

# The Analysis of Functional Needs on Undergraduate Thesis Information System Management: A Case Study in Indonesian Universities

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## ABSTRACT

Undergraduate thesis is a scientific paper that students must complete to get a bachelor's degree. During the completion of the thesis, many students face difficulties in determining research topics, supervision, and administration processes so that they cannot graduate on time. This study aims to analyze the functional needs of the undergraduate thesis information system management that is needed by both students and administrators. This system serves to accelerate the thesis preparation process that is useful for students, supervisors, and thesis administration managers. The procedure of the study was conducted by compiling matrix planning and data collection. As the data source, this study involved 20 students who were writing their undergraduate thesis and 10 alumni who have completed their theses. This sample was selected with the criteria of students or alumni who have been involved in the undergraduate thesis business process. In the process of taking samples researchers used a purposive sampling method. In addition, difficulties in managing the thesis were also explored by supervisors and study program management. Furthermore, the data were analyzed through PIECES (Performance, Information, Economy, Control, Efficiency, Service). This study produces a list of functional needs on the thesis management system that can encourage students to graduate on time, in which universities can implement this system and socialize it to users.

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## 1. INTRODUCTION

The quality of tertiary institutions in Indonesia is measured by the accreditation conducted by the National Accreditation Board for Higher Education (BAN-PT) that is presented in an accreditation grade. The grade is measured based on the established standards, including student and graduate components. These components are measured based on the percentage of students who graduate on time [1]. A study at a university in Indonesia conducted by Widarto [2] reveals that students are constrained in completing their studies on time due to some challenges, including far distance from home to campus for supervision, the students still have study loads for their courses, and some students are also working. Moreover, students have also outlined that the selection of thesis supervisors is often not in line with the students' research topic. Consequently,

effective and efficient thesis management is essential for universities to encourage students to complete their studies on time. Carl Marnewick [3] argues that the use of an information management system can provide advantages in managing business processes and enhance the advantages for the organization in a sustainable manner. The information system implemented in an organization can change the business processes to be more effective and efficient, as well as to encourage the organization to have better management [4].

This study aims to analyze the functional needs of the information management system of an effective and efficient undergraduate thesis information that can encourage students to graduate on time. The results of the functional needs of the thesis information system management can be beneficial for tertiary institutions to increase the percentage of the students who graduate on time and improve the accreditation of institutions. Some theories that form the basis of this research are discussed below. This research is very important in order to understand the obstacles or problems faced by the actors involved in the undergraduate thesis business process. By defining the problem, it will open up opportunities to be able to increase the percentage of student graduating on time, which can have an impact on fulfilling higher education accreditation.

### **1.1. Software Engineering**

Software engineering is a social activity that involves a large number of interactions such as members of a software development team who collaborate with each other in different ways and tasks such as system analysts, programmers, stakeholders, etc. [5]. Software engineering is described as an approach that governs technical and managerial efforts to turn a set of needs, expectations, and constraints of stakeholders into a solution [6]. In this engineering process, several models of software development processes, such as software development life cycle (SDLC), agile, and others, are applied to provide supervision to software developers. In each process model, the stages of defining information system needs are very essential. In this case, the defining process is considered as a key to determining specific solutions to stakeholders' problems. According Nuseibeh and Easterbrook as cited by Melegati, define requirement or information system needs as the process of discovering the purpose that a piece of software intended by identifying the stakeholders and their needs, documenting the discoveries for future analysis, communication and implementation [14][15].

### **1.2. Information System Needs**

According Kotonya and Somerville as cited Curcio, in traditional requirement engineering or information system needs some sequential activities are developed during five specific phase : elicitation, analysis, documentation, validation and verification [16]. Lamsweerde argued information system needs is concerned with the identification of the goals to be achieved by the envisioned system, the operationalization of such goals into services and constraints, and assignment of responsibilities for the resulting requirements to agents such as humans, devices, and software [17-19]. In the software development process model, developers need to determine the information system needs in order to identify problems, causes-effects, and solutions, to create a model of the system to be proposed. The determination of these needs provides a clear picture of the specifications of software products needed by stakeholders [6]. The specifications of this software product will be validated by stakeholders. The validation results become the basis for decision making whether it is necessary to extract data again or continue to the process of modeling or system construction.

### **1.3. Classification of Needs**

The information system needs in the software development process model are derived from in [6], that are classified into two. First, the functional needs that describe the functionality of the system to be developed or built. The functionality of this system is expected to be a solution desired by stakeholders. Second, non-functional needs are product specifications that are expected in terms of capturing the property used to operate the system.

#### 1.4. Practices to Get Stakeholder Needs

Some researchers [7],[9] outline that the practices used to obtain stakeholder needs include interviews, questionnaires, observations, etc. Each of these techniques or methods has advantages and disadvantages. The method selection can be adjusted based on stakeholder conditions.

Kandaga & Felix(2011) in their research have succeeded in developing web-based final project management application, but did not thoroughly discuss the process of determining the functional requirements of the system[12]. Likewise Simatupang & Muhammad also develop a mobile based final project management application, but also did not focus on the detailed system requirement analysis process. This reasearch is a study that can provide a detailed explanation of the basic process of developing a system , because the development of system or application will not provide benefits to its users if it doesn't begin with in-depth analysis related to the needs of the system[13].

## 2. RESEARCH METHOD

This study is divided into three phases, including planning, data collection, and data analysis. Intaking the sampel the reseacher considers the characteristics of the sample, namely the actors who have been involved in the undergraduate thesis business process, in this case, are limited to student and alumni, because it is adjusted to the research objectives. The number of sample involved were 20 student who were working on their thesis and 10 alumni who had complated their thesis. This sample was chosen the hope of providing in-depth information related to business process and obstacles encountered in undergraduarte thesis management. The following is the detail of activities that are conducted at each phase:

### 2.1. Planning

The procedure of this research begins with planning. This planing is done in order to get data in the right way. In the planning phase, the researchers prepared for data collection by compiling the following documents:

#### Data collection matrix

The data collection matrix contains data or information to be extracted, information sources, data collection techniques. The data or information to be extracted can be identified based on business processes in the thesis management, including registration, supervision, and evaluation processes. Users (stakeholders) who manage each business process become the sources of information. Meanwhile, the data extraction technique was used as a data collection procedure. The technique used in the data collection process includes an interview as a communication technique used to explore data or information needed to determine the needs of stakeholders. Interview technique used in this study is open intreview which aims to hear opinions related to under garduate thesis management business process. Second, this observation is a technique conducted to validate that the business processes that have been explored during the interview phase are following the information given by informants. The things observed in this business process flow are the preparation of proposals, registrastion, guidance and examination. In addition to compiling the matrix, a schedule of activities is also arranged so that the project is completed on time to guide the implementation of each phase of the research.

#### Data collection instruments

Data collection instruments are arranged based on a predetermined data collection matrix. This instrument contains a list of questions that focus on the steps taken, constraints faced, and documents related to each business process. It is expected that by understanding these three foci, the process flow, constraints and flowchart of the current system can be identified.

### 2.2. Data collection

Data collection is based on instruments that have been prepared previously. The object of the research is one of the tertiary institutions in Indonesia namely STMIK ROSMA Karawang.

**2.3. The analysis of information system needs --- Data Analysis**

This phase is divided into several activities to focus on the purpose of this analysis. The following are the activities conducted to determine the functional needs specification for the thesis management information system:

**Identify business processes on the current system**

The identification of business processes in the current system is conducted by processing the data from interviews and observations into the flowchart model.

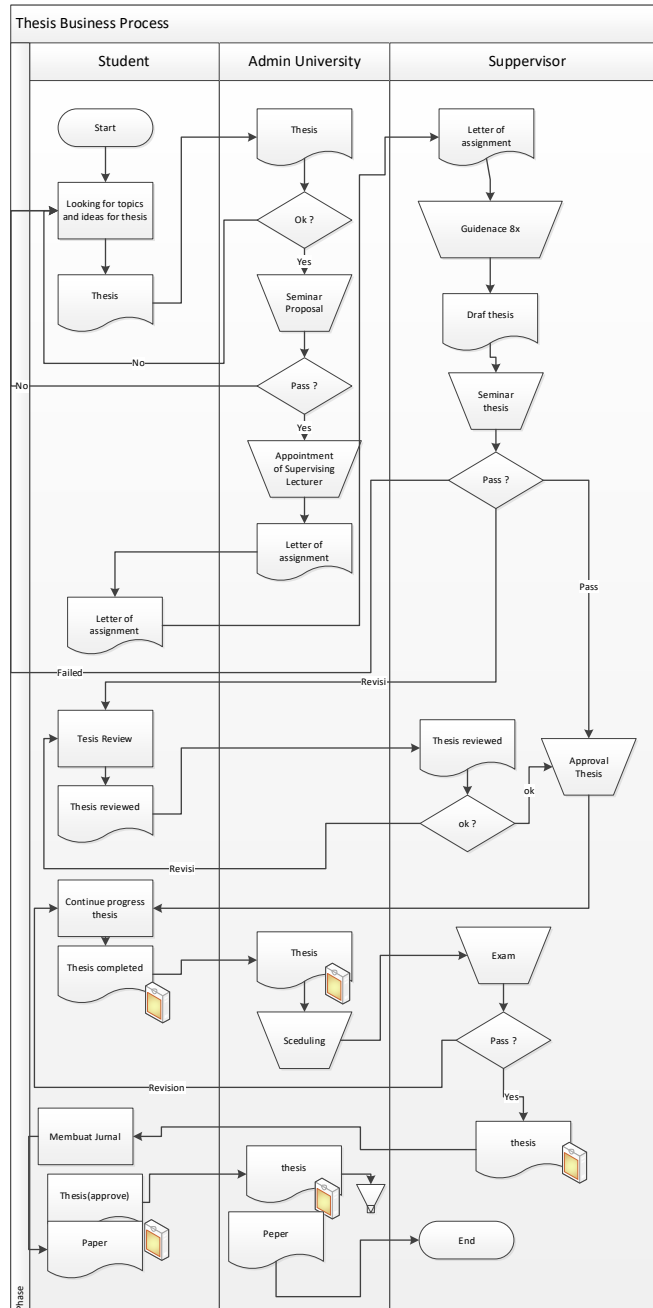


Figure 1. Business Process (flowchart)

**Identify problems using PIECES analysis**

The identification of the problem through PIECES analysis is conducted by assessing the existing business processes that have been modeled in the previous activity from six dimensions. These dimensions are as follows [10]:

- 1 Performance is a dimension used to measure the reliability of a system in processing data to produce the expected information.
- 2 Information is a dimension used to measure the value of the information or data presented. Important components to be considered in this dimension are outputs, inputs, and stored data.
- 3 Economy is a dimension used to measure the value of investments and the benefits of the current system. Components that are considered in this dimension are cost and profit.
- 4 Control is the dimension used to control and secure the current system.
- 5 Efficiency is a dimension used to measure the efficiency level of the current system being operated. The reference that can be used to measure this is the number of users needed to operate the system and fulfill material needs.
- 6 Service is a dimension used to measure the service level of the current system. Things that need to be considered in the assessment of this dimension are the accuracy and consistency of information produced, the ease of system use, flexibility and compatibility.

### Identify cause and effect

The cause and effect identification process are modeled in the form of a fishbone diagram. This diagram is developed by Ishikawa [11] as a technique to identify, explore and describe the causes of specific problems with particular cause.

### Identify the solution to the problem

The identification of the solution to this problem is conducted by compiling a list of solutions for the problems that have been identified in the previous activity. From each problem specified in the causal analysis activity, an analysis of the solution is conducted by dividing the root of the problem into three categories, including input, process, and output.

### Identify functional needs

In identifying functional needs, the determination of needs is based on users from stakeholders. Each identified need includes the explanation of the purpose of that need.

## 3. RESULTS AND DISCUSSION

### 3.1. Planning

Planning is started by compiling the data collection matrix. The following are the results of the preparation of the matrix:

Table 1. Data collection matrix

Data/Information	Data Source	Data Collection Technique
Business processes in undergraduate thesis management planning	1. Tertiary education management 2. Students	1. Interview 2. Observation 3. Documentation of the study
Business processes in the implementation of undergraduate thesis management	1. Tertiary education management 2. Students	1. Interview 2. Observation 3. Documentation of the study
Business processes in the undergraduate thesis evaluation management	1. Tertiary education management 2. Students	1. Interview 2. Observation 3. Documentation of the study

The determination of data or information is extracted based on the undergraduate thesis management. In thesis management, three processes occur such as planning, implementation, and evaluation. Based on these processes, relevant data or information is compiled. Meanwhile, the source of data is determined based on the users involved in each of these processes. Data collection techniques are adjusted based on the data sources that include interviews, observation, and study documentation. Data or information, data sources and data collection techniques will become the basis for making data collection instruments. Based on the data or information in the matrix, a

number of questions that are asked to the informants during the data collection process. The following is the arrangement of research instruments:

Table 2. Data collection instruments (Interview)

Questions	Informants' answers
Thesis management planning	
How does the thesis management planning process flow?	Explain in business process flowchart figure 1
What are the constraints experienced in thesis management planning?	Difficulties in the process of finding ideas for research topics
What documents are involved in the thesis management planning process?	Thesis registration form, thesis proposal evaluation form
Thesis management implementation	
How is the process of implementing thesis management?	Explain in business process flowchart figure 1
What are the obstacles encountered in the implementation of thesis management?	The process of guidance is not flexible, the head of the study program is difficult in controlling the progress of the thesis
What documents are involved in the process of implementing thesis management?	Guidance book
Thesis management evaluation	
How does the thesis management evaluation process flow?	Buku bimbingan
What are the obstacles encountered in the evaluation of thesis management?	The evaluation carried out did not focus the usefulness of the result of the thesis
What documents are involved in the thesis management evaluation process?	Critical assessment form

The interview was used for both data collection instruments and observation techniques, though the list of questions is different. The observation questions are answered based on the direct observation result by the researchers. Meanwhile, the study documentation instruments relate to the list of documents in every archived thesis management process.

### 3.2. Data Collection Results

Interviews, observations, and study documentation are conducted as the data collection instruments. During the interview, the researcher interviewed two categories of respondents are student who are taking thesis course and alumni who have completed thesis, including management and students. Meanwhile, observation and study documentation is conducted to ensure the validity of the information from the interview.

### 3.3. Data Analysis

The result of the data collection activities is then analyzed to identify the undergraduate thesis management business processes, the identification of the problem, the identification of cause and effect, the identification of problem solutions, and finally the identification of functional needs.

### 3.4. The Identification Result of Business Processes

The analysis is conducted by defining the processes that occur in thesis management. The result of the analysis is modeled in the form of a flowchart. From the data collection results, four business processes that occur in the undergraduate thesis management can be identified, including 1) Thesis proposal management, 2) Thesis supervision management, 3) Thesis seminar management, 4) Thesis defense management.

### 3.5. The Identification Result of Problems Using Pieces Framework

The identification of problem using PIECES framework is conducted by compiling PIECES matrix that can be seen below:

Table 3. PIECES analysis matrix

Category	Identification of problems
Performance	The process of searching thesis topics and research objects takes a long time. Reviewers and supervisors of proposals, seminars, and

	defenses do not fit the study field conducted by the students.
Information	The information generated in each data storage process (proposals, supervision, seminars, and defenses) in each process is inaccurate.
Economic	Administrative archiving process (proposals, supervision, seminars, and defenses) still use conventional methods. Face-to-face supervision requires time and money. Administrative activities require time and money.
Control	Stored data (proposals, supervision, seminars, and defenses) are lack of safety testing.
Efficiency	The students' data processing in the process of thesis proposals, supervision, seminars, and defenses takes time.
Services	Services that provide the information (proposals, supervision, seminars, and defenses) for students and managements' needs.

### 3.6. The Identification Results of Cause and Effect

Based on the identification of problems using the PIECES framework, a cause-and-effect identification is conducted to determine the causes of the problems. The following is the identification of factors that result in the problems:

Table 4. Factors that cause the problems

<i>Performance</i>	
<b>Problem</b>	<b>Cause</b>
The process of searching research topic and object takes time	Brainstorming media is not available
The competency areas of reviewers/examiners and supervisors in each process sometimes are not related to the topics discussed by the students.	The data of reviewers/examiners and supervisors are not complete.
<i>Information</i>	
<b>Problem</b>	<b>Cause</b>
The information generated in each data storage process (proposals, supervision, seminars, and defenses) in each process is inaccurate.	Some data are not well documented.
<i>Economic</i>	
<b>Problem</b>	<b>Cause</b>
Administrative archiving process (proposals, supervision, seminars, and defenses) still uses costly conventional methods	The administrative archiving process still uses paper
Face-to-face supervision requires time and money	Online supervision is not available
Administrative activities require time and money	The administrative process is not flexible in terms of time and place
<i>Control</i>	
<b>Problem</b>	<b>Cause</b>
Stored data (proposals, supervision, seminars, and defenses) are lack of safety testing	The process of storing data still uses worksheet
<i>Efficiency</i>	
<b>Problem</b>	<b>Cause</b>
The students' data processing in the process of thesis proposals, supervision, seminars, and defenses takes time.	The data input process still uses a worksheet. When

someone needs a report, they should compose the report.	
<i>Services</i>	
<b>Problem</b>	<b>Cause</b>
Services that provide the information (proposals, supervision, seminars, and defenses) for students and managements' needs.	Manual management

To better understand the relationship between the problems and their causes, a fishbone diagram is formed based on the identification of problems and their causes in table 4. The following is the analysis result of the fishbone diagram:

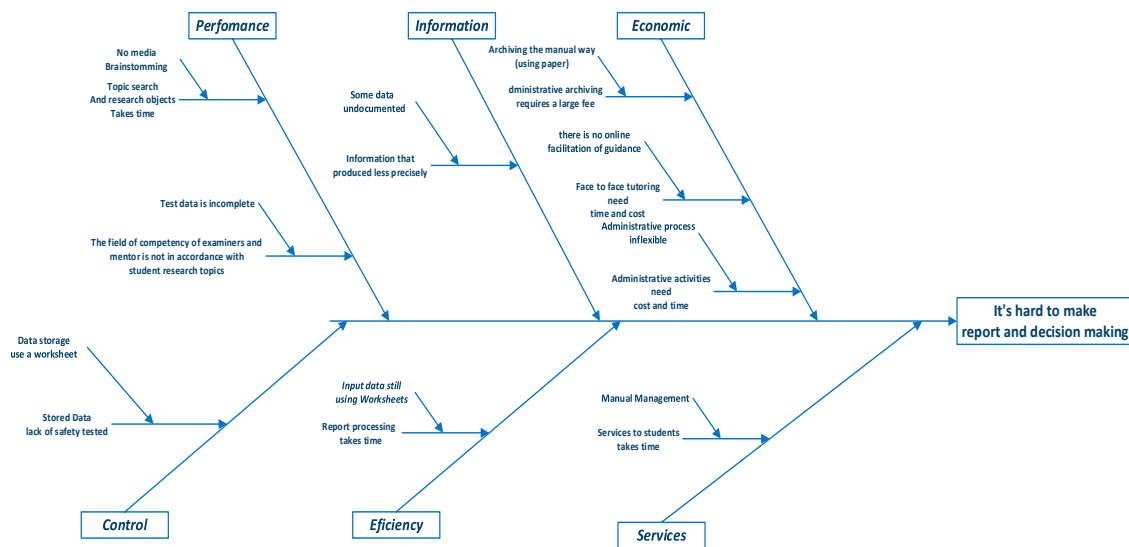


Figure 2. Cause and effect analysis

### 3.7. The Identification Result of The Solutions to The Problems

Based on the analysis of cause and effect that was determined in the previous activity, the problem is divided into three categories, including input, process, and output. This is conducted to make it easier to identify solutions that can be offered. The following table contains information about the identification of solutions to the problems:

Table 5. The identification of solutions to the problems

<i>Input</i>	
Underlying problems	The process of inputting data still uses manual process through a worksheet
Solutions	Creating a computerized information system that can facilitate the input process in a flexible and integrated way that can be used to exchange data or information between the management, students, and lecturers (examiners/supervisors)
<i>Process</i>	
Underlying problems	The management system in each process is still manual, and the data is presented as is so that it requires time and effort.
Solutions	Creating a computerized information system that can provide facilities in managing the process of thesis



	proposal, supervision, seminars, and defenses.
<i>Output</i>	
Underlying problems	The services that provide information and supporting media facilities are not optimal for students.
Solutions	Establishing a system that is able to present information and media facilities to support students in completing their studies on time. This includes the ease of composing a report to accelerate the delivery of information to the students, as well as to create a brainstorming media in order to support the students to graduate on time.

### 3.8. The Identification Result of Functional Needs

The identification of functional needs is determined based on the users' needs, which can be seen from the identification result of solutions to the problems. Based on the identification result of the business processes that occur during the undergraduate thesis management, there are three users, such as management, students, and lecturers. Furthermore, the next step is defining the information system management of the undergraduate thesis management by mapping the functional needs and their objectives as can be seen in Table 6 below:

Table 6. The analysis of college students' needs

No	Primary needs	Objectives
1	Focus group discussion (FGD) information system	To speed up the process of searching research topics and objects/accelerate the process of registering proposals.
2	Proposals, seminars, and defenses administration information system	To simplify the registration process and get information such as exam results and schedules.
3	Online supervision information system	To simplify the supervision process

Table 7. The analysis of lecturers' needs

No	Primary needs	Objectives
1	Lecturer data repository information system	To document lecturer data and specifications of expertise
2	Focus group discussion (FGD) information system	To exchange ideas with students
3	Online supervision information system	To simplify the supervision process

Table 8. The analysis of managements' needs

No	Primary needs	Objectives
1	Lecturer and student data repository information system	To display lecturer and student data
2	Administrative information systems (proposals, seminars, defenses)	For administrative management (registration, scheduling, delivery of information related to results)
3	Online supervision system	To see the progress of student thesis

## 4. CONCLUSION

Based on the result of data analysis, the functional needs of the undergraduate thesis information system management are features of the FGD media, online administration, online supervision, master data repositories (lecturer and student data). The functional needs of management of the undergraduate thesis information system are based on the results of in-depth interviews and

observations related to the business process of encryption, the constraints faced by students such as difficulties in getting research ideas, inflexible guidance processes and inaccurate evaluation of thesis results and the difficulty of the Producer in conducting control student thesis progress. This functional need analysis can be used as a reference for universities in terms of thesis management. Even though the effectiveness of implementing this system cannot be measured yet, this analysis can still provide an opportunity for universities to improve the quality of their institutions by increasing the percentage of students who graduate on time..

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