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Implementation of Design Thinking UI/UX Construction RAB Application at PT PLN (Persero) UID S2JB Lahat

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Abstract: An efficient and accurate Cost Budget Plan (RAB) plays an important role in the construction industry because it is directly related to project cost management. PT PLN (Persero) UID S2JB UP3 Lahat still uses manual methods to manage RAB, which causes the process of searching for documents and information to be slow and inefficient. To overcome this challenge, a website-based Construction RAB application was designed using the Design Thinking approach, which aims to improve the user interface (UI) and user experience (UX) in the RAB management process. This design process involves five stages of Design Thinking, namely empathize, define, ideate, prototype, and test. Using Figma, a UI/UX design prototype was developed as a visual and functional representation of the new design. The results of this development show a significant increase in the efficiency and effectiveness of RAB management at PT PLN (Persero) UID S2JB UP3 Lahat, including reducing the time needed to search for and access information related to RAB. The implementation of this application is expected to help companies manage RAB more effectively, increase productivity, and minimize errors in recording and managing costs.

Keywords: RAB; Design Thinking; UI/UX; Application; Prototype; Figma.

1. Introduction

The use of existing technology can help companies reduce data management errors such as recording, and storage, and reduce the risk of data loss [1]. The Cost Budget Plan (RAB) is an important document that contains an estimate of the costs for wages and materials needed in a construction project [2]. This cost estimate includes the calculation of the volume of work, material prices based on related specifications, and additional data such as site surveys that will be used in the construction project [3]. By creating an RAB before the implementation of construction work, companies can reduce the risk of cost overruns, so that the project can be completed with maximum results and efficient costs [4]. Therefore, the RAB functions as the main tool in planning and controlling project costs [5].

The user interface is the front view of an interactive system that allows users to interact effectively, efficiently, and enjoyably by considering the usability and emotional factors of the user (Märtin *et al.*, 2023). User experience or user experience is the result of interaction between users and a particular system both emotionally and functionally. User experience covers the entire life cycle of interaction between users and products, from first glance to post-use experience [6]. User Interface (UI) focuses on the design of the appearance of the website or application to improve the user's visual experience [7], while User Experience (User Experience/UX) emphasizes the work process of the website or application which aims to provide ease of use that suits the specific needs of the user [8]. The implementation of the right UI/UX on a website or application can improve user comfort, convenience, and security in accessing the service [9].

The Design Thinking methodology offers benefits in UI/UX development, including increasing user satisfaction, accelerating use, and reducing user errors [10]. This process includes five stages: Empathize, Define, Ideate, Prototype, and Test [11], which allows the development of solutions that are more relevant to the real needs of users [12]. Using usability tests makes it easier for developers to understand user interactions with the product and identify areas that need improvement [13]. The main aspects include ease of use, efficiency, and user satisfaction [14]. There are several methods in usability testing, such as conducting direct testing on users to complete tasks while observing and recording obstacles [15]. Single Ease Question (SEQ) is a simple yet effective tool for assessing the usability of a product or system, such as an application, website, or software [16]. Each question asked is rated on a Likert scale ranging from 1 to 7, which will be averaged to determine the ease of use of the product [17]. Although the process is quick and easy, SEQ provides valuable insights into user satisfaction and areas for improvement in product design [18].

PT PLN (Persero) UID S2JB UP3 Lahat is part of the implementing unit under the parent unit that serves the community more focused. One of the main challenges faced by PT PLN is the management of the RAB which is still done manually using Microsoft Excel. This causes data accumulation and duplication which slows down the creation of RAB documents. Difficulty in finding data related to material and service costs, as well as delays in updating project data, are also obstacles in managing RAB in the company [19][20]. Therefore, PT PLN requires a system that can help in designing and managing RAB more efficiently. By introducing Design Thinking in the development of the RAB management system, the company is expected to be able to overcome these problems by presenting more innovative and relevant solutions. Although the concept of UI/UX and RAB management has been widely applied in various industries, this study aims to fill the gap in the literature that connects the challenges of manual RAB with the application of Design Thinking methodology in the context of the electricity industry in Indonesia.

2. Research Method

This study uses the Design Thinking method which consists of five stages: Empathize, Define, Ideate, Prototype, and Test. Each stage is applied systematically to identify and design the best solution for the UI/UX design of the Construction RAB application. Data collection was conducted through in-depth interviews with two company employees, each from the General and K3 departments. Employees were selected based on their direct involvement in the management and supervision of the RAB process. In addition to interviews, literature studies from various sources such as books and websites that discuss UI/UX were also conducted to strengthen understanding of existing problems. The following is a flowchart of the current system.

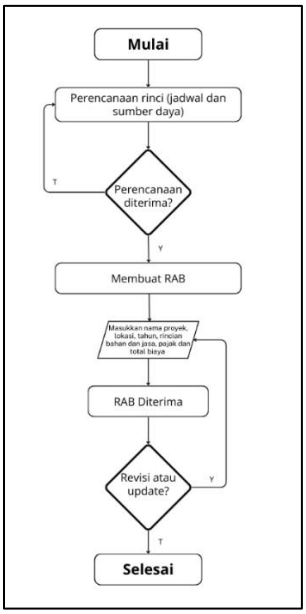

Figure 1. Flowchart of the Running System

Based on the flow chart above, it can be explained that the RAB management process is still carried out manually or using Ms. Excel so there can be a buildup of files and difficulty in finding the data needed, causing it to be less effective and efficient. From the results of the observations made, the researcher analyzed what the needs of the current system are, and user needs, including:

1) Designing an RAB application design that is easy to understand and use by employees to assist in making RAB reports
2) Shortening data search time and avoiding data accumulation

As for the define stage, there is how-might we which explains the solution to each problem and will be built into the application system to be created. Here is the use of *How-might we*:

Table 1. How-Might We

No	Problem	How	Might
1	Preparing RAB reports requires a lot of time, as manual searching for detailed material and service data takes up much of that time, making them less effective.	How we make the RAB report more effective?	Create an application design that can create RAB reports
2	Requires a simple application design to make it easier to find information on material and service data.	How to create an application design that makes it easier for users?	Create an application design that is attractive and easy for users to use in searching for information on compiling RAB reports

Solution ideas are collected and arranged into several groups according to their categories. The interface category is a solution idea related to the appearance of a website application that contains solutions to interface design problems. The information category is a solution idea for information problems such as content displayed on a website page in the form of text or design components that support the information.

Table 2. Affinity Diagram Interface and Information

Interface	Information
Create a simple and easy-to-understand interface design to facilitate navigation.	Provides RAB report templates that can be customized according to project needs
Create a quick search feature to make it easier to search for data	Data export feature to common formats such as Excel or PDF
Consistent use of colors and icons	

The initial prototype of the RAB application was created using Figma. The reason for choosing Figma over other tools such as Adobe XD or Sketch is because Figma has a real-time collaboration feature that allows

various stakeholders to provide direct input during the design process, which is very useful in a collaborative work environment.

3. Result and Discussion

3.1 Results

The use case diagram explains that this RAB application is designed to assist in planning project budget costs, with two main actors, namely Finance Employees and General Employees. This application allows both actors to create projects, manage the details of the work, materials, and services required, and export reports in PDF or Excel format. In addition, both actors can also edit their profiles. Here is the use case diagram of the Construction RAB application.

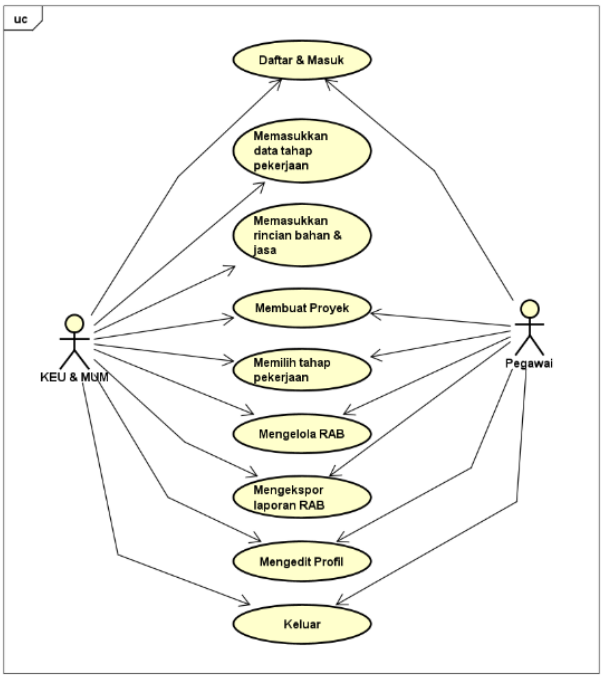

Figure 2. Use Case Diagram of the Construction RAB Application

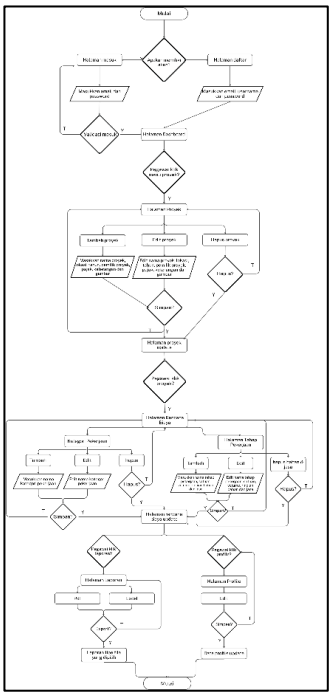

Figure 3. Flowchart of the System Process to be created

The solution ideas created will be visualized into a flowchart that describes the process or workflow with a focus on logical decisions and results in using the Construction RAB application. The following is a flowchart of the Construction RAB application (Figure 2). The flowchart that has been designed will be implemented or developed into the Construction RAB UI/UX design using Figma as a tool in creating the design. The designed system has menu and sub-menu features, such as Registration Form, Login Form, Project Menu, Budget Plan Menu with job category sub-menus and job stage sub-menus, Profile Menu, and Exit Menu. With the results of this prototype, it is hoped that it can provide good user experience and help improve efficiency in managing RAB data at PT PLN (Persero) UID S2JB UP3 Lahat (Figure 3).

3.2 Discussion

In this discussion we will discuss in more detail the page layout. The image above is the initial display when employees access the Construction RAB application, namely the registration page. If employees do not/do not yet have an account, employees will be asked to register for an account first. Employees who have an account can skip registration by clicking "login" below the register button which will take employees to the login page.

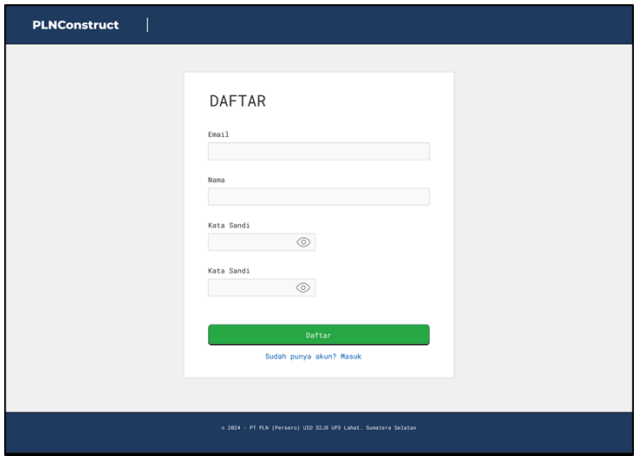

Figure 4. Register Page

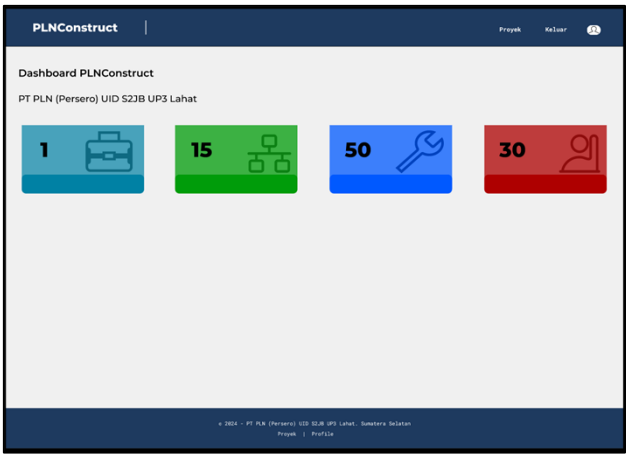

Figure 5. Dashboard Page

After employees have successfully registered for an account and logged in with their account, the system will generate a main page (dashboard) that shows the scale of the number of projects, services, and materials that have been created and 2 (two) menus, namely projects to go to the project page and profiles which are depicted using icons (Figure 4). On the project page, users can see a list of existing projects and have the option to edit them with the edit icon or delete them with the trash icon. This page also provides a data filter feature that makes it easier for employees to find old projects. This feature was created based on the problems that existed during the manual system. When using the old system, employees had to open each file to find the old project they needed. Employees can also create a new project by pressing the add project button, which will display a pop-up with an input form that must be filled in, such as project name, location, year, project owner, tax, description, and the option to add images (Figure 5).

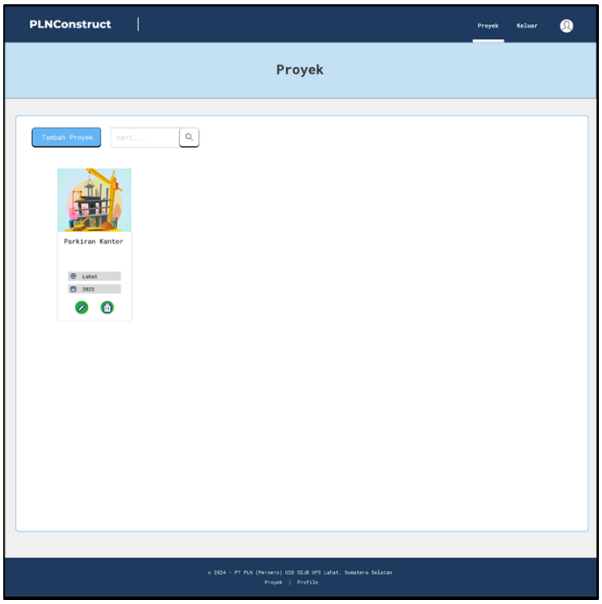

Figure 6. Project Page

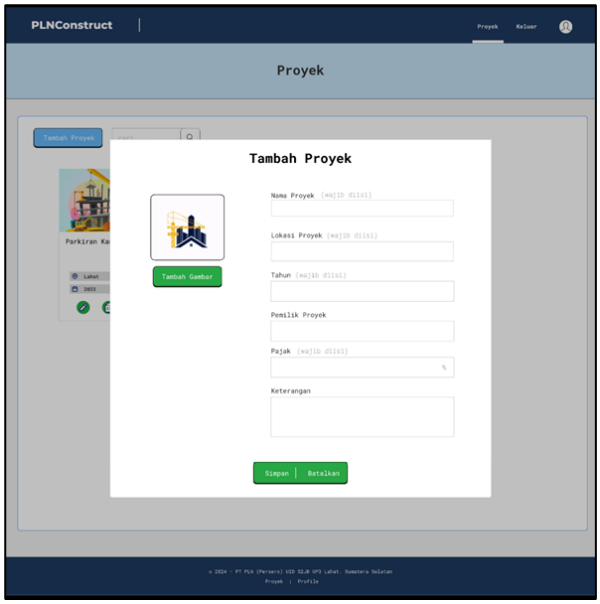

Figure 7. Form Insert Project

On this page, there is a job category template that makes it easy for employees to add new job categories. The budget plan page content is displayed in a table format that includes job descriptions, units, volumes, unit prices of materials, unit prices of services, total costs of materials and services, and action options. Employees can add job categories by pressing the add category button, which will display a pop-up input form for adding categories. There is also a delete option to delete data, as well as an edit icon to change the work stage data in each job category.

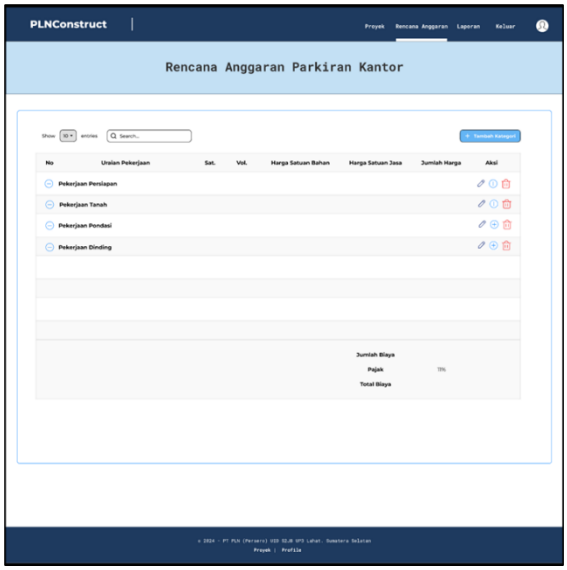

Figure 8. Budget Plan Page

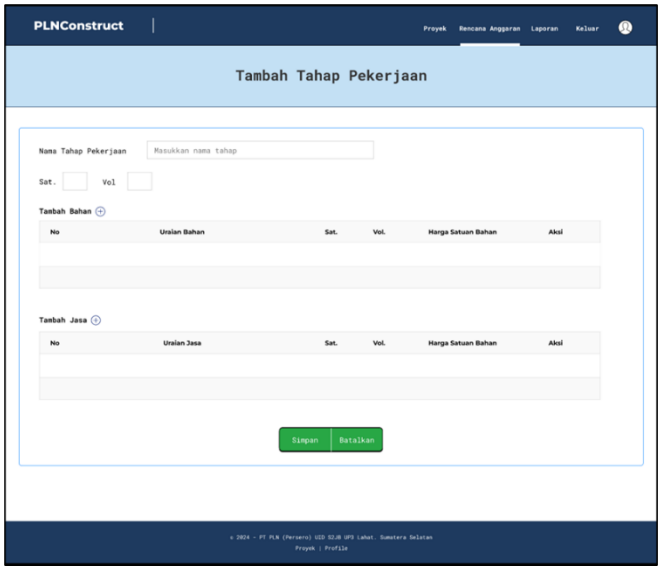

Figure 9. Add Job Stage Form

On the work stage page, employees can input work stage data, namely stage name, stage unit, and stage volume in the input boxes provided. Employees can also input detailed data on materials and services by clicking the add icon in each table (Figure 8). After adding detailed data on materials or services, employees can edit them using the edit icon in each column of materials and services. Employees can delete each material or service data using the delete icon (Figure 9).

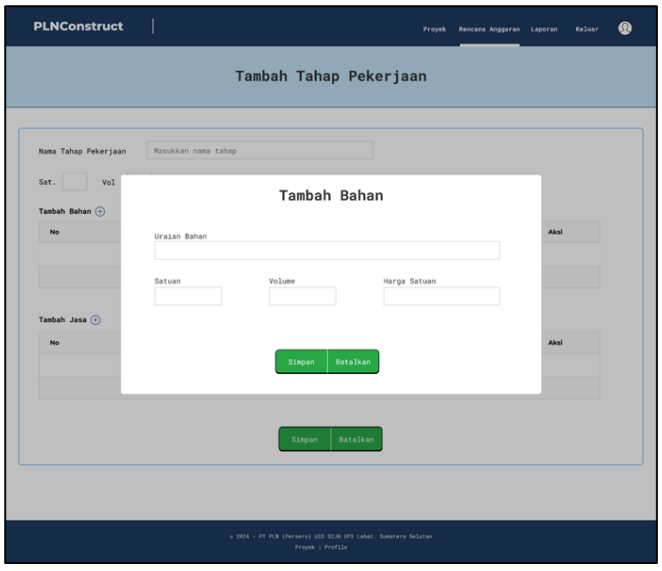

Figure 10. Add Material Form

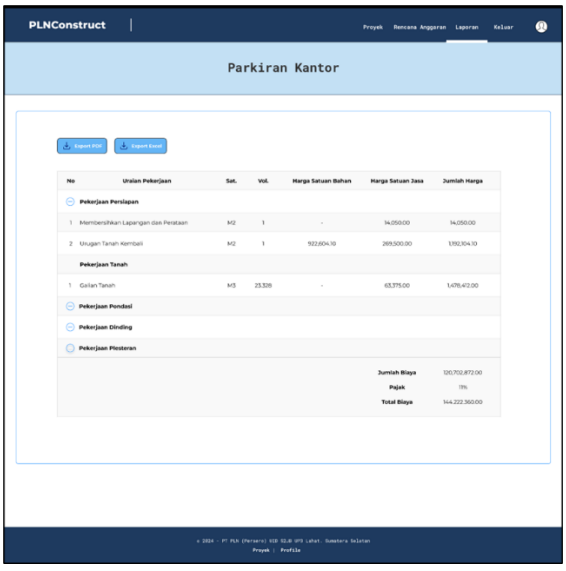

Figure 11. Report Page

After employees complete the process of inputting project data, employees can click the report menu if they want to change it to a report format. Employees choose the type of report they want, such as PDF or Excel by clicking one of the available buttons (Figure 10). On the profile page consists of data that employees fill in when registering an account. If the full name is not included in the account registration process, it can be filled in by clicking the edit button below the description (Figure 11).

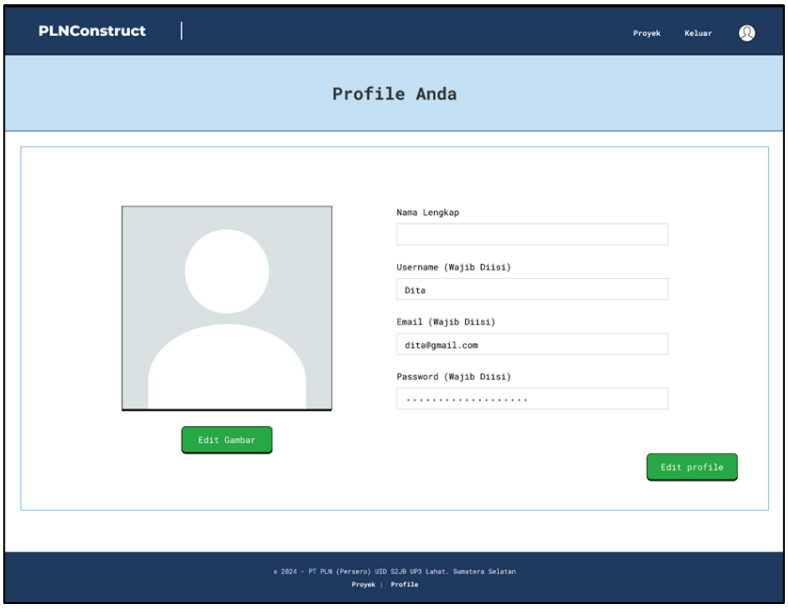

Figure 12. Profile Page

The Construction RAB application is designed to facilitate project cost planning, involving two main actors, namely Finance Employees and General Employees. Each actor has access rights that can be used to create new projects, manage work details, materials, and services needed, and export reports in PDF or Excel format. In addition, both actors can also edit their profiles according to their needs. This design aims to provide convenience in managing RAB data that is more efficient compared to the manual system previously used. On the registration page, users who do not have an account will be asked to register first. After the registration process is complete and the user has successfully logged in, the system will display the main page (dashboard) showing the scale of the project that has been created, as well as two main menus, namely Projects and Profiles. This menu makes it easy for users to directly access pages that are relevant to their needs. On the Project page, users can see a list of existing projects, as well as edit or delete projects using the available icons. The data filter feature on this page is very helpful in finding old projects that were previously managed manually. In addition, users can also create a new project by pressing the Add Project button, which will bring up an input form to enter project data, such as project name, location, year, project owner, tax, description, and the option to add images. The Budget Plan page displays data in a table format that makes it easy for users to enter work details, units, volume, unit price of materials and services, and total cost of materials and services. Users can add work categories by pressing the Add Category button, which will open an input form to add new work categories. This feature is very helpful for managing project budgets systematically. In addition, on the Work Stages page, users can input data regarding work stages, such as stage name, units, and volume. Users can also enter details of related materials and services by clicking the plus icon in each table. After all project data is entered, users can click the Report menu to convert the data into a report that can be exported in PDF or Excel format.

At this stage Test Result, testing is carried out on the prototype that has been created. Testing will be carried out by prospective users, namely KEU & MUM and K3 employees who are tasked with making RAB reports. This testing process applies to a remote trial system with the help of a testing website, namely Maze, by providing task scenarios that must be completed by employees/users. This testing was carried out by 5 prospective users. For user usability testing, the Single Ease Question (SEQ) measurement is used. Each question given only applies to one item on a Likert scale of 1 to 7 choices, consisting of very difficult, difficult, somewhat difficult, sufficient, somewhat easy, easy, and very easy. The following are the results of the Single Ease Question (SEQ) measurement.

Table 3. Result of Single Ease Question (SEQ)

Task	Respondent					Average
	R1	R2	R3	R4	R5	
T1	7	7	7	7	7	7
T2	5	5	6	5	6	5,4
T3	7	7	7	6	7	7
SEQ Average						6,4

The results of the SEQ test showed that the average score of the 5 respondents was 6.4, indicating that the PLNConstruct application was considered easy to use by prospective users. However, further discussion revealed several areas that needed attention for improvement. Several prospective users reported confusion in navigation in some parts of the application and difficulty in understanding certain instructions, although overall they felt the application was quite intuitive. This indicates potential for further improvement, especially in refining the user flow and improving application performance. For a more comprehensive view, it is important to monitor and evaluate these minor issues in the next development phase so that the application can be optimized and provide a better experience for users in the future. For a more comprehensive view, it is important to monitor and evaluate these minor issues in the next development phase so that the application can be optimized and provide a better experience for users in the future.

The prototype application was tested using a remote trial system via the Maze website, which allows potential users to complete a given task scenario. A total of five respondents consisting of Finance Employees and General Employees were tested using the Single Ease Question (SEQ) to measure the level of ease of use of the application. The results of the SEQ test showed an average score of 6.4, indicating that the RAB Konstruksi application as a whole was considered easy to use by potential users. Although the application received a positive rating in terms of ease of use, there were several issues that needed attention, such as some users' confusion in navigating some parts of the application and difficulty in understanding certain instructions. This indicates that there is room for improvement in the application usage flow and refinement of instructions to make them clearer and easier for users to understand. Therefore, in the next development phase, it is important to continue to monitor and evaluate user feedback to improve application performance. The RAB Konstruksi application developed has an intuitive interface and adequate functionality to help employees plan and manage project budgets more efficiently. Although there are some minor issues that need to be fixed, the test results show that this application is quite easy to use and provides great potential to improve efficiency in managing RAB data at PT PLN (Persero) UID S2JB UP3 Lahat. With continuous evaluation and improvement in each phase of development, this application is expected to provide a better user experience in the future.

4. Related Work

Research related to UI/UX design and the Cost Budget Plan (RAB) system has been widely discussed in the literature. Several previous studies have focused on user interface design for various applications, but differ in industry context, methodology, and intended use. The following is a critical review of relevant previous studies, which distinguishes this study from other studies in the same field. Research by Alsindo *et al*. (2023) developed a user interface for the Workfit application using the Design Thinking methodology. The main focus of this study is applications in the insurance sector, which is very different from RAB in electricity companies [11]. Applications in the insurance sector tend to focus more on claims management, risk assessment, and policy management, while RAB applications in the electricity industry focus more on budget planning, cost estimation, and infrastructure project management. This difference is the core difference between this study, where this study applies Design Thinking to develop a RAB application that specifically serves the needs of PT PLN. The main focus of this study is on understanding the needs of users who work with manual systems and how to design interfaces that can improve efficiency and accuracy in the budgeting and project planning process. Sugiyarti & Hasani (2023) applied Design Thinking to redesign the banking system interface with the aim of improving the user experience in banking transactions. However, this study is only relevant to the banking sector and has not addressed the challenges faced by the electricity industry, especially in the preparation of RAB and project budget planning [10]. This study is different from the one applied to the Indonesian electricity industry, where the RAB system requires attention to technical specifications, long-term budgets, and integration with broader operational systems. This study distinguishes itself by designing a system that is not only user-friendly but also relevant to the business processes that occur at PT PLN, integrating user experience with a more complex and project-based budget planning process. Several other studies, such as Febriani *et al*. (2023) and Karo Sekali *et al*. (2023), focus more on the UI/UX design of applications without integrating existing business processes [7][8]. These studies emphasize the aesthetic and navigation aspects of the interface, but pay less attention to the challenges faced by organizations in implementing systems that support existing workflows. One of the main differences of this research is the application of empathy design that focuses on understanding the manual RAB process that is still applied in PT PLN. This ensures that the interface design not only meets the aesthetic needs of users, but also matches

the real operational needs in the field, namely the implementation of cost estimates, resource allocation, and complex approval processes in electricity projects.

Favian Limas (2023) developed a more general website-based project management system, which does not specifically address RAB applications. Although it provides insights into web-based project management, this system does not address budget integration or cost estimation specifically in electricity projects [1]. This study differentiates itself by building an application specifically for RAB in electricity projects at PT PLN, by adding features that manage budget planning, resource management, cost reporting, and real-time monitoring that are relevant to the electricity project management process. This ensures that the proposed system is more focused on the challenges faced in the electricity sector, compared to more general studies such as those conducted by Favian Limas.

Research by Junaidi *et al*. (2023) developed a system that compares RAB with realization data, which is important for monitoring and verifying budget performance in projects. However, this study did not utilize Design Thinking or user-centered design principles, which are essential for creating an easy-to-use interface that is tailored to the specific needs of users in the field [4]. This study differs from existing studies by integrating Design Thinking principles to not only ensure the accuracy of RAB calculations, but also develop an intuitive and easy-to-understand interface for users working with manual RAB processes. This study aims to increase technology adoption among field workers at PT PLN, who may not have a technical background. Other studies, such as those conducted by Harahap *et al*. (2023), Humaera *et al*. (2023), and Mokolensang *et al*. (2021), focus on aspects of RAB calculations and cost estimates but do not discuss information systems that support or integrate these calculations with business processes in the field. These studies contribute to improving RAB calculation methods but pay less attention to integration with efficient information systems [3][5][2]. This study addresses these shortcomings by integrating RAB calculations into an information system that allows real-time data updates, automatic reporting, and more efficient budget approvals. This ensures that the electricity project management process can be carried out more quickly, accurately, and transparently.

The research is different from previous studies, especially in the development of the RAB application for PT PLN. This is different from other studies that are more general or applied to different sectors, such as insurance or banking. This study emphasizes the integration between UI/UX design and existing business processes, which not only focuses on the user interface alone, but also ensures that the RAB system can support complex budget planning in the electricity industry. This approach combines interface design with existing operational workflows, thus creating a more effective solution. Furthermore, the study also applies the Design Thinking methodology, which focuses on a deep understanding of user needs, and produces solutions that are more in line with real conditions in the field, both in terms of user experience and the business processes faced. Finally, this study offers a very specific solution for PT PLN, by developing a system that is truly tailored to their business processes, covering aspects such as cost estimation, reporting, and project planning, which is very different from similar applications implemented in other sectors.

5. Conclusion and Recomendations

Based on the research conducted, several conclusions and recommendations can be drawn. First, the study concludes that the Design Thinking methodology has proven effective in developing a user-friendly UI/UX for the Construction RAB application (PLNConstruct). The method has significantly improved the efficiency of creating RAB reports and enhanced the user experience, as demonstrated by the results of the Single Ease Question (SEQ) test, which yielded an average score of 6.4. However, the study suggests that this methodology can be further developed by expanding the PLNConstruct application to other divisions within PT PLN or similar companies, thereby broadening its impact and adding more value.

In terms of recommendations, it is advised that further testing be conducted with a larger number of respondents to obtain more comprehensive and representative results. Additionally, it would be beneficial to explore more user-centered design methodologies and consider integrating advanced features, such as artificial intelligence (AI) for predictive budgeting. This integration could enhance the user experience by improving the accuracy of budget predictions, ultimately making the application more relevant and beneficial to its users in the future.

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