Adaptive Web-Based Information System for MBKM Program Using Scrum

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ABSTRACT
The implementation of the "Merdeka Belajar Kampus Merdeka" (MBKM) program requires an integrated and adaptive information system to manage academic activities efficiently. This study aims to develop a web-based MBKM Management Information System at Universitas Prima Indonesia using the Scrum framework. The system supports structured registration, reporting, assessment, and verification processes involving students, academic advisors, department heads, and MBKM administrators. Technologies used include React.js and Next.js for the frontend, Express.js for the backend, and MySQL for the database. A key contribution of this research is the application of the agile Scrum methodology to accommodate the dynamic nature of MBKM policies, ensuring iterative development and user-centered design. Internal testing using Black Box methods indicates high functionality and usability. The resulting system enhances efficiency, data integration, and stakeholder collaboration. This study demonstrates how agile practices can be effectively applied to develop scalable academic systems that support national education reforms.

Keywords : Information System, MBKM, Scrum, Web Application, Academic Management

INTRODUCTION

The Merdeka Belajar Kampus Merdeka (MBKM) policy is a transformative initiative by Indonesia's Ministry of Education, Culture, Research, and Technology. It encourages students to expand their academic experiences by engaging in activities beyond their core study programs. These activities, including internships, independent studies, and particularly student exchange programs, are designed to enhance not only academic skills but also personal and professional development. The aim is to prepare graduates who are more adaptive, collaborative, and capable of addressing real-world challenges. For effective MBKM implementation, higher education institutions need a robust and responsive digital infrastructure. Specifically, student exchange systems should support the seamless management of participant data, institutional partnerships, curriculum adjustments, and performance tracking. These systems must empower administrators to manage MBKM activities efficiently, while also providing students with easy access to program information and self-service tools.

Several studies have attempted to address these needs by developing information systems tailored to MBKM. For example, Harijanto et al. (2022) created a system using agile methods. They evaluated it through Black Box Testing and User Acceptance Testing (UAT),

achieving high scores of 91% for functionality and 90.7% for user satisfaction. While the system was user-friendly, it primarily focused on the interface and overlooked critical challenges, such as data synchronization, multi-departmental access control, and automated decision support.

In another study, (Fachri et al., 2024) utilized the Waterfall model to develop a system that aimed to meet MBKM's administrative requirements and improve Key Performance Indicators (KPIs). However, this system lacked the adaptability required for long-term success, particularly in response to frequent policy updates and evolving institutional needs.

Similarly, (Wijaya et al., 2024) applied the Rapid Application Development (RAD) method to design a system that facilitated communication between lecturers and students. While it improved operational efficiency, the system did not address scalability or provide a comprehensive platform for managing external collaborations or aligning curricula. Additionally, (Gudiato et al., 2023) applied the Spiral Model to develop an alumni data system for Institut Shanti Bhuana, which contributed to the Career and Alumni Center's service quality. However, it focused more on post-graduation engagement rather than real-time academic program monitoring, such as that required for MBKM.

Several broader institutional studies have identified persistent challenges in MBKM implementation. (Sintiawati et al., 2022) pointed out issues such as limited funding, insufficient human resources, underdeveloped academic systems, and poor information flow. These constraints impede the successful adoption of MBKM, even when institutions support the policy. Similarly, (Kholik et al., 2022) identified four significant barriers: curriculum alignment, funding availability, external partner engagement, and academic system readiness. Without practical digital tools, these challenges remain and hinder MBKM's success.

Moreover, (Puspita et al., 2021) developed a PPDB (student admissions) system using the Spiral methodology to address disorganized data management at Raudhatul Athfal Sirojul Falah. While it improved administrative processes, issues like inconsistent data entry and scattered information remain prevalent—similar problems that institutions face when managing MBKM activities across multiple programs and stakeholders.

Despite these ongoing efforts, a clear research gap remains in the design of MBKM information systems. Existing systems tend to be limited in scope, focusing either on user interface design, static data management, or post-activity documentation, but failing to provide the integrated, modular, and scalable design required for a fully operational MBKM ecosystem. Furthermore, these systems rarely address dynamic curriculum mapping, real-time partner collaboration, or long-term reporting functions, which are crucial for accreditation and policy decision-making.

To address this gap, this study proposes the development of an MBKM information system using the Scrum framework. This well-known Agile methodology supports incremental, collaborative development and continuous delivery. Unlike the Waterfall or RAD models, Scrum emphasizes regular iteration through sprints, enabling developers to quickly respond to feedback from users, including administrators, faculty, and students. Each sprint involves planning, development, review, and retrospective processes, ensuring that the system evolves based on real user needs and institutional priorities.

The proposed system will feature a modular architecture, allowing for the integration of tools such as curriculum mapping, automated reporting, activity logs, and communication interfaces with partner institutions. By leveraging Scrum, the development process can remain flexible and collaborative, accommodating new MBKM regulations, performance indicators, or institutional reforms without requiring a complete overhaul of the platform.
Ultimately, this research aims to contribute both practically and academically by producing a system that not only facilitates MBKM management but also exemplifies how agile methodologies, particularly Scrum, can be effectively applied to large-scale educational reforms. This system will provide students with easier access to information about available programs, while administrators will gain enhanced tools for oversight and policy support. In turn, this will enable a more holistic and sustainable implementation of MBKM policies across Indonesia's higher education institutions.

LITERATURE REVIEW

The development of an information system cannot be separated from a strong theoretical foundation, which provides an understanding of the fundamental concepts of information systems, database planning, and the development approaches used.

Basic Concepts of Information Systems

According to (Mulyati, 2017), an information system combines various components that process data into meaningful information. However, in practice, many organizations still fail to distinguish between formal information (originating from information systems) and informal information (arising from social communication), which leads to less accurate decision-making. This raises the question: to what extent can the developed information system provide structured and accountable information?

Database Planning as the Foundation of the System

Database planning is an integral part of developing an efficient information system. Literature suggests that database planning should not be done separately from the organization's vision and strategy (Larkin-Perkins, 2017). Unfortunately, previous studies have often focused solely on technical aspects without considering how the database can holistically support business processes. This study addresses that gap by building a database plan aligned with the system's objectives.

System Development Models: Waterfall vs. SCRUM

System development methodology also plays a critical role in the success of system implementation. As many researchers explain, Scrum is an agile approach that emphasizes flexibility and collaboration through continuous iterations. Conversely, Waterfall offers a logical sequential process—requirements analysis, design, implementation, testing, and maintenance—facilitating documentation and project oversight. The main drawback of this method, namely its lack of flexibility in accommodating changing requirements, can be mitigated through thorough initial planning and early involvement of stakeholders (Dzaky & Kurniawan, 2023).

Synthesis and Research Gap

The literature review suggests that information systems designed using structured approaches, such as the waterfall model, remain relevant, particularly in system development with a limited scope and clear operational objectives. However, shortcomings remain in integrating database design and business process requirements, and the limited mapping of external environments as system risk factors. This study addresses these gaps by offering a system development approach that considers internal structure, is adaptive to external conditions, and is built upon a database foundation that supports long-term operational needs.

METHODS

The research method in this study is designed to produce an integrated information system that monitors all academic activities, including daily logs, assessments, and reports, based on the Scrum software development framework. The following sections present the methodological stages, data collection techniques, and testing procedures.

Research Design

Aspect	Description
Type of Research	R&D (Research and Development)
Approach	Quantitative (measuring accuracy & usability), Qualitative (user observation & interviews)
Development Model	Waterfall: Requirement Analysis → System Design → Implementation → Testing → Deployment & Maintenance

As shown in **Table 1**, this research design outlines the framework used in developing the academic activity monitoring information system. The table covers key aspects, including the type and approach of the research, system development model, and validation methods employed.

Development Procedure

The development of this information system employs the Scrum model, a method within the Agile framework that facilitates iterative and incremental software development. Scrum consists of several main stages that are repeated in cycles known as Sprints. These stages include:

1. Product Backlog: A comprehensive list of all system requirements or features. In this case, it includes: activity registration, logbook reporting, advisor validation, and dashboard reports.
2. Sprint Planning: A planning session involving the development team and the Product Owner to define the sprint goal and select items from the backlog to be completed during the sprint.
3. Sprint Backlog: A subset of the Product Backlog selected for development in a single sprint, which is then broken down into smaller tasks assigned to team members.

4. Daily Scrum: A short daily meeting (maximum 15 minutes) where team members discuss progress, upcoming tasks, and any obstacles faced.
5. Sprint Execution: The actual development work carried out by the team based on the tasks listed in the Sprint Backlog.
6. Sprint Review: Conducted at the end of each sprint to demonstrate the developed features to stakeholders and gather feedback.
7. Sprint Retrospective: An internal team reflection session to evaluate the previous sprint's process and formulate improvements for the next sprint.

The research begins with a requirements analysis phase, where data is gathered through literature studies, interviews, and observations of existing business processes. This is followed by the system design phase, which utilizes the Waterfall method, encompassing planning, system design, implementation, and testing. The system is developed using JavaScript as the programming language, React.js and Next.js for the frontend, and Express.js with MySQL for the backend and database components. Once development is complete, a testing phase ensures the application runs properly, focusing on functionality and stability without involving end users. The final stage involves evaluating and documenting the outcomes of system development.

System Design

In the system design phase, the MBKM information system is designed to identify the features and functions required by each user based on their needs. The following diagrams illustrate the flow and structure of the system:

Use Case Diagram

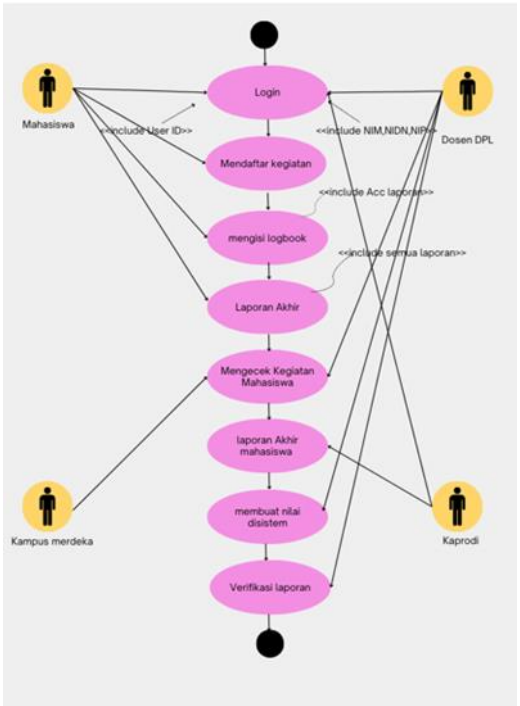


Figure 1. Use Case Diagram

Figure 1 represents the *use case diagram* illustrating the development flow of the MBKM management information system for student activities, particularly in managing logbooks, final reports, assessments, and report verification. The system includes four main user types**,** each using specific credentials such as Student ID (NIM), Lecturer ID (NIDN), or Staff ID (NIP**)** to log in. Upon successful login, users are directed to a homepage tailored to their roles and responsibilities. Activity Diagram: The *activity diagram* of the MBKM management information system depicts the entire workflow and processes that occur among various users in an integrated manner. The system involves four primary roles: Students, Academic Advisors (DPL), Head of Study Program, and the Kampus Merdeka platform, each of which has specific but interconnected activities in managing MBKM data.

The process begins with the student logging into the system. Upon successful login, the student selects an available MBKM activity and registers for the selected program. After participating in the activity, the student must create and submit weekly reports as a form of accountability. The system then receives and stores these reports accordingly.

Overall, this activity diagram illustrates the integrated sequence of activities among students, academic advisors, program heads, and the Kampus Merdeka administration in managing and validating MBKM activities, thereby supporting an effective and structured management process**.**

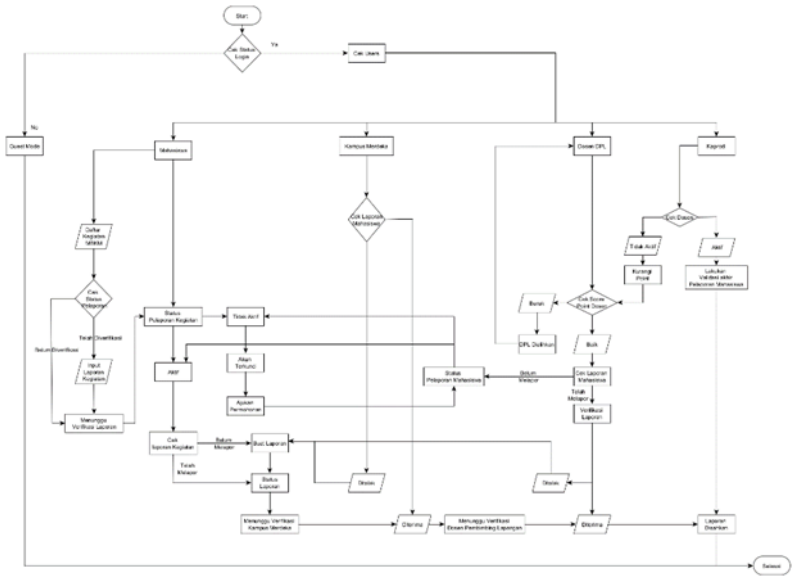


Figure 2. Flowchart of the MBKM System

The flowchart in Figure 2 illustrates the logical sequence of the main processes within the MBKM management information system, which is designed to support the systematic and digital administration of the Kampus Merdeka activities. This flowchart covers several key stages, from login to data storage and assessment**.**

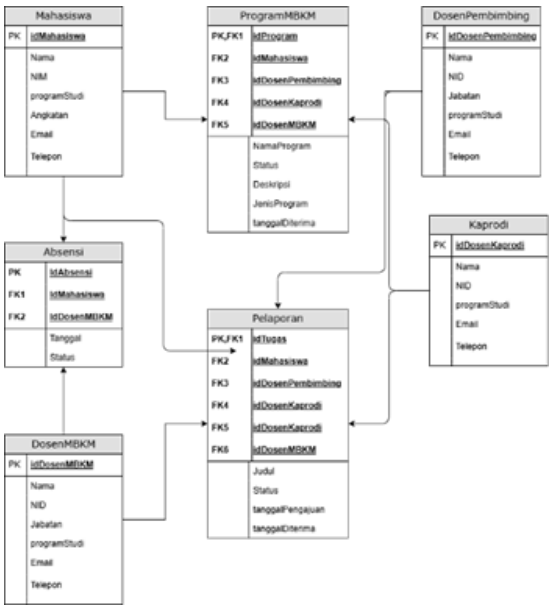


Figure 3. Entity Relationship Diagram MBKM

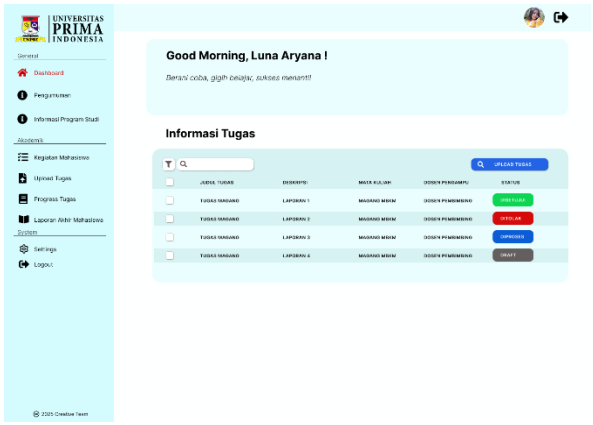
The entities in this system are designed to manage academic information related to students' final projects. In Figure 3, it is illustrated that the student, as the primary user, stores personal and academic data such as ID, name, student number (NIM), study program, and cohort year. Each student has only one final project recorded in the Final Project entity, which includes information such as the title, status, submission date, and completion date. Furthermore, students can create multiple reports related to their final project, which are stored in the Reporting entity with varying report statuses. Student attendance in mentoring sessions is also recorded in the Attendance entity, linking students with their supervising lecturers.

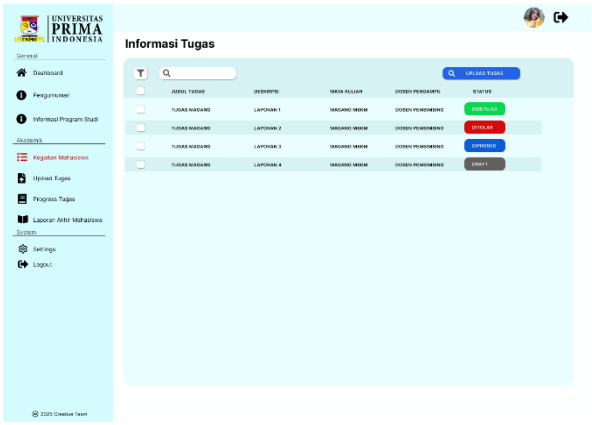
RESULTS

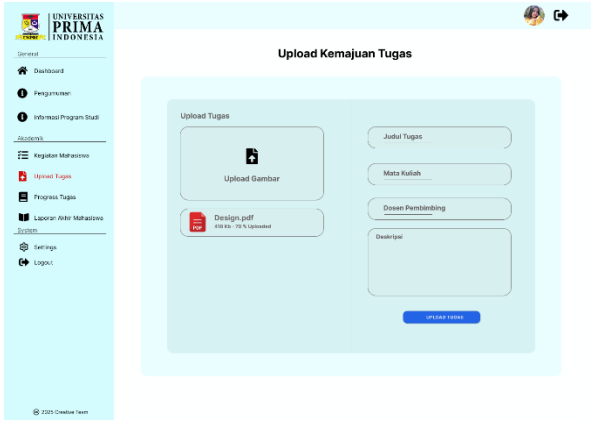
System Development Results

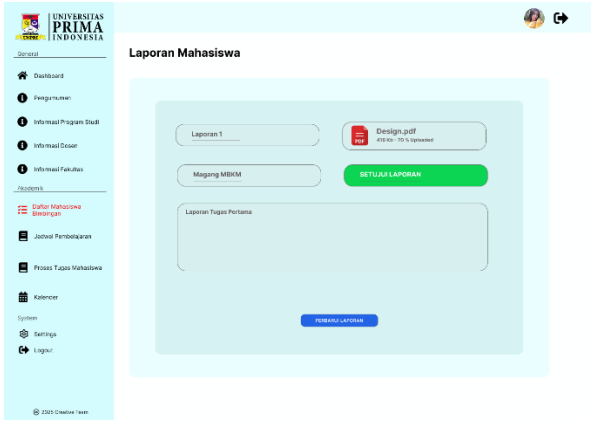
The MBKM Management Information System aims to facilitate the management of Kampus Merdeka activities, especially in the processes of registration, activity reporting, assessment, and verification by various involved parties (Students, Supervising Lecturers, Head of Study Program, and Kampus Merdeka Admin). This application uses React.js and Next.js for the frontend, Express.js for the backend, and MySQL as the database. The development model used is Scrum, which consists of several sprints to design the interface, system logic, data processing, and function testing.

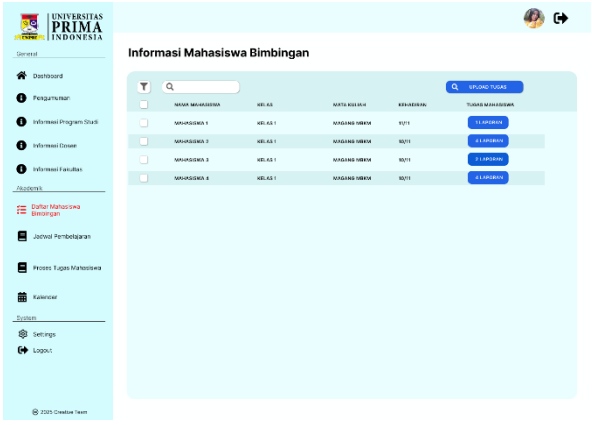
The following are the implementation results of this system:











System Testing

Testing was conducted internally to ensure all system functionalities operate according to the designed workflow. The testing method used was Black Box Testing, with the primary focus on:

The test results showed that all main system features functioned properly and met expectations

DISCUSSION

The development of this MBKM information system represents a substantial advancement in managing the complex data, reporting, and coordination required by the Kampus Merdeka program. By digitizing previously manual processes such as registration, report submission,

and verification, the system significantly enhances efficiency, transparency, and accountability. Compared to previous studies, this system distinguishes itself in its emphasis on real-time tracking, automated workflows, and flexibility across various user roles. It not only facilitates administrative tasks more efficiently—similar to the findings of (Harijanto et al., 2022)—but also incorporates asynchronous workflows, integration capabilities, and a modular frontend-backend architecture built with React, Next.js, Express.js, and MySQL. This ensures responsive performance across devices and simplifies future maintenance and system upgrades.

When benchmarked against existing studies, the current system fills several critical gaps. (Harijanto et al., 2022) primarily focused on general functionality, without addressing dynamic data sharing. (Fachri et al., 2024) employed a rigid Waterfall methodology, limiting adaptability to policy changes. (Wijaya et al., 2024) developed a system to support lecturer-student communication but lacked features for concurrent, multi-user task handling. (Puspita et al., 2021) designed a system for student admissions, which has a narrower scope. In contrast, the MBKM information system described here is designed for broader, multi-stakeholder coordination, operational scalability, and future program expansion. Its modularity and integration readiness also set it apart from previous approaches that often relied on inflexible planning or lacked role-based user support.

Despite its strengths, the system still has areas for enhancement and faces challenges in real-world implementation. Features such as automated notifications via email or WhatsApp, document uploads from partner institutions, and the automatic generation of final reports for university stakeholders could significantly enhance functionality and user satisfaction. However, challenges include varying institutional readiness, inconsistent data input across departments, and user resistance due to unfamiliarity with digital systems. Ensuring alignment with evolving MBKM policies also requires ongoing updates, making agile development practices—such as Scrum—critical for sustaining system relevance and effectiveness over time.

CONCLUSION

Based on the development and implementation results, the web-based MBKM Management Information System at Universitas Prima Indonesia was successfully developed using the Scrum methodology and modern technologies, including React.js, Next.js, Express.js, and MySQL. The system is capable of performing core functions, including MBKM activity registration, weekly logbook submissions, final report uploads, assessments by academic supervisors, and verification and validation by the department and MBKM administrators.

Testing results indicate that all system features function as designed, supporting a more efficient, structured, and transparent management process for MBKM. Consequently, the system not only enhances administrative efficiency but also supports data-driven decision-making in the implementation of MBKM policies within higher education institutions. For future development, it is recommended that the system be enhanced with the following features: automated notifications (via email or WhatsApp) to ensure users do not miss important information, and Data visualization in the form of charts or statistics to monitor participation and performance in the MBKM program.

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