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Design of research reporting and data collection information system at public university using design thinking method

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ABSTRACT

Current digital developments encourage the world of education to also participate in developing a digitalization environment, especially in higher education. Not only in terms of the learning process, but also in the managerial process, especially in the tridharma business process. This research aims to develop higher education information systems to be more efficient and effective, especially in research business process, namely the process of data reporting and data management. The method used in this research is design thinking, which consists of the empathize, define, ideate, prototype, and testing stages. At the empathize stage, data is collected in the form of strategic plan documents which are then mapped in the form of a business model canvas. Then a user interview is conducted which is then mapped into an empathy map. At the define stage, the results of the interview are detailed in the form of a user persona. From the results of document mapping and user interviews, we enter the ideate stage, namely making user flows and flowcharts. After validating user flow and flowcharts for the user, the prototype stage is carried out, where at this stage Balsamiq 3 tools are used to design the user interface. The results of this study indicate that the designed user interface and flow are in accordance with user needs.

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1. INTRODUCTION

The era of digitalization which is dynamic and continues to move forward, requires all industries to be able to adapt, especially education. Digitalization in education, especially at universities, was first introduced in the 1960s at Stanford University, namely the use of computers in the learning process (Keegan, 2021). In the 1970s lectures were held online, and in the 1990s the LMS or Learning Management System was introduced. However, with the emergence of the Covid-19 pandemic, the digitalization process in the education industry is increasingly required to cover all aspects of implementation, both learning and managerial (Marinoni & Van't Land, 2020)

The application of digitalization in higher education is also considered a significant change, based on the results of a survey conducted by the University of Oldenburg in Germany, 74% of lecturers stated that the workload on online lectures was heavier, and 42% of lecturers preferred hybrid lectures rather than completely online. (Zawacki-Richter, 2021). Through the Covid-19 pandemic, educational institutions, especially higher education institutions, are working hard to create an information system that not only facilitates the learning process for the academic community, but also ensures that management processes can be carried out online (Zawacki-Richter, 2021). This online management process includes access to all data that can be accessed from anywhere, to support the WFH (Work From Home) process. In this research, researchers will design a new information system user interface.

Based on the analysis of the company's condition, the results of the mapping of the university's strategic plan documents resulted in the Business Model Canvas or BMC, which later identified that tridharma is the main key activity. Tridharma itself consists of teaching, research and community service. This research focuses on business process research, which is under the research and community development department or in Indonesia LPPM short for Lembaga Penelitian dan Pengabdian Masyarakat. From this business process, it is revealed in BMC research and community development, where the main points in the key activities of research and community development that are highlighted are verification services, documentation, research & community service data administration, as well as data presentation for stakeholders. Analysis of the company's condition also shows that there is an urgency for efficient reporting and data management. Where based on key performance indicators (KPI), information system needs and key research and community development activities account for 60% of the total KPI.

Analysis of the condition of the company is also then followed by an interview process with users, where user opinions play an important role in the user interface development process. In this study, the user persona was also explained based on the results of interviews conducted, the results showed that users have the same need for the presence of a system to assist in the process of managing research data. Based on the explanation of the problems originating from these users, supported by the demands for digitalization in the management process, the researchers tried to analyze and design information system solutions that can support the process of reporting and research data collection at Private University by applying the Design Thinking method.

Information systems have the benefit of being a place to store a number of data containing company information (Pauziah, 2022). The information system itself is defined as a system that helps manage information, such as storing, organizing, and retrieving information. According to Laudon and Laudon (2004) the benefits of information systems for organizations can include: (1) Improved Operational Efficiency; (2) Better Decision Making; (3) Improved Coordination and Collaboration; (4) Improved Customer Service; (5) Competitive Advantage

The Business Model Canva or BMC was first introduced by Osterwalder (2004). However, the development of BMC was then introduced in a simpler form called canvas and introduced by (Osterwalder & Pigneur, 2011), which introduced important indicators of BMC: (1) Customer Segments; (2) Value Propositions; (3) Channels; (4) Customer Relations; (5) Revenue Streams; (6) Key Resources; (7) Key Activities; (8) Key Partners; (9) Cost Structure. Murniati (2008) explains that in achieving the goals of an organization, including educational industrial companies, the implementation of strategic management plays a crucial role. One of the tools utilized in the implementation of strategic management is the Business Model Canvas (BMC). Zott and Amit (2010) define BMC as a content, structure, and governance designed to create value for a company.

In addition to BMC analysis, SWOT or Strengths, Weaknesses, Opportunities, and Threats are also often utilized as strategic management methods within a company.

Learned et al. (1969) explained that SWOT has become a key method in the process of strategy identification by summarizing information in decision-making. The application of SWOT also has extensive benefits; Wheelen et al. (2015)) employ SWOT in identifying gaps and aligning competencies and resources with the business environment in business policies. Furthermore, Dealtry (1992) uses the SWOT approach to identify terms or groups and vectors with common themes and interactions within an organization.

Design Thinking is a method introduced by David Kelley and Tim Brown. This approach involves a series of stages that are carried out repeatedly, and do not always follow a linear or sequential order (Puspita, 2023) Design thinking consists of several stages including: Empathize, according to Plattner et al. (2010) this stage involves deeply understanding users, their goals, their needs, and the challenges they face. The results of observations on the empathy process are then analyzed to find/identify the focus of the problems faced by users (Sari et al., 2020). This empathy process must be interpreted as a number of things, namely observation where researchers must examine users and their behavior in the context of their lives, attachment, namely interacting or communicating with users on scheduled or incidental occasions and immersion, namely trying to experience what users also experience (Taufik, 2023).

Second define, after gaining insight from the Empathize stage, this stage involves formulating a specific problem and focus. At the end of this stage, the design team must have a clear definition of the problem to be solved (Plattner et al., 2010). The information that has been collected is also then analyzed and synthesized to determine the core problem. This definition is called a problem statement. Third ideate, the ideas obtained through the brainstorming process will generate ideas in the form of solutions to the problems faced by users (Wibowo & Setiaji, 2020) In describing this stage, you can generally use diagrams or tables that represent the results of the analysis. Several previous studies have used userflow, sitemap, and flowcharts. The function of userflow is to make it easier for designers to determine the flow before making a system design and avoid navigation that is too complicated to make it easier for users (user friendly) (Wulandari et al., 2017). In addition, there are also stages of making a wireframe to make it easier for designers to design the system interface. Meanwhile, a flowchart is a diagram of a system flow that will show logic.

Fourth step is prototype, according to Plattner et al. (2010) this stage involves creating a concrete prototype or visual representation of the proposed solution. This prototype can be a physical model, drawing, storyboard, or even a simple digital prototype. The stages of the prototyping method according to (Marthasari et al., 2017) are described as follows: (1) Analysis of system requirements; (2) System design; (3) Implementation of prototypes; (4) Prototype testing; (5)Test. The user performs final testing of the prototype, at this stage the user often uses the results of trials and prototype evaluations to redefine one or more further problems. Testing on system design is carried out to improve problem solutions, get feedback from users, and study users more deeply in order to get better information system design results according to the wishes of users (Karnawan, 2021) There are many methods to get user feedback, one of which is the User Perception Survey. The User Perception Survey aims to understand the user's perception of the system display. This survey may contain questions about visual impression, ease of use, text readability, and the effectiveness of other display elements (Tullis & Albert, 2008). This research haven't been conducted before.

2. RESEARCH METHOD

In this study the method used is a descriptive qualitative research method. The stages of the research carried out will adopt the process of the design thinking method where this design thinking has 5 stages including Empathize, Define, Ideate, Prototype and Testing. The implementation of each process in design thinking provides ideas for finding and

solving problems in this information system design development project. A consumer-centered Design Thinking approach to produce system designs that are able to solve problems faced by users. It can be seen in Figure 9 that there is a systematic relationship between one process and another.

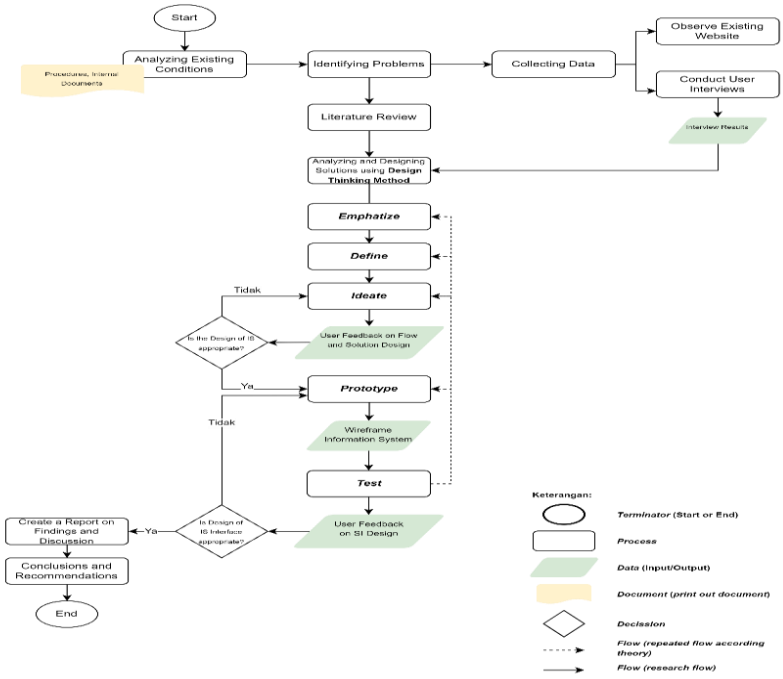

Figure 1. Design Thinking Method

In the design thinking framework, all stages have the same important goal, but in this research the prototyping stage is the main stage where in this stage the process of making a working model of the proposed system is carried out using the database desired by the user and then it will be evaluated in terms of appearance. and functions before being realized (Dalis, 2017). After prototyping system will be analyzed by using testing methods, which researchers will give a form to be filled out by users.

3. RESULTS AND DISCUSSIONS

3.1 Emphathize

Empathy Map is a process of gathering information for design needs with a user-centered approach that focuses on understanding other individuals by seeing the world through users.

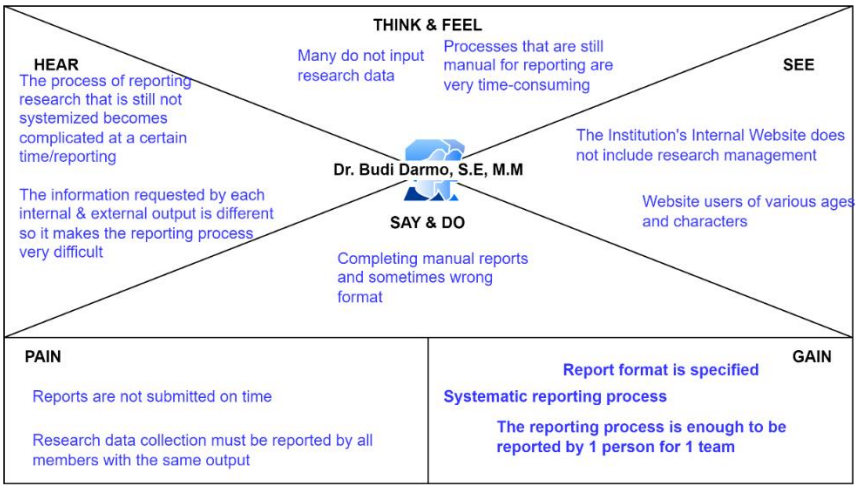

Figure 4. Emphathy map Dr. Budi Darmo, S.E., M.M

The results of Budi's empathy, one of the lecturers, showed that there was still a special need for research that had to be reported individually, even though within the same research team and a long reporting process made it late to report research.

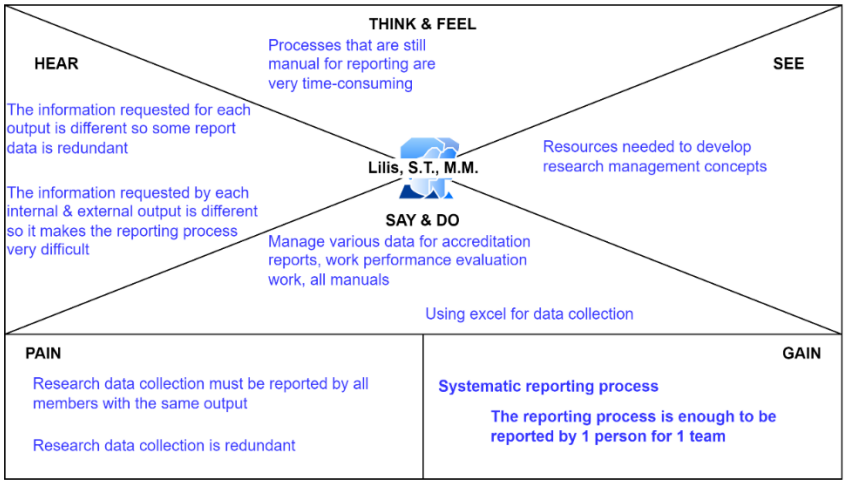

Figure 5. Emphathy map Lilis, S.T., M.M

The results of Lilis's (staff) empathy show the need for a system that can manage data collection so that research reporting can be stored properly so that in the process of output reporting for various purposes such as accreditation, performance achievements, performance evaluation will be made easier.

3.2 Define

The information gathering stage is taken from the empathize process by analyzing the observations and then synthesizing them to find the core problems that have been identified. This stage helps researchers collect ideas in building possible features, functions, and elements with the aim of solving problems that are experienced by users. Each of these parts is obtained from the user's empathy map in the previous process. The following is the stage of gathering information taken from the empathize process that has been carried out and created in the form of a user persona.

	**Prioritas Utama** - Seluruh kinerja dapat dilaporkan secara lengkap dan sesuai dengan ketentuan yang berlaku	**Goal dan Motivasi** - Terdapat sistem yang efektif dalam proses pelaporan, - Sistem yang memungkinkan pelaporan dilakukan per laporan penelitian bukan per dosen
Biografi Singkat **Nama:** Dr. Budi Darmo, S.E., M.M. **Umur:** 42 tahun **Pekerjaan:** Dosen manajemen **Lokasi Bekerja :** Universitas Ciputra	**Personality** - Manajemen - Administrasi pelaporan kinerja	**Kendala dan Tantangan** - Sangat banyak kebutuhan administrasi yang harus dipenuhi, kemudian formulir pelaporan yang diisikan juga sangat banyak dan repetitif - Masing-masing dosen harus menginputkan sendiri

Figure 6. User Persona Dosen

	**Prioritas Utama** - Data yang ditarik merupakan data yang valid (tidak repetitif dan lengkap) - Pengelolaan data yang efektif dan efisien	**Goal dan Motivasi** - Sistem informasi dapat membantu proses pelaporan data yang tidak repetitif dan juga pengelolaan data dapat dilakukan lebih efektif dan efisien.
Biografi Singkat **Nama:** Lilis, S.T., M.M. **Umur:** 35 tahun **Pekerjaan:** Staff LPPM **Lokasi Bekerja :** Universitas Ciputra	**Personality** - Administrasi database kinerja	**Kendala dan Tantangan** - Banyaknya kebutuhan data ini tidak dibarengin dengan sistem informasi yang memadai, akhirnya data yang diberikan seringkali mengalami kesalahan seperti data yang repetitif - kebutuhan data masing-masing stakeholder juga memiliki template yang berbeda-beda, sehingga dalam proses pengelolaannya masih manual karena sistem belum dapat mengakomodir

Figure 2. User Persona Staff

3.3 Ideate

The results of the user persona at the define stage will be used to compile the user flow and flowchart of the research management information system as follows.

a. Userflow

Userflow is a diagrammatic depiction to find out user flow scenarios when accessing a website-based research management information system. The function of userflow is to make it easier for designers to determine flow before designing a website interface and avoid overly complicated system flows to make it easier for users/user friendly (Wulandari et al., 2017).

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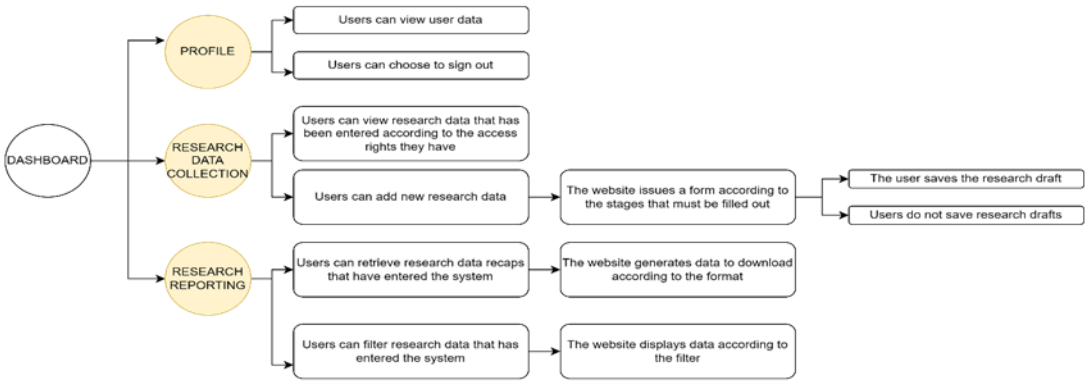

Figure 3. User flow proses ideate

b. Flowchart

Flowcharts have an important role in the research data management system. The main function of a flowchart is to help describe workflows and procedures in managing research data in a visual and structured manner. In the context of LPPM University research data management, a flowchart will help identify the steps that must be followed starting from adding research data, data management, approval to reporting.

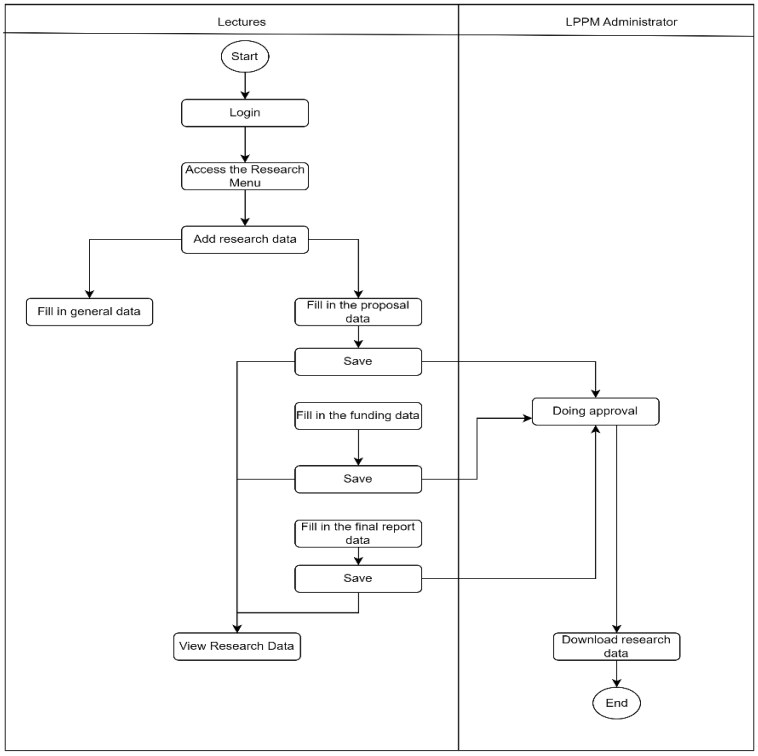

Figure 9. flowchart proses ideate

The results of this stage will be used as a validation stage for the user to ensure that the results of the system analysis and design will suit the user's needs. The method used for validation is to conduct group discussion forums with users who were previously interviewed at the empathize stage so that users can identify if there are needs that have not been accommodated in the information system design. The following is the contents of the question form that will be given to respondents before the FGD begins.

Table 1. FGD Guideline

No	Question	Yes	No
1.	Is the userflow easy to understand?		
2.	Is the flowchart or system flow in accordance with the current procedure?		
3.	Is the flowchart easy to understand?		
4.	Can the functions to be developed meet the needs in supporting the research data collection process?		
5.	Can the function to be developed meet the needs in supporting the research reporting process?		

From the results of the FGD above, there are results that can be concluded as follows: a) All respondents answered 'Yes' to question number one (1); b) All respondents answered 'Yes' to question number two (2); c) There were 4 respondents who answered 'Yes' and 1 respondent answered 'No' for question number three (3).

The comments given by respondents who answered no were: There is no description of the user's interaction with the system's reaction so that it is not understood at the beginning of the explanation. However, after going through the FGD process and explanation by the researcher, the flowchart is easy to understand: a) All respondents answered 'Yes' to question number four (4); b) All respondents answered 'Yes' to question number five (5)

3.4 Prototype

This stage is designing a prototype that displays the appearance of the system. Making a website display design according to the problems that have been found in the field. This design was made with the Balsamiq 3 application. In the prototype design it can be seen that this information system can be opened via a browser so that it is more responsive and easier to use on any device. Users do not have to open a PC/Laptop to access the system. However, the prototype design in this report is made with a display ratio on a computer or laptop.

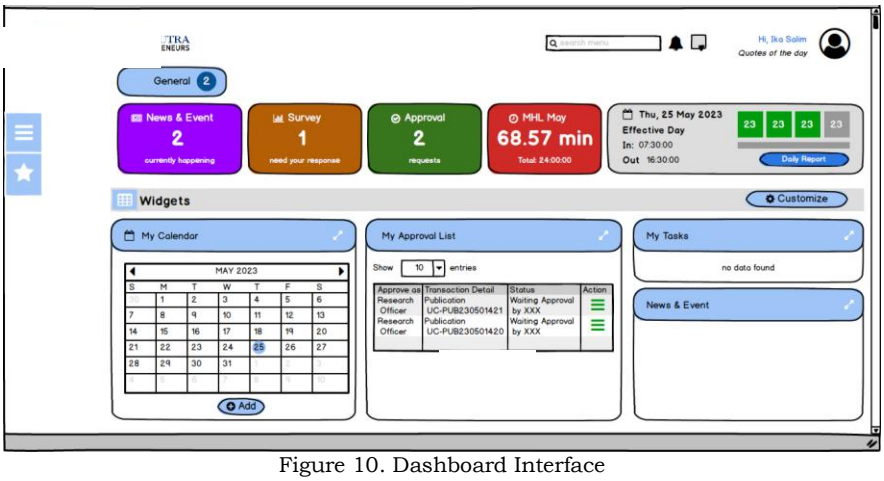

Figure 10. Dashboard Interface

Figure 10 is the main dashboard display of the system where the display reference is taken from the current system. Where researchers provide recommendations if the research data management system has the possibility to become part of an existing main system or can be developed into a separate system. In the dashboard display some important information appears that can be seen directly every time you access the system.

Figure 11. Menu Interface

Figure 11 is the display of the Menu Bar on the left and the 'Research' feature can be accessed easily through the menu. Users need to select the Menu Bar on the left then select Transaction > Research & Community Development > Research. In depicting this prototype, the researcher took references from users by using the display form that had been used earlier, namely the excel file.

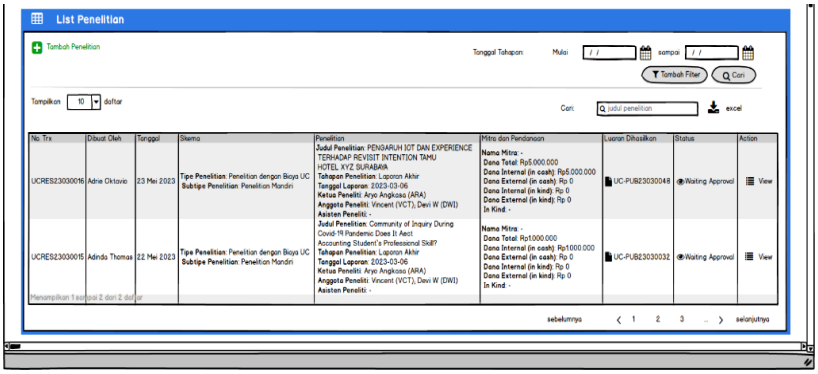

Figure 12. Research dashboard interface

Figure 12 shows the main dashboard view of the list of studies that have been entered into the system. There are several features related to Add Research, Research Filters, Search for certain Research, to Download Research Files in excel format. At the top, a menu bar is still displayed which makes it easier for users if they want to move to another transaction page or return to the system's main Dashboard.

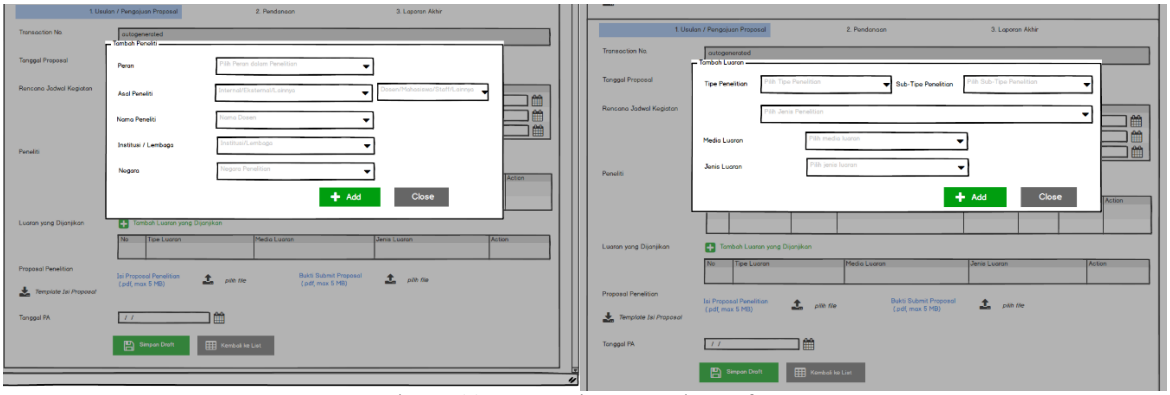

Figure 13. Research Proposal Interface

Figure 13 above shows the initial appearance of the research data form. In this menu the user can input research data. There are 2 different bars namely General Data and Detailed Data. The detailed data for this page includes the first page, namely 'Proposal'. There are two other views, namely Add Researcher and Add Output Type as different windows. When finished adding data the user can select 'Save Draft'. In depicting this prototype, the researcher took references from users by using the display form that had been used earlier, namely the excel file.

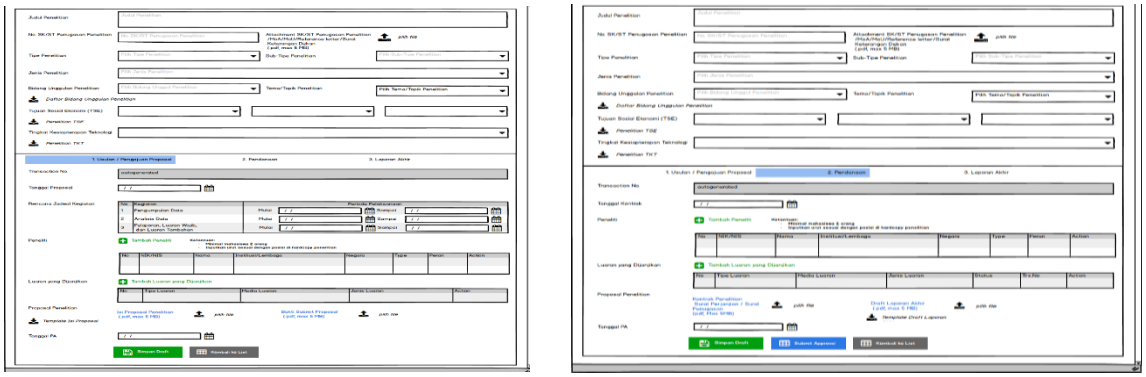

Figure 14. Research Funding Interface

Figure 14 above shows the same view in General Data. However, the detailed data for this page includes the second page, namely 'Funding'. There are two other views, namely Add Researcher and Add Output Type as different windows. When finished adding funding data the user can select 'Save Draft' or 'Submit Approval'. In depicting this prototype, the researcher took references from users by using the display form that had been used earlier, namely the excel file.

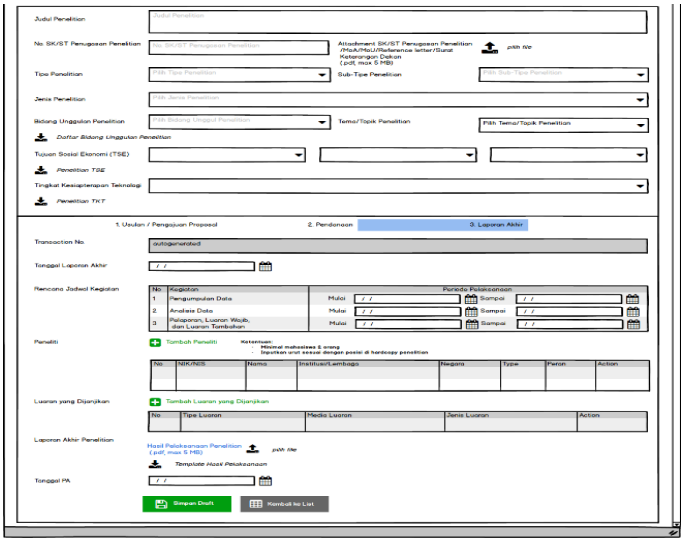

Figure 15. Research Final Report Interface

Figure 15 above shows the same appearance in General Data. However, the detailed data on this page includes the third page, namely 'Final Report'. There are two other views, namely Add Researcher and Add Output Type as different windows. When finished adding funding data the user can select 'Save Draft' or 'Submit Approval'. In depicting this prototype, the researcher took references from users by using the display form that had been used earlier, namely the excel file.

a. Evaluation

This stage is the result of the output after the testing process. In design thinking, the testing phase helps researchers to get user feedback so they can improve the design of ideas before they are used or developed further. This research accommodates changes according to the results of the feeback, namely related to the addition of file formats for downloading data on the LPPM research dashboard page. So that from the testing process the researcher returned to the prototype process to improve the appearance. This shows that the design thinking method supports processes that are iterative or iterative.

Figure 16 shows the same display in the LPPM research Dashboard data. However, based on the testing phase, there is input from users that can be accommodated, namely regarding the addition of the choice of file formats to be downloaded. The researcher added a 'download' function where if selected it will bring up a 'prompt' page to select the file format to be downloaded. The consideration for this change was accommodated by the researchers because of the overall input the 'export function' section had more than five respondents' suggestions while the other sections only amounted to two respondents.

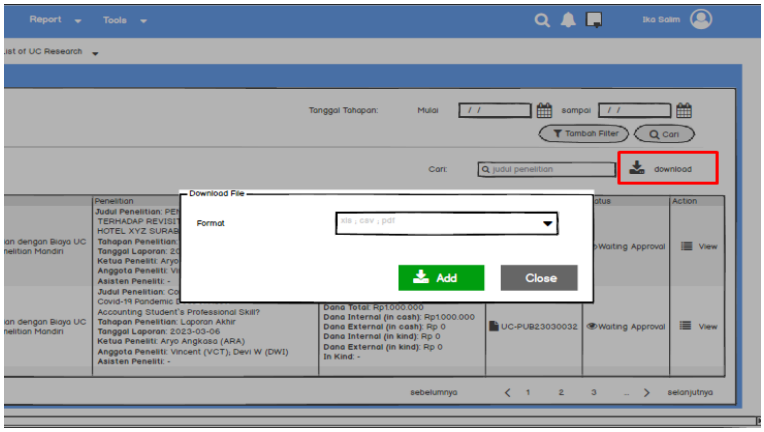

Figure 16. Fitur Development based on evaluation

3.5 Testing

The fifth stage of Design Thinking is testing the users. In the last stage of the design thinking process, researchers will conduct trials to get feedback and improve existing solutions and make products even better. Feedback from users is useful for knowing the strengths and weaknesses of the product so that improvements can be made (Ambrose & Harris, 2009). In this testing phase, the designer can make changes and improvements to rule out solutions to problems and gain the deepest possible understanding of the product and its users. The technique for determining the number of samples, this study uses Green (1991):

$$\text{Sample} = 50 + 8\ (n)$$
$$\text{Sample} = 50 + 8\ (1)$$
$$= 58$$

n = variable yang digunakan

In this study, only one variable was used, namely the display of the information system. Thus, researchers distributed questionnaires and obtained a sample of 60 respondents.

This assessment uses a Likert scale, which is a method used in surveys to measure respondents' attitudes or opinions towards certain statements or statements (Likert, 1932) The feedback obtained from the User Perception Survey activities has received good results from website users.

Based on the questions given, the results are in accordance with Table 2.

Tabel 2. Testing Question

No.	Question	Scale					Total
		5	4	3	2	1	
	1. Dashboard						60
1.	Based on figure 1, how easy is it to access or search the research menu?	25	34	1			
	2. Research list dashboard						
2.	Is the display of the research dashboard list informative?	21	38	1			
	3. Research Proposal Interface						
3.	Is the display for filling in the proposal easy to understand?	23	35	2			
4.	Can filling out the form above (proposal section) be filled easily?						
5.	Is the data entered in the proposal repetitive? Yes= 6; No=54						
6.	How compatible are the proposal fields with the external platform reporting fields? (External platforms: SINTA, SISTER, and BIMA)	24	34	2			
	4. Research Funding Interface						

7.	Is the funding filling display easy to understand?	20	39	20
8.	Can filling in the form above (funding section) be filled easily?	19	41	
9.	Is the data entered in the proposal repetitive? Yes= 6; No=54			
10.	How do the funding fields match the external platform reporting fields? (External platforms: SINTA, SISTER, and BIMA)	21	37	2
	5. Research Final Report Interface			
11.	Is the appearance of filling in the final report easy to understand?	25	34	1
12.	Can filling in the form above (final report section) be filled easily?	24	35	1
13.	Apakah data yang diinputkan pada laporan akhir repetitif? Ya= 6; Tidak=54			
14.	How do the contents of the final report match those of the external platform reporting? (External platforms: SINTA, SISTER, and BIMA)	22	35	3

Information:
Very Unsuitable = 1; Unsuitable = 2; Fairly Match = 3; Match = 4; Very Suitable = 5.

Based on the information above, the conclusions from Table 2 test results are as follows:

Table 3. Test Results

Questions	Very Unsuitable	Unsuitable	Fairly Match	Match	Very Suitable
Part 1			2%	57%	42%
Part 2			2%	63%	35%
Part 3			9%	49%	25%
Part 4			3%	45%	28%
Part 5			2%	43%	30%

From the above results, it can be concluded that the total percentage of respondents who have a tendency of 'appropriate' is 98%. Therefore, the application's outcomes are in line with the respondents' needs. The conclusions that researchers get from the results of open questions given through online surveys are as follows: (a) Display is good and easy to fill 21 (b) Add format 'Export' files 5, (c) Need to be realized for trial 4, (c) Display made simpler 2, (d) Language consistency in the system 2.

Further analysis was carried out by the researchers, and it was determined that the prototype design made in Balsamiq 3 by the researchers would undergo revision so that there would be improvements in the export files configuration section on the LPPM main Dashboard page. Then from all the results of this prototype, the researcher will submit the results to the Ciputra University ICT department for further development.

4. CONCLUSION

The Design Thinking method in website design can be used to produce an information system design that fits the needs of its users. This can be seen from user feedback, namely the results of the User Perception Survey (testing) stage of sixty participants who are prospective system users and LPPM administration staff in the field of research regarding the appearance of system design are good. The conclusions that can be drawn from the results of research related to "Research Reporting and Data Collection Information System Design at Ciputra University Surabaya with the Design Thinking Method" are as follows: a) The design of the information system has a simple user interface and includes the functions needed to make it easier for lecturers in the process of inputting research data; b) The design of the information system that is made has options in extracting data as needed so that the process of withdrawing and managing research data will be more effective and efficient.

This study has important implications for theory and practice in creating a good user-oriented information system design. This study shows that design thinking provides understanding to institutions regarding problem analysis of system users, especially staff and educators, user needs, creating solutions and how products can be well received by potential users

The stages in Design Thinking can be done repeatedly to get the best design results for its users and the empathize stage is the stage that really determines the concept and design of information systems. So, it is better at this empathize stage that observations, interviews and other elicitation processes can be carried out in depth to explore all user needs in order to provide useful input for system developers. In addition, the solutions developed provide comfort and security for users when accessing the website. In this research at the testing stage there are open questions. Referring to the results, the researcher hopes that in future studies the design of this research management information system will pay more attention to the language used in the system and a high-fidelity prototype can be developed. We recommend next research can evaluate the use of the system.

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