BCC" option is unclear and is positioned at the end of the email input box, leading users to overlook it.
	Select a subsector from the available list	4	1, 2	Form *Create Ticket*	The dropdown menu lacks a search function, making it cumbersome to scroll through the long list of options.
	Choose a category from the available list	4	1, 2	Form *Create Ticket*	The dropdown menu lacks a search function, making it cumbersome to scroll through the long list of options.
	Click the "Browse" box under Attachments	4	1	Form *Create Ticket*	The "Browse" button does not provide information about the types of files that can be uploaded and the allowed file size limits.

The analysis phase identified 27 usability-related issues from the evaluation checklist against the 13 tested scenarios. After reviewing for duplicates, these were consolidated into 14 main issues, categorized according to usability guidelines, and validated by an expert in UI/UX development. This process resulted in seven usability guideline categories, with the percentages of issues shown in Figure 9. The findings indicated that most usability problems were linked to interface design, particularly in the categories of Headings, Titles, and Labels (29%) and Page Layout and Navigation (22%).

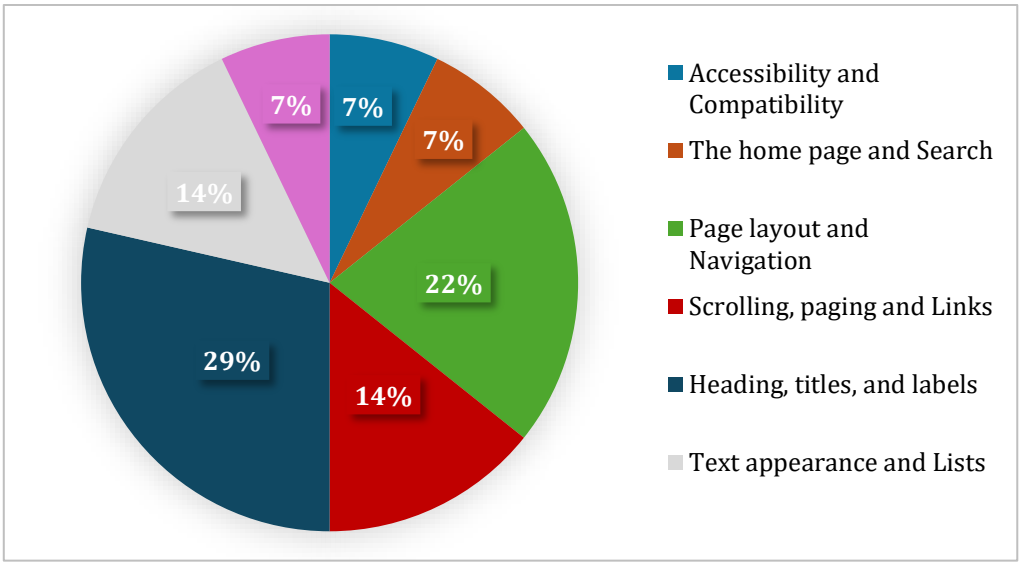

Figure 9. Usability Issues from CW based on Category

Evaluate the design solutions using PSSUQ

Post-enhancement system quality was assessed using PSSUQ, focusing specifically on perceived system quality rather than the broader user experience, including emotional aspects not readily captured through high-fidelity prototypes. Table 11 presents the PSSUQ data for the improved ESDM Ticketing & Knowledge Base prototype. A comparison of pre- and post-intervention scores (Figure 10) reveals the effectiveness of the design modifications in enhancing perceived system quality.

Table 11. Comparison of PSSUQ Results between the Improved Prototype Design (To-Be) and the Current Design (As-Is)

	PSSUQ Norms			
	SysUse	InfoQual	IntQual	Overall
Lower Limit	2,57	2,79	2,28	2,62
Mean	2,80	3,02	2,49	2,82
Upper Limit	3,02	3,24	2,71	3,02
ESDM Ticketing & Knowledge Base (As-Is)	2,87	3,29	3,46	3,17
Proposed Design Solution (To-Be)	2,42	2,60	2,46	2,51

Substantial improvements are evident in the "To-Be" scores across all four PSSUQ scales: SysUse improved from 2.87 to 2.42; InfoQual from 3.29 to 2.60;

IntQual from 3.46 to 2.46; and the Overall score from 3.17 to 2.51. These results indicate a "very good" rating for SysUse, InfoQual, and Overall, according to PSSUQ norms. Although IntQual falls within the average range, suggesting acceptable interaction quality, further refinement is recommended. While the improvements demonstrate a substantial positive impact and generally meet user expectations, contextual interviews suggest that some aspects still require adjustments.

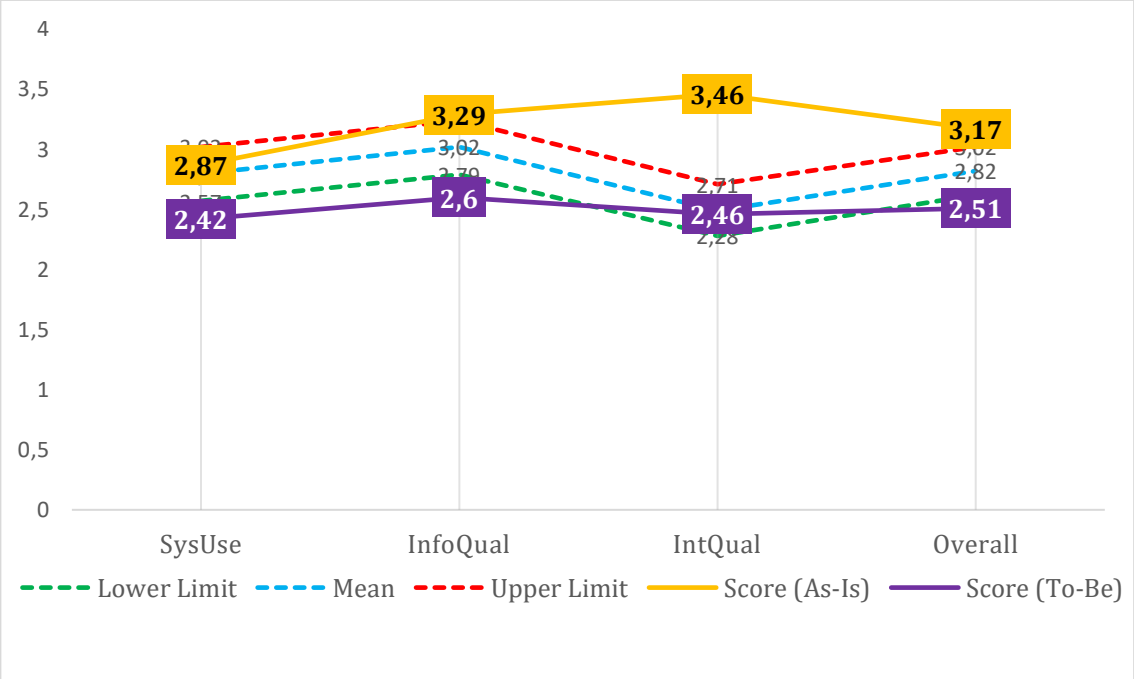

Figure 10. Results of the PSSUQ Evaluation for Improved Prototype Design

D. Conclusion

This study employed a mixed-methods approach to evaluate and improve the usability and user experience of the ESDM Ticketing & Knowledge Base web application. Initial assessments using UEQ and PSSUQ revealed significant usability challenges. The UEQ indicated below-average user experience across all six dimensions, while the PSSUQ scores for InfoQual (3.29) and IntQual (3.46) exceeded acceptable limits. UT with thirteen participants yielded an acceptable 78.1% task completion rate, yet further underscored these deficiencies. Qualitative data analysis, integrating OEQ, CW, and UT observations, identified twenty-one usability issues categorized into seven key areas. Supplementary contextual interviews with six participants provided additional qualitative insights, reinforcing many of the quantitative findings and highlighting specific areas that require refinement in the revised design.

Informed by these findings, eighteen targeted improvements were implemented in a high-fidelity prototype. Subsequent PSSUQ evaluation demonstrated substantial enhancements: SysUse improved to 2.42, InfoQual to 2.60, IntQual to 2.46, and the Overall score to 2.51. All post-intervention scores fell within the "very good" or "excellent" range, confirming the efficacy of the design improvements in significantly enhancing usability and user experience. These positive quantitative results are further supported by the contextual interviews,

which indicated increased user satisfaction with the revised application's efficiency and ease of navigation.

E. Acknowledgment

This work was supported and funded by the Ministry of Communication and Digital of the Republic of Indonesia (KOMDIGI RI) under grant number 75/BLSDM/KOMINFO/HK.03.02/08/2023.

F. References

[1] A. T.-K. Ho, "Reinventing Local Governments and the E-Government Initiative," *Public Adm Rev*, vol. 62, pp. 434–444, 2002, [Online]. Available: https://api.semanticscholar.org/CorpusID:154986137

[2] H. N. Saputro, "Inovasi Pelayanan pada Organisasi Publik," *Jurnal Wacana Kinerja: Kajian Praktis-Akademis Kinerja dan Administrasi Pelayanan Publik*, 2023, [Online]. Available: https://api.semanticscholar.org/CorpusID:259619609

[3] S. Culbertson, "E-Government and Organizational Change," 2005. [Online]. Available: https://api.semanticscholar.org/CorpusID:168246520

[4] E. Raguseo and E. Ferro, "eGovernment and Organizational Changes: Towards an Extended Governance Model," in *International Conference on Electronic Government*, 2011. [Online]. Available: https://api.semanticscholar.org/CorpusID:358001

[5] The Global Economy, "Public services index - Country rankings."

[6] I. Bernhard, "Local e-Government in Sweden - Municipal contact Centre Implementation with Focus on Public Administrators and Citizens," *The Journal of Community Informatics*, vol. Vol. 10, Sep. 2014, doi: 10.15353/joci.v10i1.2666.

[7] M. Saberi, O. Khadeer Hussain, and E. Chang, "Past, present and future of contact centers: a literature review," *Business Process Management Journal*, vol. 23, no. 3, pp. 574–597, Jan. 2017, doi: 10.1108/BPMJ-02-2015-0018.

[8] I. Bernhard, "Evaluation of customer centre and e-Services in a Swedish municipality with focus on the citizens' perspective," *Proceedings of the 3rd European Conference on Information Management and Evaluation, ECIME 2009*, pp. 34–41, Jan. 2009.

[9] A. Lichtsteiner, "Influence of Information Technology on Service Delivery among the Customer Care Centers in Switzerland," *Journal of Information and Technology*, 2022, [Online]. Available: https://api.semanticscholar.org/CorpusID:246799935

[10] B. Szajna and R. W. Scamell, "The Effects of Information System User Expectations on Their Performance and Perceptions," *MIS Q.*, vol. 17, pp. 493–516, 1993, [Online]. Available: https://api.semanticscholar.org/CorpusID:42005067

[11] A. F. Rosa, A. I. Martins, V. Costa, A. Queirós, A. G. Silva, and N. P. Rocha, "European Portuguese validation of the Post-Study System Usability Questionnaire (PSSUQ)," *2015 10th Iberian Conference on Information Systems and Technologies (CISTI)*, pp. 1–5, 2015, [Online]. Available: https://api.semanticscholar.org/CorpusID:28472410

[12] J. Sauro and J. R. Lewis, "Quantifying the User Experience: Practical Statistics for User Research," in *Quantifying the User Experience (Second Edition)*, Second Edition., J. Sauro and J. R. Lewis, Eds., Boston: Morgan Kaufmann, 2016, pp. 185–248. doi: https://doi.org/10.1016/B978-0-12-802308-2.00008-4.

[13] L. A. Sulaiman, H. B. Santoso, and R. Y. K. Isal, "Interaction Design Development on Indonesia)s Computer-Based National Exam Using User-Centered Design," in *2019 International Conference on Advanced Computer Science and information Systems (ICACSIS)*, 2019, pp. 69–76. doi: 10.1109/ICACSIS47736.2019.8979827.

[14] M. Schrepp, J. Thomaschewski, and A. Hinderks, "Construction of a Benchmark for the User Experience Questionnaire (UEQ)," *International Journal of Interactive Multimedia and Artificial Intelligence*, vol. 4, no. Regular Issue, pp. 40–44, 2017, [Online]. Available: http://www.ijimai.org/journal/sites/default/files/files/2016/12/ijimai20174_4_5_pdf_94297.pdf

[15] B. Laugwitz, T. Held, and M. Schrepp, "Construction and Evaluation of a User Experience Questionnaire," in *HCI and Usability for Education and Work*, A. Holzinger, Ed., Berlin, Heidelberg: Springer Berlin Heidelberg, 2008, pp. 63–76.

[16] H. Santoso, M. Schrepp, Y. Isal, A. Y. Utomo, and B. Priyogi, "Measuring User Experience of the Student-Centered e-Learning Environment," *Journal of Educators Online*, vol. 13, pp. 1–79, Jan. 2016, doi: 10.9743/JEO.2016.1.5.

[17] M. W. M. Jaspers, "A comparison of usability methods for testing interactive health technologies: Methodological aspects and empirical evidence," *Int J Med Inform*, vol. 78, no. 5, pp. 340–353, 2009, doi: https://doi.org/10.1016/j.ijmedinf.2008.10.002.

[18] C. Lewis and C. Wharton, "Chapter 30 - Cognitive Walkthroughs," in *Handbook of Human-Computer Interaction (Second Edition)*, M. G. Helander, T. K. Landauer, and P. V Prabhu, Eds., Amsterdam: North-Holland, 1997, pp. 717–732. doi: https://doi.org/10.1016/B978-044481862-1.50096-0.

[19] P. G. Polson, C. Lewis, J. Rieman, and C. Wharton, "Cognitive walkthroughs: a method for theory-based evaluation of user interfaces," *Int J Man Mach Stud*, vol. 36, no. 5, pp. 741–773, 1992, doi: https://doi.org/10.1016/0020-7373(92)90039-N.

[20] C. Wharton, J. Bradford, R. Jeffries, and M. Franzke, "Applying cognitive walkthroughs to more complex user interfaces: experiences, issues, and recommendations," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, in CHI '92. New York, NY, USA: Association for Computing Machinery, 1992, pp. 381–388. doi: 10.1145/142750.142864.

[21] J. Rubin and D. Chisnell, *Handbook of Usability Testing: How to Plan, Design and Conduct Effective Tests*, 2nd ed. Indianapolis, Indiana: Wiley Publishing, Inc., 2008.

[22] B. Shneiderman and C. Plaisant, *Designing the User Interface: Strategies for Effective Human-Computer Interaction (4th Edition)*. Pearson Addison Wesley, 2004.

[23] T. Lowdermilk, *User-Centered Design: A Developer's Guide to Building User-Friendly Applications*, 1st ed. Sebastopol, CA: O'Reilly Media, Inc., 2013.
[24] D. Lanter and R. Essinger, "User-Centered Design," in *International Encyclopedia of Geography*, John Wiley & Sons, Ltd, 2017, pp. 1–4. doi: https://doi.org/10.1002/9781118786352.wbieg0432.
[25] ISO, "ISO 9241-11:2019(en) Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts.," 2019, Accessed: Dec. 12, 2024. [Online]. Available: https://www.iso.org/standard/77520.html
[26] F. Bagheri, F. Abbasi, M. Sadeghi, and R. Khajouei, "Evaluating the usability of a cancer registry system using Cognitive Walkthrough, and assessing user agreement with its problems," *BMC Med Inform Decis Mak*, vol. 23, no. 1, p. 23, 2023, doi: 10.1186/s12911-023-02120-8.