Design of E-Budget with SAP Integration Using the Design Thinking Method for Budget Management Optimization at PT. Krakatau Steel

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Abstract

Integrated budget management is a crucial aspect in improving the efficiency and accuracy of corporate budget planning and implementation. One innovation developed to address this need is the E-Budget system, an application designed to automate the budget submission, evaluation, implementation, and monitoring processes more systematically. In its implementation, this system still faces various obstacles, such as the time-consuming and error-prone budget data input process, the lack of integration with SAP systems that hinders data processing, and limited access available only through the intranet. Furthermore, the lack of transparency in the budget evaluation process also hinders data-driven and more accurate decision-making. To address these challenges, this study employed a Design Thinking approach with five main stages: empathize, define, ideate, prototype, and test. In the empathize stage, in-depth interviews were conducted with eight employees from the finance and IT units to explore user needs and constraints. Next, a prototype of the E-Budget system integrated with SAP was developed and tested through functional testing (black box testing) to verify feature completeness and usability testing involving 15 active user respondents. The data collected included the time of data input, the number of errors, the user's satisfaction level, and the data access speed. This study shows that the Design Thinking-based E-Budget system can reduce data input time by up to 35%, reduce input error rates by 40%, and increase user satisfaction by 82%. Integration with SAP also accelerates the data consolidation process and increases the transparency of budget evaluations. Thus, this system is proven to be more efficient, easily accessible, and supports more accurate financial decision-making at PT Krakatau Steel.

Keywords: E-Budget; Design Thinking; Budget Management; Efficiency; Transparency

1 Introduction

In the digital era, an integrated budget management system is crucial for enchancing efficiency and accuracy in the planning and execution of corporate budgets. The E-Budget (BMS) system, integrated with SAP, offers a solution to automate the structured processes of budget proposal, evaluation, realization, and monitoring. However, one of the primary challenges in implementing this system is ensuring

that the developed design truly aligns with user needs. Therefore, the Design Thinking method is an effective approach to designing a user-friendly system that prioritizes user requirements.

Several previous studies have demonstrated the success of Design Thinking in financial system development. A study by Arip Irwansyah et al. (2023) in "Implementation of Design Thinking Method in UI and UX Design for Mobile-Based Financial Applications" showed that this approach

enhances user experience by providing an intuitive and easily accessible interface. This highlights the importance of user involvement in the design process to ensure an effective and efficient system.

Additionally, research conducted by Afif Ramadhan (2019) in "Design of Budget Control System Fund Management (FM) Module Using SAP Application with SAP Activate Method for Capital Expenditure (CAPEX) Budget at PT Telkom Indonesia, Tbk." discusses the implementation of an SAP-based budget management system that helps companies manage budgets more effectively. Although SAP provides an integrated solution, this study indicates that challenges remain in adapting the system to user needs, which can be addressed through the Design Thinking approach.

Another previous study, "Implementation of Design Thinking Method in Designing a Prototype Data Management System" (Dini Anggraini et al., 2024), emphasizes that the Design Thinking approach can produce a more flexible system tailored to operational user needs. This method emphasizes gaining a thorough understanding of user requirements before proceeding to the design and development phases.

Furthermore, research on "Android-Based UI/UX Design for Personal Financial Management Using the Design Thinking Method" (Faris Al Baihaq et al.: 2023) also confirms that this method improves user experience by providing a more user-friendly interface design that aligns with specific user needs.

One of the main challenges in budget management is the difficulty in inputting budget data. Users often encounter challenges when manually entering data, which is both time-consuming and prone to errors. Additionally, the current budget management system is not fully integrated with SAP, causing delays in data processing and discrepancies in the information required by various stakeholders.

Apart from technical challenges, accessibility is also a significant issue. The system's restriction to intranet-only access limits user flexibility in entering and evaluating budgets, particularly for those needing access outside the company's work environment. This limitation reduces work efficiency and can slow down decision-making processes that should be quick and precise.

Moreover, budget evaluation processes often lack transparency, making it difficult for stakeholders to understand the budget status and allocation. This lack of transparency impacts the effectiveness of decision-making in financial management, which should be conducted accurately and based on clear data.

To address these issues, the development of E-Budget presents an ideal solution. E-Budget is an application designed to facilitate data collection for RKAP (Corporate Budget and Work Plan) preparation and other budgeting activities. This application offers various features that enable users to access and manage budgets without requiring on an intranet connection. Consequently, data collection processes can be expedited and aligned with predetermined timelines.

The development of this system is expected to provide several benefits to the company, particularly in simplifying the budget data entry process at PT Krakatau Steel. Additionally, E-Budget serves as an integrated planner, implementation guideline, coordination tool, monitoring tool, and evaluation tool in budget management. With an integrated and easily accessible system, users can quickly and accurately obtain budget data whenever and wherever needed.

Integrated budget management is a key element in strengthening the efficiency and accuracy of corporate budget planning and implementation. The Design Thinking-based E-Budget system is designed to address common issues. Including lengthy data input times, high error rates, and low user satisfaction. This study quantitatively evaluates its performance, with concrete targets: reducing data input time by 35%, reducing input error rates by 40%, and increasing user satisfaction (as measured by usability score) by 82%.

System integration with SAP is also expected to accelerate the data consolidation process and increase the transparency of budget evaluation—in line with evidence showing that SAP BPC integration with finance modules can reduce manual errors and accelerate the budgeting process (SuretySystems, 2025), the use of SAC with S/4HANA strengthens control and real-time visibility in budget planning (ResearchGate, 2025), the Design Thinking approach has been proven to produce solutions that are more desirable by users and easy to implement (SAP BTP Guidance, 2024),

the SAP BTP platform enables faster and more integrated budgeting application development (IBsolution, 2025) and modern SAP tools substantially reduce budgeting and forecasting cycle times (SAP-Press Blog, 2021–2022)

Based on the aforementioned studies, it can be concluded that applying the Design Thinking method in financial system development, including the SAP-integrated E-Budget, can help create a more effective, efficient, and user-oriented system. Therefore, this study aims to design an SAP-integrated E-Budget using the Design Thinking method to optimize corporate budget management processes.

Through this approach, the developed system is expected to be more responsive to user needs, feature an intuitive interface, and improve efficiency in budget management processes.

2 Research Method

This research is a qualitative study and system design with an iterative approach, focusing on understanding user needs and developing appropriate solutions. The data in this study were obtained through:

a. Direct observation of the ongoing budget management system.
b. Interviews with the finance team, budget managers, and SAP users.
c. Literature review of previous studies related to budget management systems, SAP implementation, and the Design Thinking method.

Design Thinking is an iterative process in which we strive to understand users, challenge assumptions, and redefine problems to identify strategies and alternative solutions that may not be immediately apparent at our initial level of understanding (NNGroup: 2025). The Design Thinking method is applied in this study through the following five key stages:

a. **Empathize**
   Understanding users' needs, problems, and perspectives through research and observation. This stage involves direct interaction with users to gain in-depth insights into their experiences within the company.

b. **Define**
   Formulating the core problem based on insights obtained from the Empathize stage. Clearly defining the issue allows the team to focus on the areas that require the most urgent solutions.

c. **Ideate**
   Generating various creative solutions through brainstorming and discussions. At this stage, the team is encouraged to think outside the box and explore different possibilities without limitations.

d. **Prototype**
   Developing a model or initial version of the solution for testing. Prototypes help the team visualize the solution and identify areas that need improvement before full implementation.

e. Test
   Testing the prototype with users to gather feedback and refinements. This stage ensures that the developed solution effectively meets user needs and is ready for implementation.
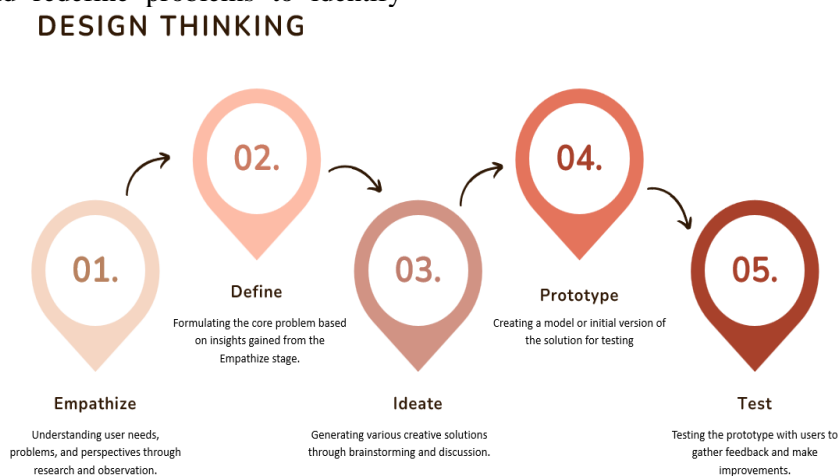

Figure 1. Design Thinking Proce

3 Result and Discussion

a. Empathize

The Empathize stage in the Design Thinking method focuses on gaining a deep and comprehensive understanding of the needs, challenges, expectations, and real issues faced by users who will utilize the E-Budget system integrated with SAP. This stage emphasizes observing user behavior, conducting interviews, and collecting relevant insights to explore users' perspectives, workflows, and pain points in budget planning, allocation, and monitoring processes. By understanding how users interact with existing systems and identifying inefficiencies or obstacles they encounter, this process ensures that the developed E-Budget system is user-centered. Ultimately, the Empathize stage aims to align the system design with user requirements to support effective, accurate, and efficient company budget management.

Table 1. User Identification

No	User Role	Description
1	Administrator	Manages system configuration, grants user access, ensures system security, maintains performance stability, and supports smooth daily operations across platforms.
2	PK (Control Center)	Responsible for overseeing the entire budget management process, ensuring compliance with company policies, and verifying all submitted budget proposals accurately.
3	Manager	Reviews, approves, or rejects budget proposals from operational departments, ensuring all allocations align with strategic company targets and financial priorities.
4	Key Person	Acts as the budget requester from each operational department, submitting budgets according to business activity needs.

Empathy Map Based on Interviews to Identify Pain Points in the E-Budget Design for PT. Krakatau Steel

Table 2. Empathy Map E-Budget

No	Aspect	Findings
1	Think & Feel	▪ Difficulty in entering budget data due to a non-user-friendly system. ▪ Concern about budget data inaccuracies due to manual errors. ▪ Expectation for a faster, more accurate, and user-friendly system.
2	Hear	▪ Complaints from colleagues about budget processing delays. ▪ Management requests for a more transparent and real-time system. ▪ Feedback from the IT team regarding challenges in integrating the new system with the existing one.
3	See	▪ Time-consuming manual processes in budget preparation and evaluation. ▪ Stacks of physical documents or Excel files prone to duplication and input errors. ▪ Use of an outdated system that lacks efficiency and real-time access.
4	Say & Do	▪ Expressing the need for a more modern, integrated, and automated system to improve efficiency and accuracy ▪ Using alternative methods like spreadsheets to create budgets due to the inflexibility of the existing system. ▪ Spending a significant amount of time correcting budget data input errors.

Based on the results of the empathy map above, the identified Pain Points are:
1) Slow budget input process and vulnerability to errors.
2) Difficulty in tracking budgets in real time reduces financial control, monitoring accuracy, and timely decision-making.
3) Lack of coordination tools that facilitate communication between departments.

From the analysis in this stage, insights were gained to define the main problems that need to be addressed by the E-Budget system integrated with SAP. With a better understanding of users, the

system design will be more user-centered, making budget data input easier with a more user-friendly interface. Additionally, the system will function as a planning, execution, coordination, monitoring, and evaluation tool, providing fast and accurate data access at anytime and from anywhere.

b. Define

The Define stage in the Design Thinking methodology aims to formulate the main problems based on insights gained from the Empathize stage. Some key challenges that may arise in a manual or poorly integrated system include:

1) An inefficient budget proposal process still relies on manual methods, making it time-consuming, increasing administrative workload, and prone to frequent data input errors.

2) Lack of transparency in the evaluation process prevents applicants from tracking the status, progress, and results of their budget proposals

3) No real-time integration with core systems such as SAP requires data to be repeatedly reprocessed or manually transferred, increasing inefficiency, delays, and the risk of operational errors.

4) Difficulty in coordination between relevant parties (Manager, PK, and MA), leading to delays in budget approvals.

In the context of E-Budget design integrated with SAP, this stage is used to create a User Journey, illustrating the steps users go through when utilizing the E-Budget system from budget submission to budget realization.
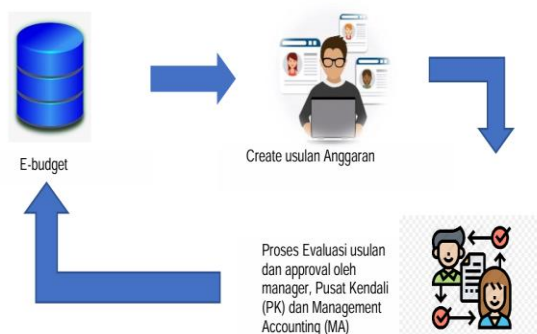

Figure 2. User Journey of E-Budget

The flowchart in Figure 3 illustrates the budget proposal, evaluation, and approval processes within the E-Budget system. This structured workflow enhances transparency, supports real-time monitoring, ensures seamless integration with the company's core systems, reduces manual intervention, minimizes errors, accelerates processing time, and enables more accurate, efficient, accountable, and data-driven decision-making in overall financial management activities across organizational planning and reporting.
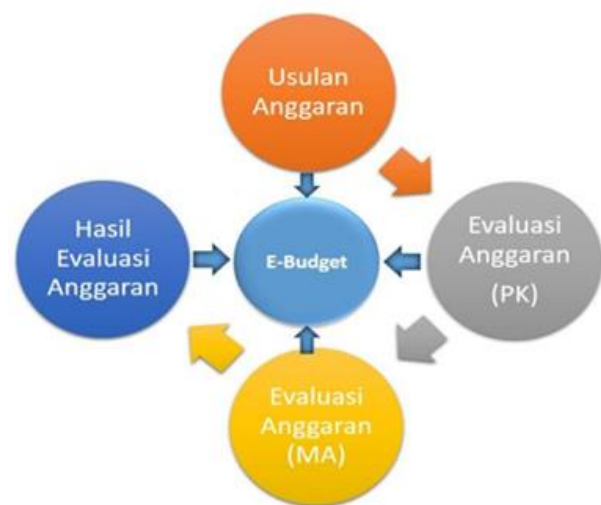

Figure 3. E-Budget Flow

The following flowchart illustrates the approval process of the Company Work Plan and Budget (RKAP) variable within the E-Budget system, detailing each stage from submission and evaluation to final authorization and documentation.
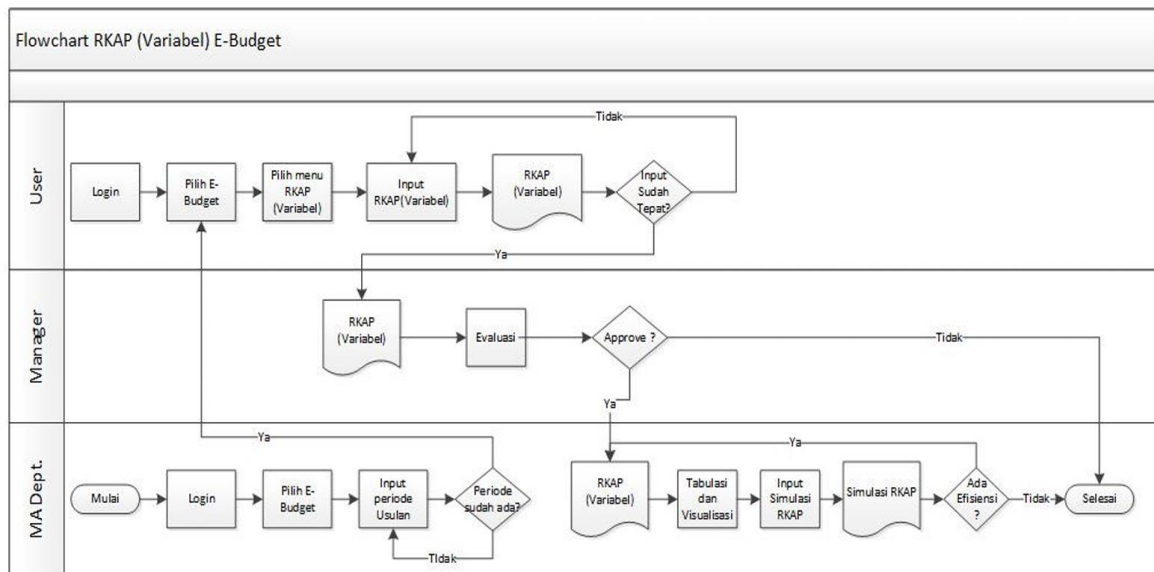
Figure 4. RKAP Flowchart

This flowchart illustrates the RKAP approval process, ensuring a structured and efficient workflow within the E-Budget system.
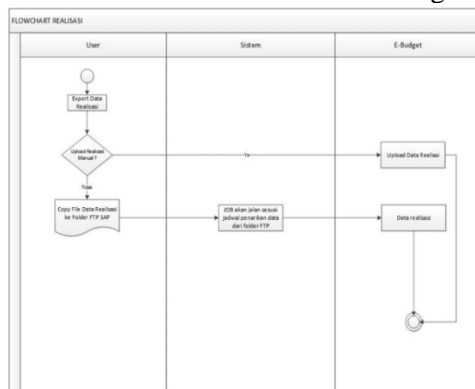

Figure 5. Realization Flowchart

The budget realization process in the E-Budget system involves exporting data and integrating it with the SAP system via FTP.

c.   Ideate

The Ideate stage in Design Thinking focuses on generating various creative ideas as solutions to the problems defined in the Define stage. In the context of designing an E-Budget system integrated with SAP, this stage aims to develop an effective budget management system and produce a system design as a reference for prototype development.
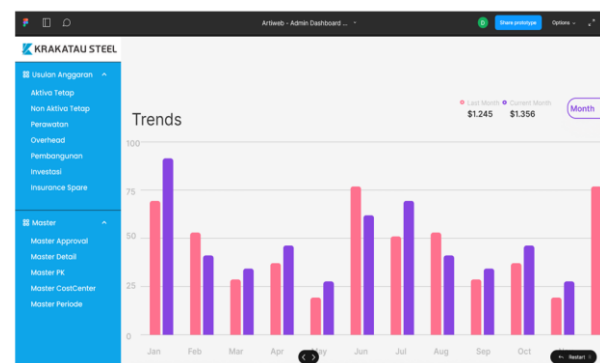

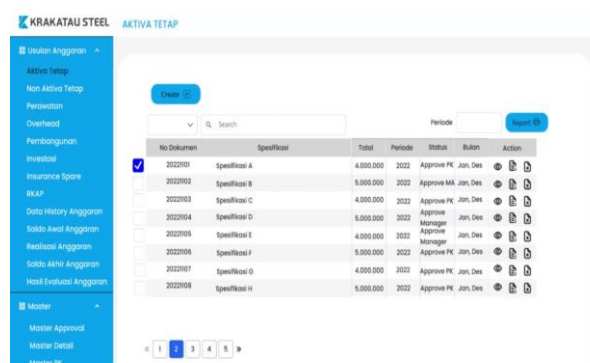Figure 6. Design System Dashboard

Figure 7. Design System Fixed Assets

Figure 8. Design System Entry Fixed Assets

Figure 9. Design System Log History

Figure 10. Design System Realization

Figure 11. Main Menu

Figure 12. Budget Proposal Input Menu

Figure 13. Budget Evaluation Menu

Figure 14. Budget Evaluation Approval

d.   Prototype

The Prototype stage in the Design Thinking method involves creating an initial model or prototype of the designed system to be tested before its full implementation. In the development of the E-Budget with SAP integration at PT Krakatau Steel, this stage aims to ensure that the developed solution meets user needs before being fully deployed. The researchers designed an initial version of the E-Budget system, showcasing key features such as budget proposal input, budget evaluation, RKAP (Corporate Budget and Work Plan), and budget realization.
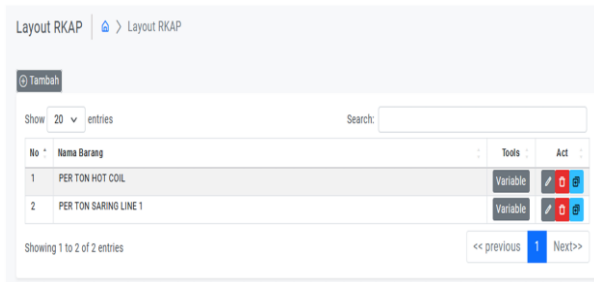
Figure 15. RKAP Menu

Figure 16. Budget Realization Menu

e.   Test

The Test phase in the Design Thinking method is a crucial step to ensure that the developed system truly meets user needs and expectations. In this phase, the prototype or functional version of the system is tested directly by end users in real or simulated working conditions. Users are asked to interact with the system to perform specific tasks, allowing developers to observe usability, efficiency, and potential issues. Feedback gathered during this process includes user satisfaction, system performance, and identified errors or limitations. The results of testing are then analyzed to refine, improve, and optimize the system. This iterative process helps ensure the final system is reliable, user-friendly, and ready for full-scale implementation.

This testing focuses on the system's input and output to ensure that each feature functions as expected.

Table 3. Black Box Testing

No	Scenario	Input	Output	Result
Budget Proposal Input				
1.	User fills out the budget proposal form with valid data	Complete budget data (amount, unit, category)	Data is successfully saved and appears in the proposal list	Success
2.	User submits a budget proposal without entering an amount	Empty field in the amount section	System displays an error message: "Amount is required"	Success
3.	User enters the budget amount in text format (e.g., "Eighteen Million")	Text input in the amount field	System displays an error message: "Invalid amount format"	Success
Budget Evaluation				
1.	Approve budget proposal that meets the criteria	Valid proposal data	Budget status changes to "Approved"	Approved: Proposal completed
2.	Reject budget proposal due to exceeding budget limit	Proposal data exceeds budget limit	Budget status changes to "Rejected"	Rejected: Proposal has been denied
3.	Login to budget evaluation with the role of Key Person	Username & Password	System displays an error message: "You do not have permission"	Success
Company Budget Plan (RKAP)				
1.	Display RKAP report after budget proposal is approved	Approved budget data	RKAP report	Success
2.	Display RKAP report before any budget proposals are approved	No approved proposals	List of unapproved budgets	Success

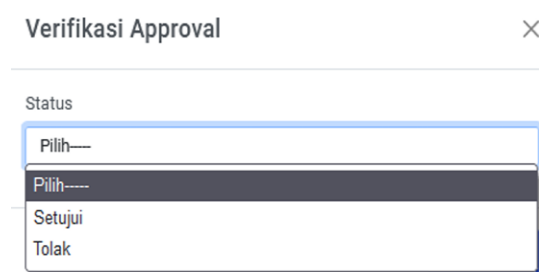|				
3.	Create RKAP Layout	RKAP Layout Form	System displays RKAP Layout according to user requirements	Success
Budget Realization				
1.	User views budget realization after a transaction occurs	Select the "Realiz	Displays budget realization data according to the user's cost center	Success
2.	Admin imports budget realization data	Budget realization data in Excel format is imported	System receives the data and displays it in the realization menu	Success
3.	User downloads budget realization data after a transaction occurs	Select the "Realization" menu and click the download icon	System exports the data in Excel format	Success

Mockup Verification Approval

Figure 17. Approval Verification

Figure 18. Budget Proposal Recapitulation

4   Conclusion

Based on the results of this study, it can be concluded that the E-Budget with SAP Integration is capable of improving efficiency and accuracy in budget management at PT Krakatau Steel. With a Design Thinking-based approach, the system is more user-friendly and responsive to user needs, as well as reliable in the company's budget planning, monitoring, and realization processes. Black Box testing ensures that the system functions properly; however, further evaluation and additional feature development can be carried out to enhance the system's performance and flexibility in the future.

For further research, development can focus on:

a. Implementing other quantitative evaluation methods, such as the System Usability Scale (SUS) or the Technology Acceptance Model (TAM), to strengthen the validity of the results.
b. Integrating with Business Intelligence and machine learning technologies to enable the system to provide predictive analysis related to budget requirements.
c. Expanding system access through mobile platforms to increase user flexibility.
d. Comparative studies with E-Budget implementations in other companies to obtain a broader generalization.

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