Development application of a quality assurance management information system for Paulus Indonesia Christian University

Lande Sudianto1*, Petrus Simon2

1Electrical Engineering Department, Universitas Kristen Indonesia Paulus, Indonesia
2Universitas Kristen Indonesia Paulus, Indonesia

*sudianto@ukipaulus.ac.id

Abstract. University of Christian Indonesia Paulus (UKI Paulus) currently already has the standard documents, policies and quality documents. Yet the implementation is not supported by an information system, so the socialization process for standards, policies and quality documents is ineffective and causes limited access for those who need it. Furthermore, the implementation of monitoring and evaluation quality audits is also inefficient and brings obstacles to the implementation of the quality assurance system. The Unified Modeling Language (UML) is used for the information and communication technology (ICT) based quality assurance management information system. The development of the UKI Paulus Quality Assurance Management Information System (SIM-MUTU UKI Paulus) uses a System Development Life Cycle (SDLC) paradigm approach which consists of 5 stages: (1) identification of system requirements; (2) analysis and modeling system; (3) the system creation; (4) the system testing and restoration; and (5) implementation. The SIM-MUTU UKI Paulus which was developed is a web-based information system that provides convenience in managing the quality assurance at the university level. Various features developed in this system include: accreditation features, internal academic quality audit features and library features. System testing is carried out using white box testing and black box testing methods. 5 aspects usability testing questioners were given to 30 respondents, they are: (a) learnability, (b) efficiency, (c) memorability, (d) errors, (e) satisfaction and the result were 86.5%, 78, 2%, 75.0%, 72.5%, and 75.2% for each aspect. Based on the ISO 9241-11 indicator, the average level of usability is 77.5%. The results of this test indicated that the system run optimally, has a high level of usability with a feasibility rate of 86%. Higher education quality assurance management information system based on information and communication technology able to facilitate auditing and provide information with complete documentation related to the quality management business process in Higher Education. The utilization of technology in the form of implementing an information system support the quality assurance management process to be more automated without eliminating the business processes that have been running so far. This Information system also increase the value of an organization's competitive advantage and facilitate the users in the decision-making processes.
1. Introduction

Qualified university is a university that produces graduates who are able to actively develop their potential and produce science and/or technology that is useful for society, the nation and the state. Higher education quality assurance is a systemic activity to improve the quality of higher education in a planned and sustainable manner. The aims of higher education are [1] [2]:

a. to develop the capability and shape the character and civilization of the nation with dignity in the framework of the intellectual life of the nation;

b. developing innovative, responsive, creative, skilled, competitive and cooperative academicians through the implementation of Tridharma; and

c. to develop science and technology by taking into account and applying humanities values.

To obtain a qualified higher education, the government organized a Higher Education Quality Assurance System (SPM Dikti). The quality of higher education is the level of conformity between the implementation of higher education and the Higher Education Standards which consist of the National Higher Education Standards (SN Dikti) and the Higher Education Standards (Dikti Standards) that have been set by each university. The higher education quality assurance system aims to ensure the fulfillment of Higher Education Standards in a systemic and sustainable manner, so that a quality culture grows and develops in every university in Indonesia. The higher education quality assurance system consists of:

- Internal Quality Assurance System (SPMI) developed by tertiary institutions and the External Quality Assurance System (SPME) which is carried out through accreditation.

Based on the Higher Education Law, study programs or tertiary institutions that fulfill SN Dikti are declared to meet a good accredited ranking, while study programs or tertiary institutions that are able to exceed SN Dikti will be declared highly accredited or superior, as determined by the Independent Accreditation Institute (LAM) and/or the National Higher Education Accreditation Board (BAN-PT).

The quality of study programs or tertiary institutions, apart from being measured by the fulfillment of each Dikti standard, must also be measured by the fulfillment of interactions between Dikti standards to achieve higher education goals. Clause 52 paragraph (2) Law No.12 of 2012 concerning Higher Education Quality Assurance is initiated and carried out by higher education institutions through a cycle of activities abbreviated as PPEPP (Determination, Implementation, Evaluation, Control, and Improvement) of higher education standards [1][2][3].

![Figure 1. PPEPP Cycle [1][2][3]](image)

a. Determination (P) of higher education standards is a standard setting activity consisting of SN Dikti and Dikti Standards set by tertiary institutions and guidelines for higher education quality assurance systems.

b. Implementation (P) of higher education standards is an activity to fulfill standards consisting of the SN Dikti and Dikti Standards set by tertiary institutions.
c. Evaluation (E) of the implementation of higher education standards, is an activity of comparing the output of standard compliance activities with standards consisting of SN Dikti and Dikti Standards set by tertiary institutions.

d. Control (P) on the implementation of higher education standards, namely the analysis of the causes of standards consisting of the SN Dikti and the Dikti Standards that have been set by tertiary institutions that are not achieved for corrective action.

e. Increasing (P) higher education standards, namely activities to improve standards so that they are higher than standards consisting of SN Dikti and Dikti Standards that have been set.

The Higher Education Quality Assurance System (SPM-PT) is very important in supporting the success and quality of the higher education institutions to become better. Since the Directorate General of Higher Education launched a strategic position on quality assurance in the 2003–2004 Higher Education Long Term Strategy (HELTS), with the coordination of the Academic Directorate quality assurance activities have developed in such a way in each university. To implement SPM-PT, it needs to be gradual according to the readiness of higher education. SPM-PT which consists of the Internal Quality Assurance System (SPMI) implemented by each university, the External Quality Assurance System or accreditation implemented by BAN-PT, and the Higher Education Database both at universities and at the Directorate General of Higher Education. Law number 12 of 2012 concerning Higher Education (Dikti Law) which continues the university autonomy policy by stipulating Clause 62 and article 64 of the Higher Education Law, which in essence regulates that Higher Education has the autonomy to manage its own institution as the center for implementing the Tridharma of Higher Education. Furthermore, the Higher Education Law stipulates that the autonomy of higher education management includes both the academic and non-academic fields. Thus, the policy and implementation of the SPMI, which is a system within higher education institutions, must be an autonomous system established by the tertiary institutions themselves [4][5][6].

The implementation of the quality assurance system at UKI Paulus has started by setting quality standards and policies, the next stage will be continued with the realization and evaluation of the quality assurance system. It's just that at this time the quality assurance system is still done manually, such as procedures and policies that are archived manually, socialized only through meetings so that there is limited access for those who need it. In addition, monitoring and evaluation of lectures are also done manually so that it takes a long time to get the results. Therefore, it requires information system support that can accommodate all the needs of the quality assurance system.

The Study Program Accreditation Instrument or abbreviated as IAPS is one of the tools used to measure the quality of the study program. At the tertiary level, this instrument was prepared by the National Accreditation Board for Higher Education (BAN-PT). This is in accordance with Permenristekdikti no. 32 of 2016 that the National Accreditation Board for Higher Education is also tasked with developing study program accreditation instruments. The National Accreditation Board for Higher Education has developed a study program accreditation instrument since 1996 called the Study Program Accreditation Instrument 1.0. In 2000 an update was made and the Study Program Accreditation Instrument 2.0 was launched. In 2008 the Study Program Accreditation Instrument launched the revised results of the accreditation instrument, namely the Study Program Accreditation Instrument 3.0. In 2018 the Study Program Accreditation Instrument developed a study program accreditation instrument launched in 2019, namely the Study Program Accreditation Instrument 4.0 (IAPS 4.0) [7].

The problems identified in this study: the process of collecting, compiling data and making quality audit reports takes a long time and archiving quality documents as supporting attachments to the quality audit and accreditation processes is still manual. The development of Information Technology (IT) has led to various applications and management models for IT. These various IT developments have made many companies experience a shift from manual systems to computerized systems so that data storage is efficient, information is up to date, and is fast in presenting information. An educational institution has a control factor, information and documentation is important and affects the quality of an educational institution.
The specific objective in this research is the development of appropriate technology in the form of a Higher Education Quality Assurance Management Information System (SIM-MUTU) based on information and communication technology to be able to facilitate auditing and provide information with complete documentation related to existing processes and as a socialization media related to the process, quality control in Higher Education.

2. Methodology
This paper uses a Research and Development (R&D) approach with a System Development Life Cycle (SDLC) paradigm model, which consists of 5 stages, namely: (1) identification of system requirements; (2) system analysis and modeling; (3) making the system; (4) testing and improving the system; and (5) implementation. [4][5].

![SDLC Paradigm Model](image)

**Figure 2. SDLC Paradigm Model [4][5]**

The identification stage of system requirements, namely determining the equipment needed in making the system both primary and secondary data, hardware and software. The hardware used in this study is a computer and the software used is Notepad++ to edit source code, MySQL for database system implementation, Apache HTTP Server as a language translator written in the PHP programming language. Details of the hardware and software used in this application can be seen in table 1.

| No | Hardware/Software | Uses | Information |
|----|-------------------|------|-------------|
| 1  | Computer          | The main device for application development | Intel(R) Cote(TM) i5- 8525U, RAM 8 GB |
| 2  | HTML, CSS, PHP, JavaScript | Application interface design | HTML5, CSS3 |
| 3  | PHP, JavaScript   | Application logic design | PHP 5.0.2 (include in XAMPP Lite version 1.4.8) |
| 4  | MySQL             | System database design | MySQL 4.0.21 (include in XAMPP Lite version 1.4.8) |
| 5  | Google Chrome     | Web browser | Version 87.0.4280.88 (Official Build) (64-bit) |
| 6  | Notepad++         | Text editor | Notepad++ 7 (64 bits) |
| 7  | Router            | Network configuration | Mikrotik Broadband |

The analysis and modeling phase of the system is carried out with a flow map to determine the functions or activities that will be applied in the system. Flow map systems are made in the form of context diagrams, data flow diagrams, entity relationship diagrams, relationships between files, file
structures, program structures, menu structures, input formats and output formats. System analysis and modeling is carried out based on UML (Unified Modeling Language) [8].

Figure 3. Use Case Diagram

In the system development stage, the process of making the software of SIM-MUTU UKI Paulus is complete by using the UML technique, namely the selection of program packages that are suitable analysis for building the system. Making the system starts from system design, database design and system interface design. The system interface design serves as a reference for creating a user interface in system implementation.

Figure 4. Database configuration
The testing and repair phase of the system was carried out by testing the SIM-MUTU UKI Paulus system based on the white box and blackbucks testing methods. White box testing is used to test the correctness of the algorithmic flow and data structure of the system being created. Black box testing is used to test the usability of the system through 5 aspects, namely (a) learnability, (b) efficiency, (c) memorability, (d) errors, (e) satisfaction through respondent questionnaires. Data analysis is not only carried out in the process of identifying system requirements either through interviews, observations or questionnaires to obtain user requirements. However, data analysis is also carried out to determine the results of software tests as well as the method of making the system. The data processed at this stage is to measure the level of usability of the software being built. The instrument matrix used to measure the level of usability refers to ISO 9241-11 as in previous research. While the feasibility level is measured by the formula [8][9]:

\[ tk = \frac{\text{research score}}{\text{expected value score}} \times 100\% \]

The system implementation stage is carried out on the server computer and internet network at UKI Paulus. The implementation of the system involves UKI Paulus Quality Assurance Agency (BPM) as a user partner in this research.

3. Result and Discussion
Based on the first stage, namely identification of system requirements, that in order to build an internal quality assurance information system consisting of various standards (SN Dikti and Dikti Standards from each PT), a system that is integrated with other units is required so that the SPM implementation mechanism through the PPEPP procedure can done. The system architecture used in the Internal Quality Assurance Information System (SIPMI) is shown in Figure 6. Where SIPMI is connected to a system that is integrated with the academy, staffing, lecture performance, research and community service information system. The development of SIPMI includes university standard documentation, standard achievement indicators, an internal audit process, and a survey of users of UKI Paulus services.

![Network configuration](image1)

Figure 5. Network configuration

![Network configuration](image2)

Figure 6. Network configuration
There are 5 user roles in SIM-MUTU namely administrator, BPM, leaders, auditors, and guest. BPM at higher education has full control over the implementation of all SIM-MUTU mechanisms supported by user auditors, leaders, and general respondents as BPM stakeholders. In the implementation of this application database, there are 10 tables used, namely: user table, datauser table, datapimpinan table, dataauditor table, datastaff table, dataunit table, standarami table, dataami table, rekapami table, and dokumen table.

The quality assurance information system is built with a website platform with MySQL database. The initial appearance of SIM-MUTU is the login of the user who will adjust the system features according to the role of each user. Users can carry out the business process of each feature as shown in Figure 9.

![Figure 7. Login page](image1.png)

![Figure 8. User homepage](image2.png)

![Figure 9. SIAMAI and SIM-AKREDITASI homepage](image3.png)
In this research, the application has several types of views according to the role of the user who uses the application. The grouping of application interface types is intended so that users can use the application according to the user's needs. Application views available to users of the Quality Assurance Agency allow users to view files uploaded by the study program, and assign assessors to assess the study program, application views available to assessor users allow users to comment on performance a study program, and checking the files that have been uploaded by the study program, and application displays available to study program users allow the study program to upload the required files in the application.

System testing is carried out using white box testing and black box testing methods. Testing with the black box testing method, namely at the input and output testing stage. Black box testing focuses on application functionality. The purpose of this test is to allow an assessment of the item being tested. Testing is carried out on a Use case diagram by looking at the input and output of the application user. The following is a test scenario table for the application of the SIM-MUTU UKI Paulus.

| No | Use case Name       | Testing result                                                                 |
|----|---------------------|-------------------------------------------------------------------------------|
| 1  | manage users        | • administrators can add, change, and delete user data.                        |
|    |                     | • administrators can change the permissions of each user                      |
| 2  | manage menu system  | • administrators can add, change, and delete system menus                     |
| 3  | manage quality      | • BPM can add, change and delete quality standards in the system              |
|    | standards           |                                                                               |
| 4  | manage academic     | • BPM can arrange the schedule for the implementation of monitoring and evaluation |
|    | quality audits      | • the auditor can access the unit's quality performance report data           |
|    |                     | • auditors can fill out the quality achievement report form                   |
|    |                     | • leaders can see the results of the quality achievement analysis             |
| 5  | manage accreditation| • auditors can fill out the IAPS 4.0 table form                               |
|    | data                | • BPM and leaders can see the unit entry data in the IAPS 4.0 table           |
|    |                     | • IAPS 4.0 data can be accessed according to the evaluation year             |
| 6  | manage libraries    | • administrators and BPM can add, modify and delete document repositories in the library menu |

White box testing was carried out by using 5 aspects of usability test, namely (a) learnability, (b) efficiency, (c) memorability, (d) errors, (e) satisfaction through questionnaires to 30 respondents, the result was 86.5% (learnability), 78.2% (efficiency), 75.0% (memorability), 72.5% (errors), and 75.2% (satisfaction). Based on the ISO 9241-11 indicator, an average assessment of the usability level is obtained by 77.5%, this shows that most respondents agree that the system built has a high level of usability where the score of the research results is 77.5 and the expected score is 90 so the product feasibility level is 86%. This shows that the information system that has been built can be implemented.

4. Conclusion
The design of the SIM-MUTU UKI Paulus has a usability rate of 77.5%, by 30 respondents which means that the software has a high usability. And obtained a product feasibility level of 86% of the software was declared fit for mass production through dissemination/socialization and product implementation. Higher education quality assurance management information system based on information and communication technology able to facilitate auditing and provide information with complete documentation related to the quality management business process in Higher Education. The utilization of technology in the form of implementing an information system support the quality assurance management process to be more automated without eliminating the business processes that have been running so far. This Information system also increase the value of an organization's competitive
advantage and facilitate the users in the decision-making processes. Even so, SIM-MUTU UKI Paulus still needs a lot of development because it is to meet the needs of the information system at the UKI Paulus Quality Assurance Agency.

References

[1] Kementerian Riset, Teknologi, dan Pendidikan Tinggi, Direktorat Jenderal Pembelajaran dan Kemahasiswaan, Direktorat Penjaminan Mutu. Pedoman Sistem Penjaminan Mutu Pendidikan Tinggi, 2016.
[2] Badan Penjaminan Mutu UKI Paulus. Instrumen Penilaian Evaluasi Mutu Internal, UKI Paulus. 2016.
[3] BAN-PT, Panduan Penyusunan Laporan Evaluasi Diri, 2018.
[4] Lande Sudianto & Petrus Simon, "Application of Monitoring Database for Accreditation Instrument UKI PAULUS," IOP Conf. Series: Materials Science and Engineering 846, 2020.
[5] Sudianto Lande, Simon Petrus, & Doddy Suanggana, "Basis Data Sistem Informasi Audit Mutu Akademik Internal Universitas Kristen Indonesia Paulus," Prosiding Seminar Nasional Teknologi Industri VI, pp. 65-71. 2018.
[6] Sudianto Lande & Chirs Batara, "Data Borang Akreditasi Program Studi Teknik Elektro UKI Paulus," Prosiding Seminar Nasional Sinergitas Multidisiplin Ilmu Pengetahuan dan Teknologi, vol. 2, pp. 392-400, 2019.
[7] Dr. Akla, M.Pd., Tubagus Ali Rachman Puja Kesuma M.Pd., & Sri Wahyuni, M.Pd., Desain Pengembangan Mutu Perguruan Tinggi Berbasis IAPS 4.0, Institut Agama Islam Negeri (IAIN) Metro, 2019.
[8] Josua Waraney Supit, Virginia Tulenan, & Steven Ray Sentinuwo, "Rancang Bangun Simulasi Akreditasi Program Studi Berbasis Web," Jurnal Teknik Informatika vol. 15 no. 3, pp. 163-170, 2020.
[9] I K R Arthana, I M A Pradnyana, & G R Dantes, "Usability testing on website wadaya based on ISO 9241-11," IOP Conf. Series: Journal of Physics: Conf. Series 1165, 2019.
[10] Dwi Rolliawati, Ahmad Yusuf, & Asep Saipul Hamdani, "Desain Prototipe Sistem Informasi Penjaminan Mutu Internal Berbasis Standar Nasional Pendidikan Tinggi," Prosiding Seminar Nasional Inovasi dan Aplikasi Teknologi di Industri, pp 167-173, 2018.