

Business Process Analysis with Business Process Improvement Method Case Study: University Integrated Registration Management System

Oka Sudana^{a1}, Suwija Putra^{a2}, Pradita Dewi^{a3}

^aDepartment of Information Technology, Udayana University,
Jl. Raya Kampus Udayana, Bali 80361, Indonesia

¹agungokas@unud.ac.id (Corresponding author)

²putrasuwija@unud.ac.id

³dayupradita@student.unud.ac.id

Abstract

The University's Integrated Registration Management System is a system to facilitate the registration of prospective new students at University X. A good registration system should be able to provide accurate and relevant information to improve the quality of the information system. Quality improvement can be done with business process analysis. In this research, business process analysis is done using business process improvement methods (BPI) up to phase 3, namely streamlining. The data to be analyzed is obtained from questionnaires distributed to stakeholders. Determination of quality factor indicators on questionnaire questions using the McCall framework. The questionnaire results showed a business process that is categorized as critical, namely, Study Program Transfer Management, with an average quality factor of 80%. Quality factors categorized as critical are Correctness 80% and Integrity 51%. Scholarship Application Management, with an average quality factor of 78%, quality factors categorized critically are Correctness at 80% and Integrity at 53%. Recommendations for business process improvement include a draft Standard Operating Procedures (SOP) flowchart using streamlining with bureaucracy elimination and upgrading simplification tools in moving management program and management of waiver submissions.

Keywords: Business Process Analysis, Business Process Improvement (BPI), McCall, University Integrated Registration Management System

1. Introduction

Information systems are the implementation of the application of technologies used to support operational processes and decision-making in an organization. An information system is a set of interconnected components that collect, process, store, and distribute information [1]. A piece of information is valuable if it has more effective and efficient benefits compared to the cost of getting it [2]. The increasing role of information in organizations and the need to have the type of information to continue activities are the most important reasons for realizing an information system [3]. By implementing an information system, an organization also improves its services. Service is critical in helping to improve the adequate performance of every institution [4]. Higher education becomes one of the institutions that need information systems to improve the quality of service.

The University's Integrated Registration Management System is a system to facilitate the registration of prospective new students. Modules on the admin side contain a dashboard menu, master data, period setup, waivers, graduation and re-listing, report, and transfer study program. In contrast, on the prospective student side, it consists of an initial registration and re-registration menu. The University's Integrated Registration Management System has been used in the registration process of prospective new students. However, it still needs to be evaluated to determine if the system is running correctly and by the expected.

Research related to the evaluation of information systems has been done before using the Waterfall Method [5]. Similar research uses the Business Process Improvement (BPI) method[6] by implementing one of its tools called streamlining. Business processes resulting from improvements get a reduction in the number of activities that can make CO business processes more efficient to 17 activities from the previous total of 19 activities.

BPI aims to enhance business processes and guarantee the appropriate resolution of concerns of an organization's business processes[7]. The chosen method for business process modeling is the utilization of Business Process Model and Notation (BPMN)[8]. Research [9][10], the authors analyzed, evaluated, and provided recommendations for business process improvements using the Business Process Improvement (BPI) method. Similar research[11] uses current business process modeling and simulation using BPMN, which continues to analyze problems using the BPI approach. Furthermore, it involves the development of models and simulations for proposed business processes, allowing for comparing outcomes derived from process simulations.

Based on the description, it is possible in this research to model the business process running in the University's Integrated Registration Management System to generate recommendations for critical business processes. The Business Process Improvement (BPI) method and the McCall framework are applied in this study to analyze the business processes and generate recommendations for improving business process effectiveness. It is expected that with the analysis and improvement of these business processes, the University's Integrated Registration Management System can operate optimally and enhance the quality of future services.

2. Research Methods

This research process goes through several stages, as shown in Figure 1. The research process starts with an observation regarding the research objects of the University's Integrated Registration Management System website, followed by literature studies to add insight and understanding. The next step is to design the system's business process, phase 1 of BPI, and the system conditions, phase 2 of BPI. The business process will be analyzed with the RACI Chart determination step to determine which entity will be the respondent at the time of the spread of the questionnaire. The questionnaire was designed using the McCall framework.

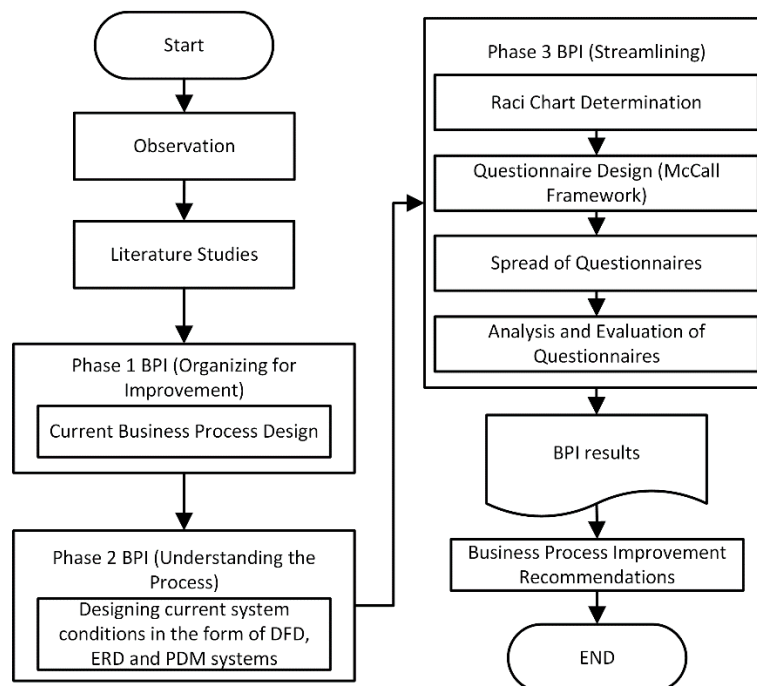


Figure 1. Research Flow

The results of business process analysis are used as guidelines to determine recommendations for improvement of business processes, which is phase 3 of the BPI analysis method. Recommendations are provided in the form of recommendations for improving business processes.

Table 1. RACI Chart

	Vice-Rector I	Bureau of Academic Administration	Head of SI Development	UPT Computer Lab Employees	Student
Ensuring the fulfillment of System Access Rights	A	C	I	R	I
Ensuring the fulfillment of System Login	A	C	I	R	R
Ensuring the fulfillment of Master Data	A	C	I	R	I
Ensuring the fulfillment of The Period Setup	A	C	I	R	I
Ensuring the fulfillment of student registration	A	C	I	R	R
Ensuring the fulfillment of the Transfer of Study Programs	A	C	I	R	I
Ensuring the fulfillment of Waiver Submissions	A	C	I	R	I
Ensuring the fulfillment of Student Registration	A	C	I	R	R

2.1 Business Process Improvement (BPI)

BPI is an important technique that focuses on integrating data from several sources to collaborate by integrating the business processes of an organization [12]. The method is a systematic approach to help organizations change their business processes [13]. The evaluation of BPI allows for using performance indicators in conjunction with process enhancement methodologies to quantitatively assess and compare measurement data between the existing and desired processes [14]. BPI provides a system that will help simplify and streamline operations and ensure the process produces good results [15].

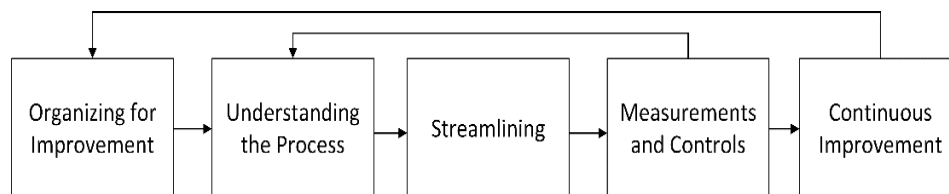


Figure 2. Business Process Improvement Phase

BPI has 5 phases in business process improvement, as shown in Figure 2. Organizing for Improvement is a phase of building commitment, understanding, and leadership so that the process can succeed. Understanding the process is a phase of understanding and determining the limitations of the process, creating graphic notation from the process flow [16]. Streamlining is a phase of improving the efficiency and adaptability of business processes [17] and increasing efficiency, efficiency, and process adaptation business. Measurements and controls implement and establish systems to control the continuous repair process to implement a system to control the process for improvement [18]. Continuous improvement is a phase of implementing and establishing a continuous improvement process [19]. In this phase, the process has been improved, evaluated, and redefined problems that arise for later improvement.

Results from using BPI in the form of new business process recommendations[20]. This research only reached phase 3, namely streamlining, while phases 4 (Measurements and Controls) and 5 (Continuous Improvement) were not carried out.

2.2 BPI Simplification Techniques

The streamlining technique in BPI consists of 12 tools [21]. The simplification tools used in this study are Bureaucracy Elimination and Upgrading. Bureaucracy Elimination is eliminating administrative processes that still use documents such as letters or paper while upgrading is increasing high effectiveness that improves the performance of business processes.

2.3 RACI Chart

The determination of entities on the RACI chart is adjusted to the organizational structure as well as the roles and responsibilities at the University. The RACI Matrix is usually used to describe the relationship between jobs and determine the roles, responsibilities, and levels of authority for each activity in the project[22]. The total number of respondents, as many as 70 respondents, were 64 student respondents, three were UPT Computer Lab Employees, one was Head of SI Development, and one was Bureau of Academic Administration. One respondent was Vice Rector I, as shown in Table 1.

2.4 McCall Framework

The drafting of the questions used on the questionnaire used McCall's method. McCall's method is a method that measures or evaluates the quality of software that has specific criteria that affect software[23]. McCall model has software quality factor consisting of 11 factors grouped into 3 product quality categories/perspectives[24]. McCall divides these factors into three important interrelated aspects [17], namely Product Operation, Product Revision, and Product Transition, as shown in Figure 3.

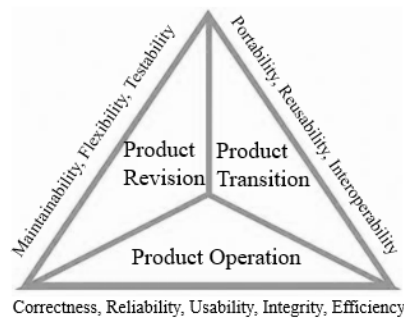


Figure 3. McCall's Software Quality Factors

According to McCall's taxonomy, there are five quality factors to determine software quality: Correctness, reliability, efficiency, usability, and efficiency[25]. The product revision category encompasses quality attributes such as maintainability, flexibility, and testability. In contrast, the product transition category contains quality attributes such as portability, reusability, and interoperability[26]. Testing is carried out to maintain the quality of the software itself, with more and more developers maintaining product quality and reliability[27].

2.3. Processing Data Questionnaire

Questions on the questionnaire using McCall's framework. Calculation of each quality factor based on predefined criteria using the Likert scale. The Likert scale measures the attitudes, opinions, and perceptions of a person or group of people about social phenomena[28]. The choice of each answer to the respondent's response to the satisfaction quality dimension is given a score that can be seen in Table 2, and the eligibility category can be seen in Table 3.

Table 2. Likert scale

Answer Options	Abbreviation	Weight
Strongly Agree	SA	5
Agree	A	4
Neutral	N	3
Disagree	D	2
Strongly Disagree	SD	1

Table 3. Eligibility Category

Category	Percentage
Excellent	81% - 100%
Good	61% - 80%
Pretty Good	41% - 60%
Bad	21% - 40%
Very Bad	<21%

Eligibility categories have a percentage range that refers to the percentage division of quality categories. According to Juliane et al. [29], Consisting of 5 categories that can be seen in the Categories column, each category has a percentage range that can be seen in the Percentage column in Table 3.

$$Fa \text{ Criteria} = (w1c1+w2c2+w3c3+w4c4+w5c5) \quad (1)$$

$$Fa \text{ Quality Factor} = \frac{Fa \text{ Criteria}1+Fa \text{ Criteria}2+ \dots +Fa \text{ Criteria} n}{\text{Number of Criteria}} \quad (2)$$

Keterangan :

Fa = Total value of the factor a

W = Likert Scale Weights

$$C = \frac{\text{Number of Answer Options}}{\text{Number of Respondents} \times \text{Number of Criteria Questions}}$$

Equation 1 is a calculation to obtain quality factor results in each business process and Integrated Registration Management System.

$$\text{Percentage} = \frac{\text{Result Value}}{\text{Maximum Value}} \times 100\% \quad (3)$$

The resultant percentage was employed to address the appropriateness of the scrutinized facets[30]. Equation 3 is a calculation used to obtain a percentage of the value of the quality factor obtained from Equation 2. The Result value is the total amount of quality factor value. The maximum value is the maximum score on the Likert scale.

3. Result and Discussion

The study's results include assessing the quality factors of the University's Integrated Registration Management System business process, an analysis of business process testing, and business process recommendations. The questionnaires were distributed offline and online with as many as 70 respondents, according to their respective responsibilities and roles predetermined on the RACI Chart table (Table 1). The details of the respondents are 64 student respondents (including new users). The old users comprised three respondents from UPT Computer Lab employees: one respondent is the Head of Information System Development Division, one respondent is the Academic Administration Bureau, and one respondent is the Assistant Chancellor.

3.1. Assessment of Business Process Quality Factors

Assessment of the quality of business processes to determine the value of quality factors by looking for the value of criteria from each criterion. Here is a calculation of the correctness quality factor in one of the business processes, namely the University's Integrated Registration Management System Access Rights Management System, using Equations 1 and 2.

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$$\text{Fa Completeness} = ((w1c1) + (w2c2) + (w3c3) + (w4c4) + (w5c5))$$

$$= \left(\left((5) \times \frac{34}{68} \right) + \left((4) \times \frac{24}{68} \right) + \left((3) \times \frac{10}{68} \right) \right)$$

$$= 2,5 + 1,41 + 0,44$$

$$= 4,35$$

$$\text{Fa Consistency} = ((w1c1) + (w2c2) + (w3c3) + (w4c4) + (w5c5))$$

$$= \left(\left((5) \times \frac{42}{68} \right) + \left((4) \times \frac{26}{68} \right) \right)$$

$$= 3,08 + 1,53$$

$$= 4,61$$

$$\text{Fa Traceability} = ((w1c1) + (w2c2) + (w3c3) + (w4c4) + (w5c5))$$

$$= \left(\left((5) \times \frac{78}{68} \right) + \left((4) \times \frac{56}{68 \times 2} \right) + \left((1) \times \frac{2}{68 \times 2} \right) \right)$$

$$= 2,86 + 1,64 + 0,01$$

$$= 4,52$$

$$\text{Fa Quality Factor} = \frac{\text{Fa Criteria1} + \text{Fa Criteria2} + \dots + \text{Fa Criteria n}}{\text{Number of Criteria}}$$

$$= \frac{4,35 + 4,61 + 4,52}{3}$$

$$= 4,50$$

$$\text{Persentase} = \frac{4,50}{5} \times 100 = 90\%$$

The above calculations are carried out to all quality factors in each business process. The University's Integrated Registration Management System has eight business processes: System Access Rights Management, System Login, Data Master, Setup Period, Student Registration Management, Moving Study Program, and Re-Registration Management of Prospective Students.

Fa Completeness is a factor that measures the extent to which the implementation of software functions has been achieved. Fa Consistency is an aspect that emphasizes the consistency of the design for each page within the software. Fa Traceability is a factor that measures the software's ability to trace data flow for each business process. These three factors are part of the correctness element in product operation to support software quality.

3.2. Integrated Registration Management System Business Process Testing Analysis

Business process analysis is an advanced stage to determine critical business processes in the Integrated Registration Management System. Table 4 is the result of an assessment of the business process of the Integrated Registration Management System.

Table 4. System Quality Assessment Results

No	Business Processes	Questionnaire Assessment Results	Business Process Category
1.	System Access Rights Management	85%	Excellent
2.	System Login Management	86%	Excellent
3.	Data Master Management	87%	Excellent
4.	Period Setup Management	89%	Excellent
5.	Student Registration Management	86%	Excellent
6.	Study Program Transfer Management	80%	Good
7.	Scholarship Application Management	78%	Good
8.	Re-Registration Management of Prospective Students	88%	Excellent

Business processes are categorized critically according to the eligibility category that is referred to in Table 3. The critical business process in the University's Integrated Registration Management System is the Transfer Management Study Program and Scholarship Application Management. After knowing the necessary business process, the next step is to look for quality factors that affect critical business processes.

The results of the quality factor calculations for both critical business processes can be seen in Tables 5 and 6, respectively.

Table 5. Results of Business Process Assessment Study Program Transfer Management

No	Quality Factor	Questionnaire Assessment Results	Business Process Category
1.	Correctness	80%	Good
2.	Reliability	89%	Excellent
3.	Efficiency	86%	Excellent
4.	Integrity	51%	Good Enough
5.	Usability	89%	Excellent

Business Process Category according to the eligibility category that refers to Table 3. Quality factors categorized critically in the Study Program Transfer Management are Correctness, with questionnaire assessment results of 80%, and Integrity, 51%.

Table 6. Results of Business Process Assessment Scholarship Application Management

No	Quality Factor	Questionnaire Assessment Results	Business Process Category
1.	Correctness	79%	Good
2.	Reliability	86%	Excellent
3.	Efficiency	84%	Excellent
4.	Integrity	53%	Good Enough
5.	Usability	84%	Excellent

Quality factors categorized critically in Scholarship Application Management are Correctness, with questionnaire assessment results of 79%, and Integrity, with 53%.

3.3. Business Process Improvement Recommendations

Recommendations for improvement of business processes in the system are carried out against critical business processes, namely Study Program Transfer Management and Scholarship Application Management. The first step is to describe the problem in the initial business process with a repair solution using simplification tools from streamlining. The following business process improvement plan results are used to compile business process recommendations.

Table 7. Business Process Improvement Plan

Problems with Early Business Processes	Types of Streamlining	Business Process Recommendations
The study Program Transfer Management menu does not provide a track history of every user updating data.	Upgrading	The system automatically records the last time the data was updated and saves the track history of users accessing the Study Program Transfer Menu.
The study program transfer menu is still done manually by prospective students by showing a letter of application for waivers.	Bureaucracy elimination	The system accessed by prospective students can submit online by determining the Path Period and Bargain Study Program.
The submission menu does not provide a trace history of every user updating data.	Upgrading	The system automatically records the last time the data is updated and stores the track history of users accessing the Scholarship Application Management.
Scholarship Application Management is still done manually by prospective students by showing a waiver application letter.	Bureaucracy elimination	The system accessed by prospective students can make submissions online by determining the type of Waiver and uploading a Waiver Application Letter.

Table 7 is a table for a business process improvement plan. The following business process improvement plan results are used to compile business process recommendations.

Table 8. Business Process Recommendations

Business Processes	Initial Business Process Activities	Activities added/changed to The Recommendation Business Process
Study Program Transfer Management	There is no trace history of data updates on the Study Program Transfer Menu. Prospective students apply to move manual study programs offline on the admin system.	The system records the last time the data was updated and stores the trace history of users accessing the Study Program Transfer Menu. The system adds the Study Program Transfer Submission menu to the system accessed by Prospective Students.
Scholarship Application Management	There is no trace history of any data updates on the Scholarship Application Menu. Prospective students apply for manual waivers offline on system admins	The system records the last time the data was updated and stores the trace history of users accessing the Scholarship Application. The system adds a Scholarship Application on the system accessed by Prospective Students

Table 8 is a table for improvement of the business process Transfer Management Program Study and Scholarship Application Management. Business Process given recommendations can be seen in the Business Processes column. Initial business process activity can be seen in the Initial Business Process column, and the activities recommended in the business process can be seen in the Activity added/changed in the Business Process Recommendation column. Figure 4 is the existing Standard Operating Procedure (SOP) Study Program Transfer Management.

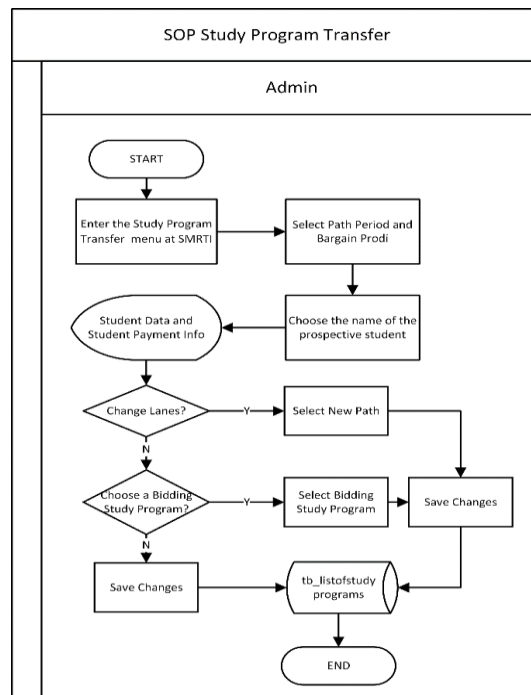


Figure 4. Standard Operating Procedure (SOP) Study Program Transfer Management (Existing)

SOP is an official document that delineates the manner in which individuals or establishments carry out assignments and chronicles the implementation of said assignments [31]. The results of business process analysis show that the SOP of business process Study Program Transfer Management falls into the category of Good, while other business processes have excellent categories. Quality factors that must be improved are completeness and Integrity.

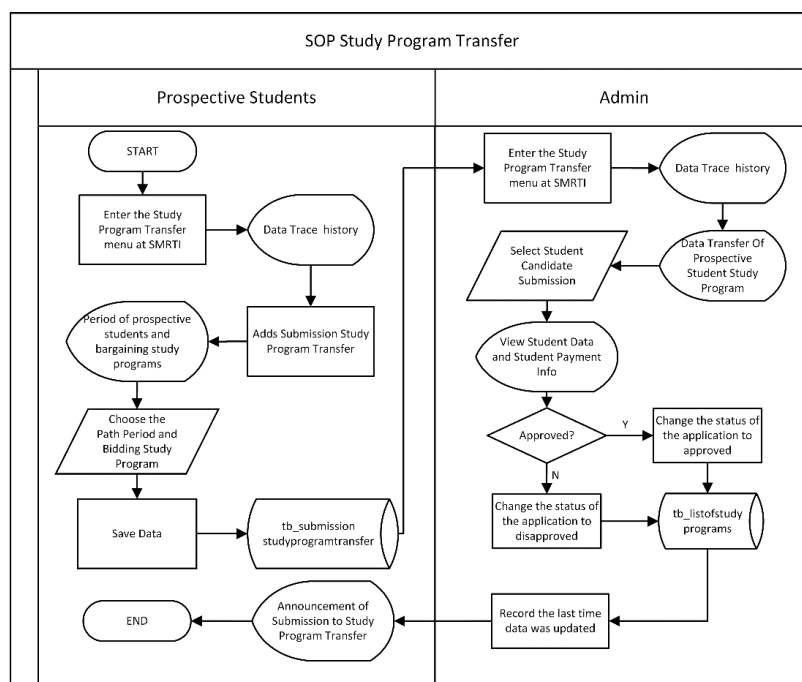


Figure 5. Recommendations for Business Process Study Program Transfer Management

Figure 5 illustrates recommendations for the business process of Study Program Transfer Management. The completeness factor recommends adding the Application to Study Program Transfer menu on the side of prospective students. In contrast, from the Integrity factor, the history of data renewal traces is displayed when the user goes to the Study Program Transfer Menu. The last time the updated data was recorded was after the admin changed the path and program on the business process of The Study Program Transfer.

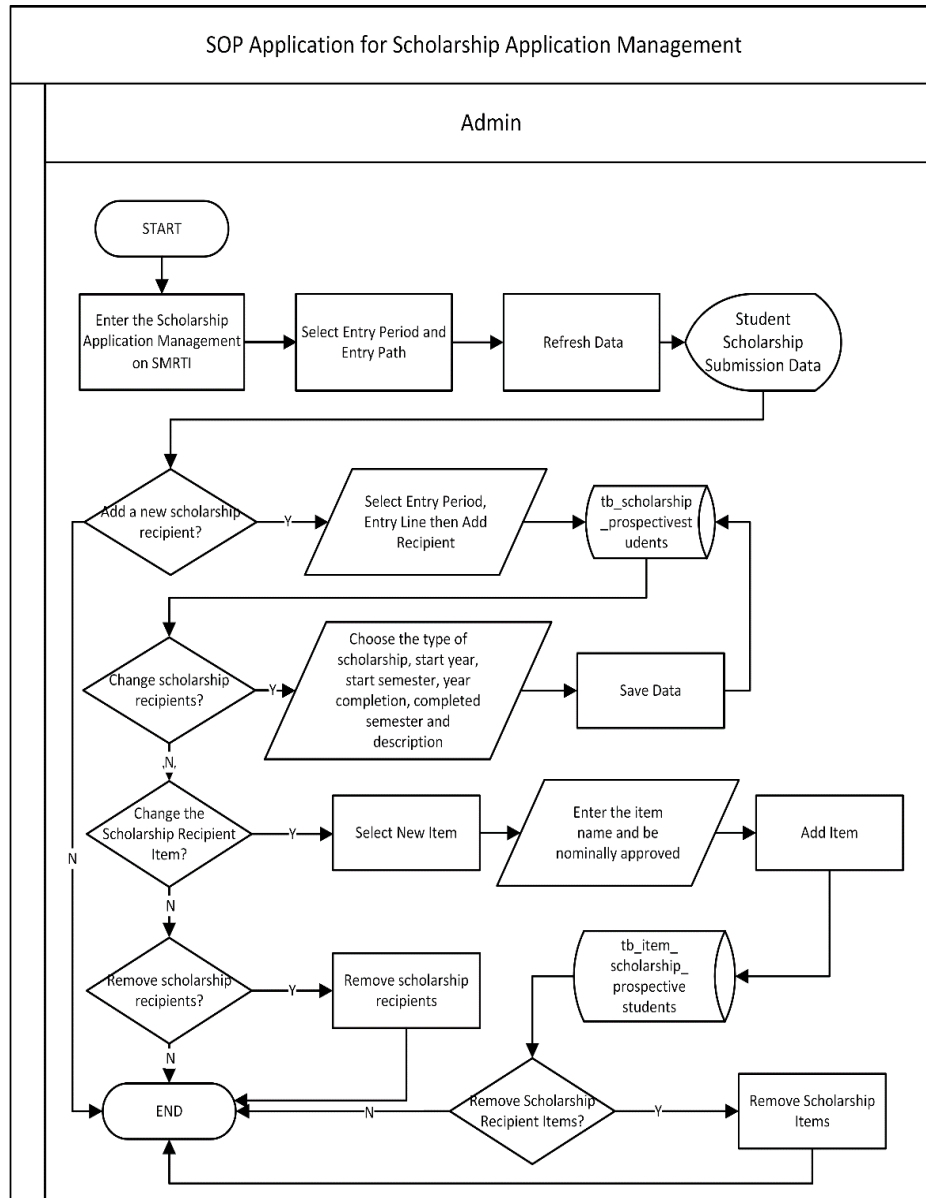


Figure 6. Business Process Scholarship Application Management (Existing)

Figure 6 is an existing business process or SOP in Scholarship Application Management. The results of the business process analysis show that the business process of Scholarship Application Management falls into the category of Good, while other business processes have excellent categories. The quality factors that must be improved are completeness and Integrity. Here are the recommendations for improvement of the business process of Scholarship Application Management.

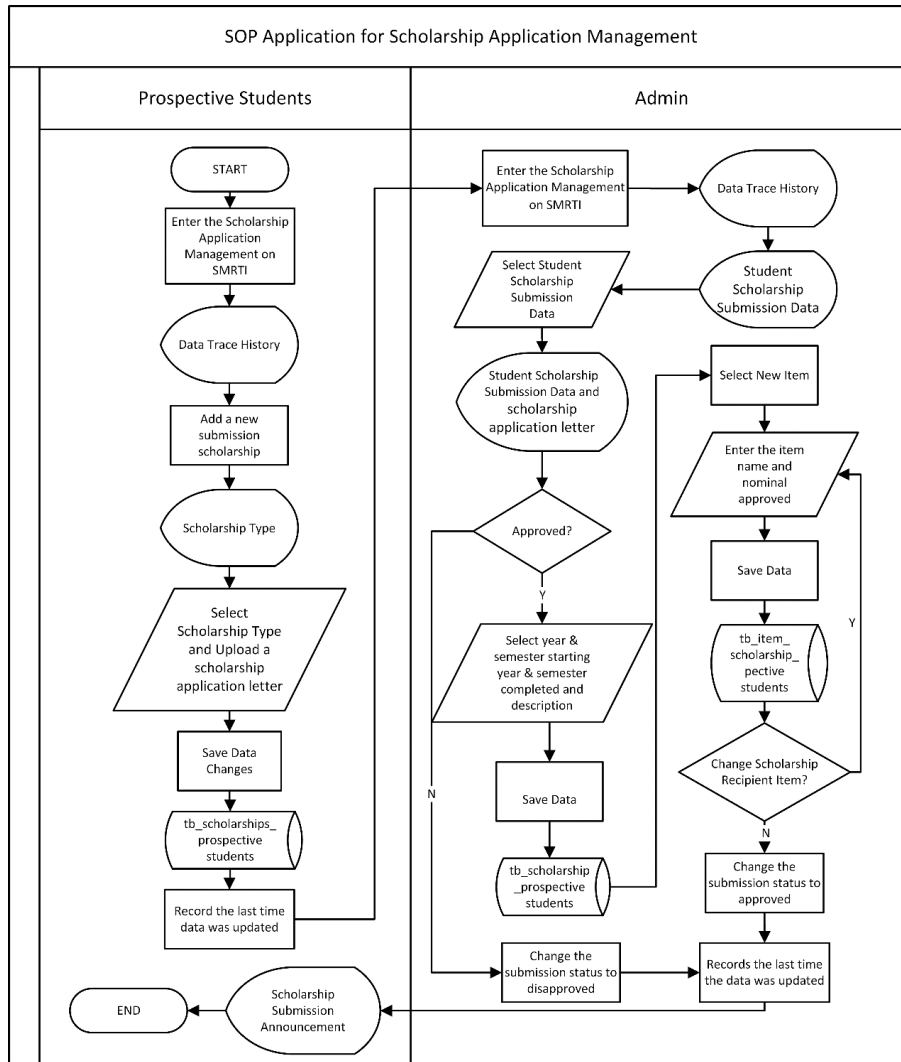


Figure 7. Recommendations for Business Process Scholarship Application Management

Figure 7 illustrates recommendations for the business process of Scholarship Application Management. Recommendations from the completeness factor are to add a Scholarship Application Management menu on the side of prospective students, while from the integrity factor, the history of data renewal traces is displayed when the user goes to the Lightning Menu. The last time the updated data was recorded after the admin added and changed the recipient of the new Waiver on the Scholarship Application Management business process.

4. Conclusion

Business Process Improvement (BPI) method used for business process analysis in the University's Integrated Registration Management System consists of the first phase (organizing for improvement), designing the SOP of the existing system. The second phase (understanding the process) is designing the system's condition. The third phase (streamlining) tests business processes using questionnaires with the McCall framework to determine critical business processes and improvement recommendations.

Critical business processes are Study Program Transfer with an average Quality Factor score of 80%; Critical quality factors are Correctness at 80% and Integrity at 51%. Scholarship Application Management has an average Quality Factor score of 78%; Critical quality factors are Correctness at 80% and Integrity at 53%. Recommendations for business process improvement in the form of SOP design in the form of flowchart flow using streamlining with bureaucracy elimination and

upgrading simplification tools, the activities added to the business process of Study Program Transfer Management, namely the system records the last time the data is updated and stores the trace history of users who access the Study Program Transfer Menu and add the Study Program Transfer Submission menu on the system accessed by Prospective Students. Activities added to the business process of The Scholarship Application Management Menu: The system records the last time the data is updated as well as stores the trace history of users who access the Scholarship Application Management and the system of adding the Scholarship Application Management menu on the system accessed by Prospective Students.

However, these results were obtained only from applying the Business Process Improvement (BPI) method up to the third phase, Streamlining. Therefore, there is an opportunity to continue the research to the subsequent phases, up to the fifth phase, Continuous Improvement, to achieve more complex results.

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