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Development of a Smart Repository Based on Rapid Application Development for Automation of Study Program Performance Report Preparation

I Made Ari Dwi Suta Atmaja[1*]✉, Putu Wijaya Sunu[2], Made Pradnyana Ambara[1], I Made Agus Oka Gunawan[1]

[1]Information Technology Department, Politeknik Negeri Bali, Badung, Indonesia
[2]Mechanical Engineering Department, Politeknik Negeri Bali, Badung, Indonesia
**Corresponding Author: arisuta@pnb.ac.id*

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ABSTRACT

The Study Program Performance Report (LKPS) is an important document in the accreditation and quality evaluation process that requires accurate, consistent, and easily traceable data. LKPS management in the D2 Computer Network Administration Study Program at the Bali State Polytechnic is still carried out using separate spreadsheets and cloud-based document storage, which can lead to data duplication, difficulty tracking documents, and low coordination efficiency. This study aims to develop a Smart Repository, an integrated system that automates the management of LKPS data and documents. The system development uses the Rapid Application Development (RAD) method, which includes the stages of Requirements Planning, User Design, Construction, and Cutover. The system is built using the CodeIgniter 4 framework, MySQL database, Model-View-Controller (MVC) architecture, and Role-Based Access Control (RBAC) mechanisms. Black Box Testing results show that all system functions meet user requirements. Smart Repository integrates data and documents into a centralized repository, increasing management efficiency, strengthening data integrity, and supporting the digital transformation of LKPS preparation in higher education.

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1. INTRODUCTION

Digital transformation has become an important strategy for improving governance, the effectiveness of academic services, and quality assurance systems in higher education [1] [2]. The use of information technology enables integrated data management, thereby improving information accuracy, accelerating administrative processes, and supporting data-driven decision-making [3]. One aspect that requires support from an integrated information system is the management of data and documents for preparing the Study Program Performance Report (LKPS). The Study Program Performance Report (LKPS) is a document that presents information on a study program's performance achievements based on indicators established by an accreditation agency [4]. This document covers various aspects, including governance, human resources, students, research, community service, collaboration, and the outputs of the Tri Dharma of Higher Education. The preparation of the LKPS requires accurate, up-to-date, consistent, and easily traceable data because each indicator must be supported by valid evidence. Therefore, systematic data and document management is an important factor in supporting the quality evaluation and accreditation processes of study programs [5] .

Despite the rapid development of information technology, the process of preparing the Study Program Performance Report (LKPS) at many universities is still carried out semi-manually using spreadsheets and cloud-based document storage [6]. This approach facilitates document sharing but does not provide comprehensive integration between performance data and supporting documents [7]. As a result, document retrieval can be time-consuming, data can be duplicated, and discrepancies can occur between numerical data and supporting evidence. These conditions make LKPS validation and compilation less effective, particularly when updates are required within a short period [3]. The same problems were identified in the D2 Computer Network Administration Study Program at the Department of Information Technology, Bali State Polytechnic. LKPS supporting data are managed in several spreadsheet files, while supporting documents are stored separately in a Google Drive-based repository. Because each work unit manages its data independently, consolidation, updating, and verification require additional time. Moreover, the existing workflow cannot automatically link performance data to supporting documents or monitor the completeness of each LKPS indicator [8], which reduces coordination efficiency and increases the potential for data management errors. Previous studies have developed information systems to support accreditation data and quality assurance document management. Centralized storage has been shown to reduce file redundancy in accreditation data repositories [9], while dedicated database applications can support organizational processes and the tracking of quality evaluation documents at the institutional level [10].

Previous studies also show that the CodeIgniter framework can support the development and maintenance of web-based information systems through the Model-View-

Controller (MVC) architecture [11] [12]. In this study, Rapid Application Development (RAD) was selected because LKPS management involves multiple users, interconnected data-document workflows, and functional requirements that may require progressive refinement during system development. Compared with a sequential Waterfall approach, RAD provides greater flexibility for refining requirements, interface flows, and validation rules throughout the development process rather than defining all system elements rigidly at the outset. Agile methods also support iterative development; however, RAD was considered more appropriate for this study because the development focused on rapidly producing a specific institutional information system through successive requirements identification, design, construction, and validation activities. Therefore, RAD's short development cycles and user-oriented development process were considered well suited to the LKPS context, where data-entry, document-linking, validation, and monitoring functions need to reflect existing operational practices [13]. Based on these conditions, an integrated information system is needed to manage study program performance data and supporting documents for the Study Program Performance Report (LKPS) within a single centralized repository. Such a system is expected to facilitate data storage, document retrieval, validation, and completeness monitoring, thereby supporting a more effective, efficient, and accurate LKPS preparation process.

This study aims to develop a Smart Repository, an integrated information system designed to automate the management of data and documents required for LKPS preparation. The system was developed using the Rapid Application Development (RAD) method, the CodeIgniter 4 framework, a MySQL database, and a Role-Based Access Control (RBAC) mechanism to manage user access rights. The Smart Repository is designed to integrate performance data, supporting documents, data validation, and monitoring dashboards into a single centralized repository. Through this integration, the system is expected to improve the efficiency of LKPS preparation, strengthen data integrity, facilitate inter-unit coordination, and support the digital transformation of quality assurance processes in higher education.

2. RESEARCH METHOD

The Rapid Application Development (RAD) method was employed to develop a Smart Repository application that automates the preparation of the Study Program Performance Report (LKPS) [14]. RAD was selected because its iterative and user-involved process enables system requirements and features to be progressively refined based on user needs. Data were collected through observation, interviews, and analysis of documentation related to the LKPS preparation process in the D2 Computer Network Administration Study Program at the Department of Information Technology, Bali State Polytechnic. The application was implemented using the CodeIgniter 4 framework, PHP programming

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language, MySQL database, and a Role-Based Access Control (RBAC) mechanism to manage user access rights [15].

To ensure consistency with the RAD framework, the development activities were organized into four stages: Requirements Planning, User Design, Construction, and Cutover. Requirements Planning was conducted through the identification of system and user requirements; User Design translated these requirements into system architecture, database structures, use cases, and interface designs; Construction involved the implementation and refinement of the system modules; and Cutover included functional testing and evaluation of system readiness before implementation. User involvement was initiated during Requirements Planning through observation and interviews to identify existing workflows, problems, data requirements, and access needs. The resulting user requirements were then used as the primary reference during the User Design and Construction stages and as the basis for validating system functions during Cutover. Figure 1 illustrates the operationalization of these four RAD stages.

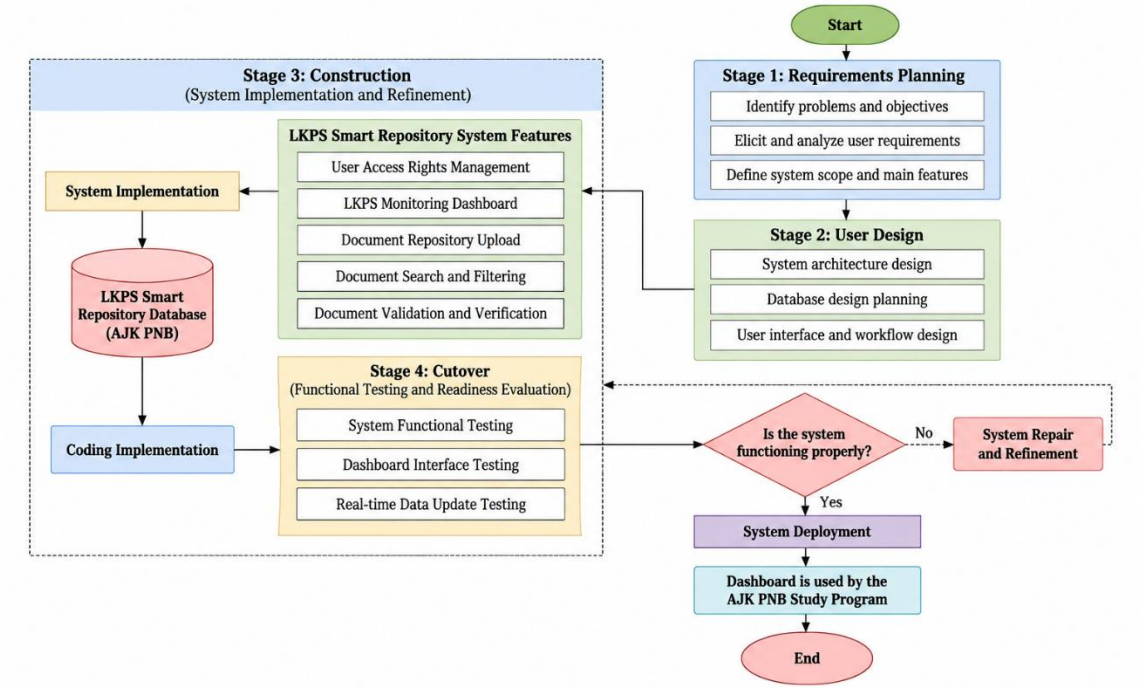


Figure 1. Operationalization of RAD Stages in the LKPS Smart Repository Development

2.1 Requirements Planning

The Requirements Planning stage focused on identifying the needs of the Smart Repository through observation, interviews, and analysis of LKPS-related documents. User involvement at this stage was carried out through the identification of existing LKPS management workflows, problems encountered during data and document management,

required data, access rights, and primary system functions. The results of this stage were formulated into a system requirements specification covering user requirements, data requirements, access rights, and the main functions to be implemented in the Smart Repository. These requirements served as the basis for the subsequent User Design stage.

2.2 User Design

The User Design stage translated the requirements identified during Requirements Planning into the system design. This stage included the development of the system architecture, database design using an Entity-Relationship Diagram (ERD), Use Case Diagram, and user interface design. The design process was guided by the user requirements, workflow characteristics, data structures, and access needs identified in the previous stage. The resulting design served as a reference for system development during the Construction stage.

2.3 Construction

During the Construction stage, the Smart Repository application was developed based on the requirements and system design produced in the previous RAD stages. Development was carried out using the CodeIgniter 4 framework and included the implementation of authentication, LKPS data management, document repository, data validation, monitoring dashboard, and user access rights management modules. All modules were integrated with a MySQL database to provide centralized storage of data and supporting documents. The implemented functions were continuously checked against the previously identified user and system requirements to maintain consistency between the designed functions and the needs of LKPS management.

2.4 Cutover

The Cutover stage was conducted to evaluate the functional readiness of the Smart Repository before its implementation in the D2 Computer Network Administration Study Program. Black Box Testing was used to verify whether the implemented functions operated according to the user requirements identified during Requirements Planning [16]. The testing covered user authentication, LKPS data management, document upload and retrieval, data validation, dashboard functions, and access rights management. The testing results were evaluated against the expected system functions, and any identified inconsistencies were used as the basis for final refinement before implementation. Thus, the Cutover stage served as the final validation step to ensure that the developed system was functionally aligned with the requirements established at the beginning of the RAD process.

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3. RESULTS AND DISCUSSION

3.1. Smart Repository Development Results

The main result of this research is a web-based Smart Repository application designed to automate the preparation of Study Program Performance Reports (LKPS). The application was developed using the CodeIgniter 4 framework with a Model-View-Controller (MVC) architecture and a MySQL database. The system implements a Role-Based Access Control (RBAC) mechanism, granting users access rights based on their role, such as admin, study program coordinator, lecturer, and assessor. The study program LKPS smart repository page is shown in Figure 2.

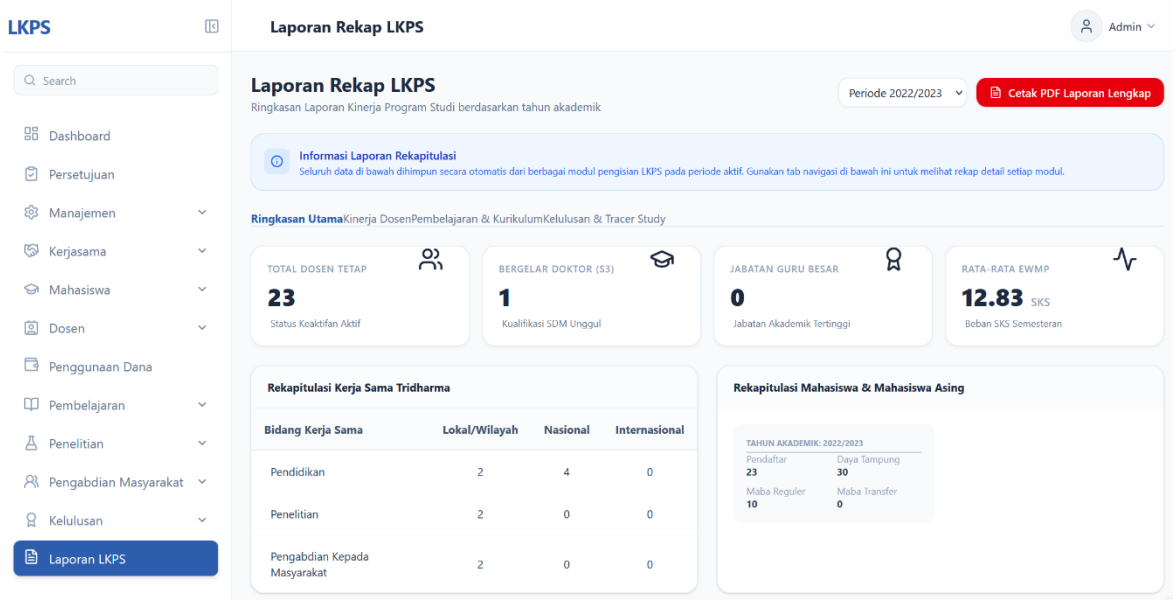


Figure 2. LKPS Smart Repository Page

The Smart Repository serves as an integrated data and document repository within a single database, enabling centralized management of all supporting information for preparing the Study Program Performance Report (LKPS). The system not only provides document storage but also supports data validation, document retrieval, monitoring of indicator completeness, and real-time information presentation through a dashboard.

3.2. Smart Repository Feature Implementation Results

The Smart Repository implementation focuses on managing lecturer, learning, research, community service, and student data as key components for preparing the Study Program Performance Report (LKPS). Each feature is designed to support integrated data

management, thereby facilitating data storage, updating, retrieval, and information presentation in accordance with the requirements of the LKPS indicators. The lecturer data feature is used to manage lecturer information, including identity, academic position, education, certifications, areas of expertise, and supporting documents. Figure 3 below displays the lecturer data management feature. This data is a source of information for various indicators related to human resources in the LKPS.

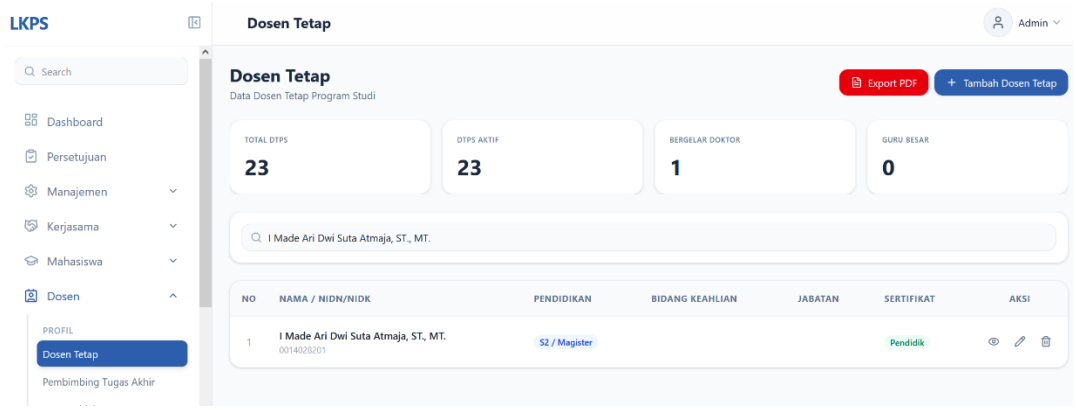


Figure 3. Lecturer Features Page

The learning data feature manages learning activity information, including courses taught, lecturers' teaching load distributions, and supporting documents for academic activities. The feature is displayed as shown in Figure 4 below.

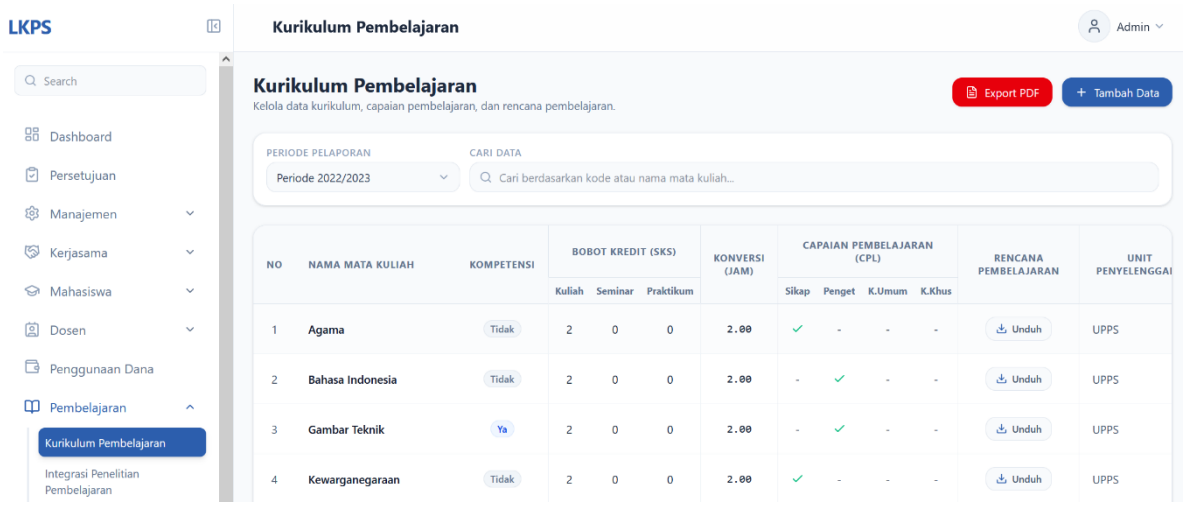


Figure 4. Learning Features Page

Centralized learning data management facilitates the summarization and reporting of learning activities. The student data feature is used to manage student information, including academic data, student status, achievements, and other supporting data required

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to develop LKPS indicators. Integrated student data management facilitates the presentation of accurate information in accordance with study program evaluation requirements. The student data repository management feature is displayed in Figure 5 below.

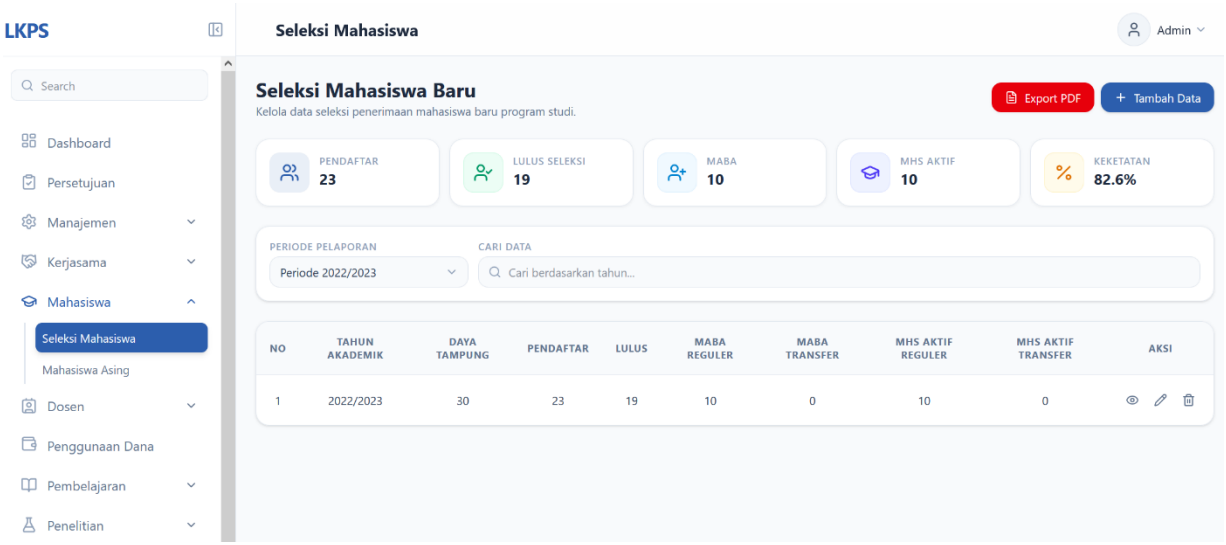


Figure 5. Student Features Page

The integration of these features results in a centralized data repository that supports more effective data management, reduces the risk of duplication, accelerates information retrieval, and supports a more accurate, efficient, and well-documented LKPS preparation process..

3.3. System Test Results

As part of the Cutover stage, system testing was conducted using the Black Box Testing method to verify whether the implemented functions operated according to the requirements identified during Requirements Planning. Testing focused on each main feature of the Smart Repository without considering the internal program code structure. Based on the test results, all 26 test cases were successfully executed, resulting in a 100% functional test success rate. Each tested input produced the expected output according to the system specifications, and no functional errors were identified during testing. These results indicate that the implemented functions conformed to the specified functional requirements and that the system was functionally ready for implementation.

Table 1. System Functional Test Results

No.	Module	Number of Test Cases	Passed	Failed	Success Rate
1	Authentication & Access Control (Role-Based Access Control)	4	4	0	100%

No.	Module	Number of Test Cases	Passed	Failed	Success Rate
2	LKPS Indicator Performance Data Management	6	6	0	100%
3	Physical Evidence Document Management & Upload	5	5	0	100%
4	Supporting Document Search & Retrieval	4	4	0	100%
5	Validation and Verification Module for the Validation Team	4	4	0	100%
6	LKPS Report Digitalization	3	3	0	100%
	Overall Total	**26**	**26**	**0**	
	Success Rate		**100%**		

Overall, the Black Box Testing results demonstrate that all tested functions of the Smart Repository operated according to the specified requirements. The successful execution of all 26 test cases indicates functional conformity across authentication and access control, LKPS data management, document management and retrieval, validation, and LKPS report digitalization. These results support the functional readiness of the system for implementation in the study program.

4. CONCLUSION

This study developed a Smart Repository using the Rapid Application Development (RAD) method to support the preparation of the Study Program Performance Report (LKPS). The developed system directly addresses the main problems identified in the existing LKPS management process. The use of a centralized repository reduces the fragmentation of data and documents previously stored across separate spreadsheets and cloud-based storage, while integrated data and document management helps minimize duplication and facilitates information retrieval. The validation and document management functions support the verification of performance data against their supporting evidence, whereas the monitoring functions facilitate the identification of incomplete LKPS data and documents. Role-Based Access Control (RBAC) further supports controlled data management among users with different responsibilities. Black Box Testing showed that all 26 functional test cases were successfully executed, resulting in a 100% functional test success rate. These results demonstrate that the implemented functions conformed to the specified system requirements and support the functional readiness of the Smart Repository for implementation in the study program. However, the present evaluation focused on functional testing; therefore, further studies should evaluate the system's usability, user acceptance, and its impact on the efficiency and accuracy of LKPS preparation after implementation. Future development may also include integration with other institutional information systems and analytical features to support decision-making and continuous quality assurance improvement. improvement.

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