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Development of an Executive Dashboard as a Decision Support Tool on the myUnila Application

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Abstract *- Advances in information technology and the concept of big data require higher education institutions to prioritize data-driven decision-making. Universitas Lampung has developed the myUnila Super Apps under a "One Data" initiative to integrate academic and administrative services into a single unified platform. However, the ability of university executives to access strategic data quickly and comprehensively still requires further improvement, as important data remain scattered and not yet integrated into a single interface. This study aims to develop a web-based executive dashboard module within the myUnila application using Next.JS as the frontend framework and Laravel as the backend. System development was carried out using the Scrum methodology completed in 8 sprints with 14 features from the product backlog. The dashboard presents data including faculty-level and study program-level lecturer-to-student ratios, accreditation data, and lecturers' key performance indicators (KPIs). A drill-down feature was implemented to enable hierarchical data exploration from university level down to individual study programs. System testing was performed using User Acceptance Testing (UAT) and yielded an acceptance rate of 88.4%, categorized as Excellent. These findings indicate that the developed executive dashboard system successfully met functional requirements and was well received by users, suggesting its potential to support strategic decision-making within Universitas Lampung.*

Keywords*: Executive Dashboard; Decision Support Tool; Drill Down; Scrum; User Acceptance Testing*

1. INTRODUCTION

The rapid development of information technology and the increasing availability of big data have compelled higher education institutions to shift toward data-driven decision-making [1][2] . Academic and operational data within universities are frequently extensive, intricate, and fragmented across numerous standalone information systems, thereby impeding institutional decision-making and diminishing the efficacy of performance monitoring [3]. This challenge is widespread; many higher education institutions depend on specialized systems that provide only a limited perspective of the organization, depriving leaders of centralized access to the comprehensive data essential for informed decision-making [4][5]. Universitas Lampung tackled this problem through its "One Data" initiative, which unified academic and administrative services into a singular super-app platform called myUnila. This platform functions as the central academic-community portal for student and lecturer data, as well as campus administrative services [6].

Despite this integration, university executives still lack a means to access strategic data quickly and comprehensively for decision-making purposes. Before this dashboard, executives' strategic data were spread across several separate web-based information systems, each managing a different aspect of academic or administrative data. Consequently, obtaining a complete picture for decision-making necessitated manually accessing and retrieving data from each system individually for compilation and comparison. This fragmented process hindered executives' ability to quickly access information, especially when decisions required combining data from multiple systems simultaneously. Driven by the inadequacy of current reporting methods, institutional dashboard systems have been widely adopted as a generalized solution for transforming raw data into actionable insights [7], [8]. Existing studies proves that the use of dashboard systems can greatly improve

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decision-making processes in many areas, including education, businesses, and public sector [9][10][11] [12][13][14]. Traditional approaches in creating dashboards differentiate between high-level executive dashboards providing summarized key performance indicator (KPIs) [15]. However prior dashboard research in the higher-education context has generally emphasized visualization of a single domain of data without demonstrating how such dashboards can be integrated, at an architectural level, with super-app system to support hierarchical [16][17][18]. Although myUnila already integrates various academic and administrative services, it did not yet provide a dedicated module for presenting strategic, cross-domain data in a summarized and drilldown format for executive use. Existing studies on dashboard development in higher education tend to focus on stand-alone analytical tools [19][20][21]. Consequently, few studies have examined how an executive dashboard can be designed as an integrated module of an existing academic super app [22][23]. As a result, universities continue to rely on disconnected systems, which emphasizes the need for an integrated architecture within a single platform.

This study addresses this limitation by developing an executive dashboard as an integral module within existing myUnila super app. The aforementioned institutional challenge, specifically the difficulty university executives encounter in promptly accessing strategic data due to data fragmentation across disparate systems, directly informs the identified research gap: the absence of studies illustrating the architectural integration of a dashboard into an existing super-app system as opposed to its development as a standalone application. The novelty of this study lies in examining how strategic institutional indicators lecturer-to-student ratios, accreditation records, and lecturer KPIs can be presented through a drill-down, hierarchical exploration mechanism that is connected to myUnila's existing data services through a microservice architecture. Taking into account the proposed, the aim of this study is to: (1) explore the development of an interactive dashboard module that would allow visualization of strategic academic data in the context of the myUnila application; (2) examine the dashboard's integration with existing myUnila data services to support strategic university decision-making using a drill-down feature; and (3) evaluate the integration process through a microservice architecture based on Next.js and Laravel in the context of Scrum and Kanban approaches.

2. RESEARCH METHODOLOGY

The study adopted Scrum agile methodology for software development (illustrated in Figure 1). Requirements elicitation was conducted through a semi-structured interview with the Head of the Integrated Management and Information System Division of UPA TIK. This individual had previously consulted with the Vice Rector concerning the strategic data needs of university leadership. The insights gathered from this interview were subsequently translated into a set of functional requirements and organized into the product backlog. Scrum was selected for this process since it allows for iterative and incremental development where the executive dashboard module can be developed and improved through a series of short development periods called sprints.

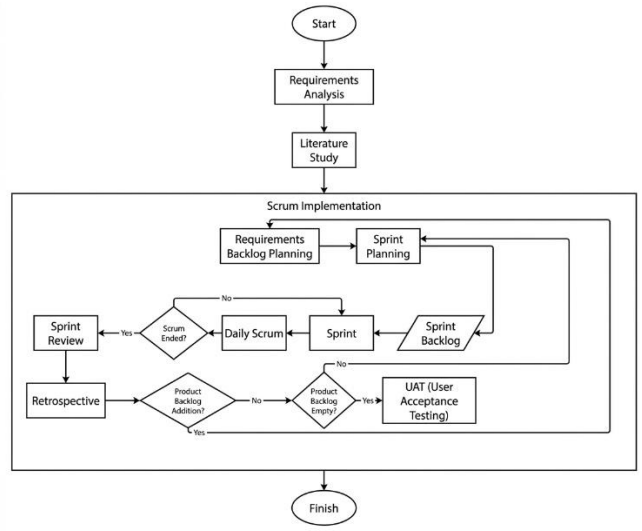


Figure 1. Research flow.

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This methodology involves several key roles, namely the product owner, held by the Head of the Integrated Management and Information System Division, who represents executive needs and is responsible for defining and prioritizing requirements; the Scrum master, who facilitates the development process; and the development team, who implements the identified requirements into working features. Each sprint begins with sprint planning to determine the tasks to be completed, followed by daily coordination, and concludes with a sprint review and retrospective, in which the Product Owner validated completed features against executive requirements, occasionally requesting minor adjustments for the next iteration.

2.1. Requirement Analysis

In the requirements analysis stage, the system requirements are identified, encompassing both functional and non-functional requirements [24]. As described in Section 2, this process was carried out through an interview with the Product Owner from UPA TIK to determine the strategic indicators and data structures needed at the executive level. The results of this stage serve as the basis for compiling the product backlog as a list of tasks to be carried out [25].

2.1.1. Functional Requirement

The functionality of executive dashboard in this study includes providing integrated visual data presentation within the myUnila application. The dashboard aggregates strategic data presenting it in interactive charts and tables that support informed decision-making. The system implements a drill-down feature, enabling hierarchical data exploration from the university level down to individual study programs. Table 1 presents the list of functional requirements identified in this study.

The dashboard presents three main categories of data: (1) Lecturer-to-Student Ratios, showing 5-year historical trends, distributions, and geographical plots at both faculty and study program levels; (2) Accreditation Data, displaying current accreditation status and historical accreditation records for each faculty and study program; and (3) Lecturer KPIs, including gender distribution, employment status, functional positions, rank and grade, and educational level. These three categories were selected based on the strategic data needs conveyed by the Vice Rector to the Head of the Integrated Management and Information System Division of UPA TIK, who acted as the Product Owner in this study and translated these needs into the functional requirements listed in Table 1, ensuring that the dashboard directly addresses the decision-making needs identified at the executive level.

Table 1. Functional requirement.

Code	Functional Requirement
FR-01	The system can display the ratio of lecturers and students by faculty
FR-02	The system can display the ratio of lecturers and students by study program
FR-03	The system can display the accreditation table by faculty
FR-04	The system can display the accreditation table by study program
FR-05	The system can display the ratio of lecturers' gender by faculty
FR-06	The system can display the ratio of lecturers' gender by study program
FR-07	The system can display the ratio of lecturers' employment status by faculty
FR-08	The system can display the ratio of lecturers' employment status by study program
FR-09	The system can display the ratio of lecturers' functional positions by faculty
FR-10	The system can display the ratio of lecturers' functional positions by study program
FR-11	The system can display the ratio of lecturers' ranks/grades by faculty

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Code	Functional Requirement
FR-12	The system can display the ratio of lecturers' ranks/grades by study program
FR-13	The system can display the ratio of lecturers' education levels by faculty
FR-14	The system can display the ratio of lecturers' education levels by study program

To trace how these requirements originate from the identified stakeholder need, Table 2 summarizes the relationship between the requirement category, the requesting stakeholder, and the resulting functional requirements. This traceability was constructed by mapping each functional requirement back to the specific data need conveyed during the initial requirements discussion.

Table 2. Requirements traceability.

Stakeholder Need	Requirement Category	Related Functional Requirements
Monitor lecturer adequacy relative to student enrolment	Lecturer-to-Student Ratio	FR-01, FR-02
Monitor institutional accreditation standing	Accreditation Data	FR-03, FR-04
Monitor lecturer profile and qualification for KPI reporting	Lecturer KPI (5 indicators)	FR-05–FR-14

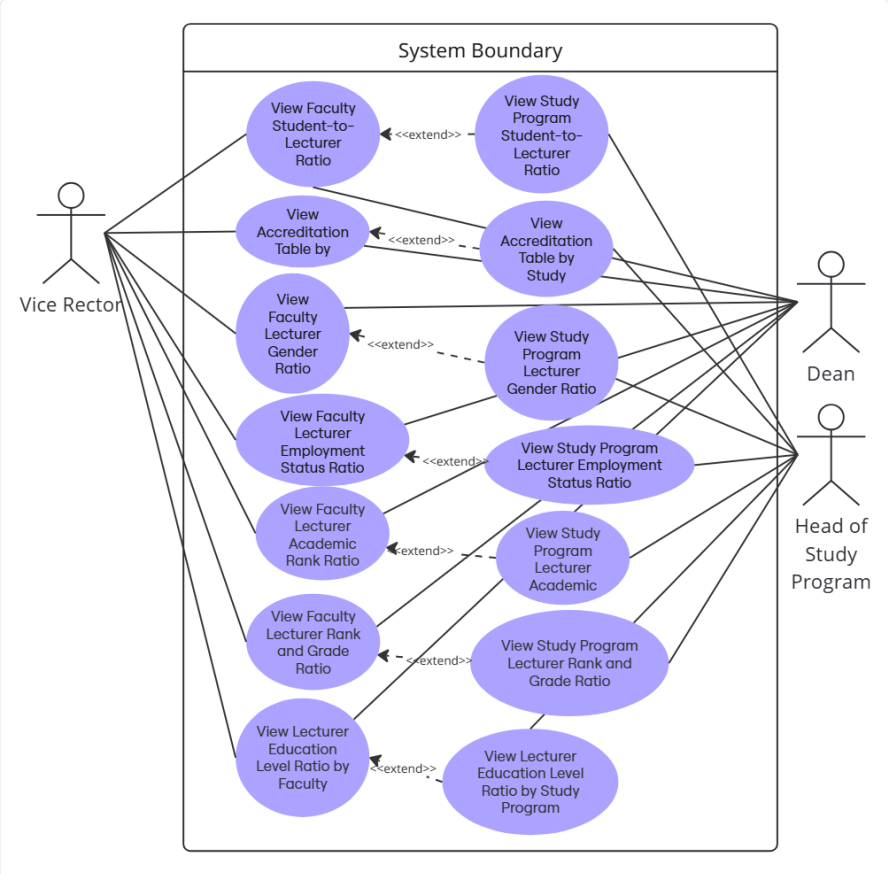


Figure 2. Executive dashboard's use case diagram.

Furthermore, each functional requirement will be represented in the use case diagram shown in Figure 2. This use case diagram is considered the starting point for creating different design elements such as activity diagrams. The use case diagram is transformed into an activity diagram which provides information on the

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interactions of the user, the system, and the database through different processes. Besides the creation of activity diagrams, the use cases which have been found were used to create the database schema and API endpoint needed for implementing the microservices architecture for connecting the dashboard module and myUnila. It was made sure that every functional requirement found through the requirement analysis process could trace to different design artifacts.

2.1.2. Data Collection

Data collection involved two methods. Primary data was gathered through direct observation of the existing myUnila system and related stand-alone information systems, as well as an interview with the Product Owner, who is the Head of the Integrated Management and Information System Division of UPA TIK Universitas Lampung. Secondary data was obtained from official myUnila documentation, technical references, and related literature on dashboard development. Interview findings were then cross-referenced with this documentation to confirm the technical feasibility of identified requirements before their finalization into the product backlog.

2.2. Literature Study

In the literature review stage, there will be gathering and analysis of different scientific sources, which are related to the research problem. Such sources might include scientific journals, books, scientific articles, software development norms, and documentation of the tools or frameworks that are employed. This step is aimed at developing a solid theoretical basis of the theories, which lie behind the research, like the Agile Scrum development approach, dashboard theory, backlogs, and software testing practices.

2.3. Scrum Implementation

The project was designed based on the Scrum methodology, an agile approach that provides for iterative and incremental development of software in time-boxed sprints. The Scrum process entails five phases including (1) Product Backlog, which describes the process of setting up prioritized product backlog that includes all required features; (2) Sprint Planning that entails distribution of tasks among team members based on product backlog; (3) Daily Scrum that includes reporting of the progress of team members and highlighting problems; (4) Sprint Review, which implies showing of the delivered increment and evaluating it; and (5) Sprint Retrospective that involves reflecting upon the whole process and improving it for further sprints [26].

The development was carried out in 8 sprints resulting in 14 features extracted from product backlog. Sprint 1 involved system modelling including use case diagrams, activity diagrams and wireframe designs. Sprints 2–8 included progressive implementation of core dashboard features such as lecturer-to-student ratio module, accreditation tables, and different KPI dashboards for lecturers. At the end of each sprint sprint review took place with the participation of product owner in order to evaluate the delivered features according to predefined requirements. The feedback was added to product backlog for further sprints.

2.4. User Acceptance Testing

User acceptance testing (UAT) was used for conducting the system test. This is an approach to validating the software through its assessment by the real users who check whether the software meets the requirements of the real world [27]. The evaluation of user acceptance in this study employed a five-point Likert scale, a psychometric instrument originally developed by Likert [28] to measure the extent to which respondents agree or disagree with a given statement. This scale was selected for its established reliability and validity in education and social science research, as well as its ability to convert subjective user perceptions into structured, quantifiable scores that are simple for non-technical respondents to answer.

UAT was performed by five subjects representing the role of the Heads of Study Programs within the Department of Computer Science, Faculty of Mathematics and Natural Sciences, Universitas Lampung, representing the S1 Computer Science, S1 Computer Science PSDKU Way Kanan, D3 Informatics Management, S1 Information Systems, and S2 Computer Science programs. These respondents, as Heads of

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Study Programs, represented the primary end-users of the executive dashboard's study-program-level features. Their direct responsibilities included monitoring the lecturer-to-student ratio, accreditation status, and lecturer KPI data for their respective study programs. The system was evaluated using a 10-question survey on a 5-point Likert scale. The User Acceptance Testing (UAT) score was calculated using Equations (1) and (2).

$$Qn = \sum_{i=1}^{5} F(i) \times scale(i) \quad (1)$$

$$P = \frac{Total\ Qn}{N} \div 5 \times 100\ \% \quad (2)$$

Where Qn represents the score for question n, F denotes the answer frequency, Scale indicates the Likert scale value (1-5), P signifies the acceptance percentage, and N refers the total number of respondents. The acceptance categories are: 0%-19.999% (Very Poor), 20%-39.999% (Poor), 40%-59.999% (Neutral), 60%-79.999% (Good), and 80%-100% (Excellent) [29].

2.5. System Development Tools

Tools used to develop the software were Next.js (React based framework), Laravel (PHP based framework), SQL Server (Database Management system), Docker (Containerization system), Visual Studio code (Code editing tool), and Miro (used to develop UML diagrams and wireframes). The hardware resources that were used in this project include a laptop with an Intel Core i5 processor, 16GB RAM, and 512GB SSD space using Ubuntu Desktop OS.

2.6. System Architecture

The architecture of the system will be a microservices one, where the frontend and backend services will be decoupled. The frontend is going to be built with the help of Next.js – the React framework capable of server-side rendering (SSR), static site generation (SSG), and incremental static regeneration (ISR) [30]. As for the backend API, it will be implemented with the help of Laravel – the PHP framework which uses the Model-View-Controller (MVC) architecture and is famous for its great documentation and strong community support [31]. SQL Server will be used for data management and all the services will be containerized with Docker.

The role-based access control (RBAC) will be included into the system, allowing for three types of user roles with different access level: (1) Rector / Vice Rector, having full access to the dashboard capabilities at all levels of organization – university, faculty and study program; (2) Dean / Vice Dean, having access only to the faculty-level and study program-level data in their faculty; and (3) Head of Study Program, having access only to the data concerning their study program. Thus, the RBAC implementation reflects the institutional hierarchy of Universitas Lampung and ensures that users have access to the data corresponding to their authority. It should be stressed that the functional requirements have been elicited in the interview with the Product Owner of the UPA TIK, who has talked to the Vice Rector about data needs of the institution.

3. RESULTS AND DISCUSSION

3.1. Implementation Using Scrum

The Scrum methodology was followed as per the procedure stated in Section 2.3, resulting in a full product backlog containing 14 items and delivery via eight sprints. Some of the key functionalities developed were as follows: (1) lecturer-to-student ratio visualization at faculty and study program levels Faculty level and Study Program level, with a feature to drill down into the list of lecturers and students; (2) Accreditation status table along with its history organized in terms of Faculty and Study Programs; (3) KPI Dashboards of lecturer's gender, employment status, position function, grade/rank, and education level; and (4) role-based access control of Rector, Dean, and Head of Study Program.

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3.2. Dashboard Interface

There are three methods that the lecturer-to-student ratio dashboard uses to present the data: the first is a line graph showing five-year trends, the second method is a pie graph showing percentage distribution, and the third one is a scatter graph that shows the spread of lecturers and students. One can go from the faculty level through the study program level to the list of lecturers and students.



Figure 3. Ratio lecturer and student 5 years history.

Figure 3 is the lecturer to student ratio dashboard. "*Total Dosen*" stands for the total number of lecturers and "*Total Mahasiswa*" stands for the total number of students. Based on the summary card information, there are 1,531 lecturers and 37,117 students, hence making the lecturer to student ratio "*Rasio Dosen:Mhs*" 1:28. The trend line chart labelled "*Tren Rasio Dosen-Mahasiswa*" (Lecturer to Student Ratio Trend) shows this ratio during the last five years. The blue trend line showing the number of lecturers has been relatively constant while the green trend line showing the number of students has steadily risen. The trend implies that the ratio of lecturers to students has been increasing gradually.

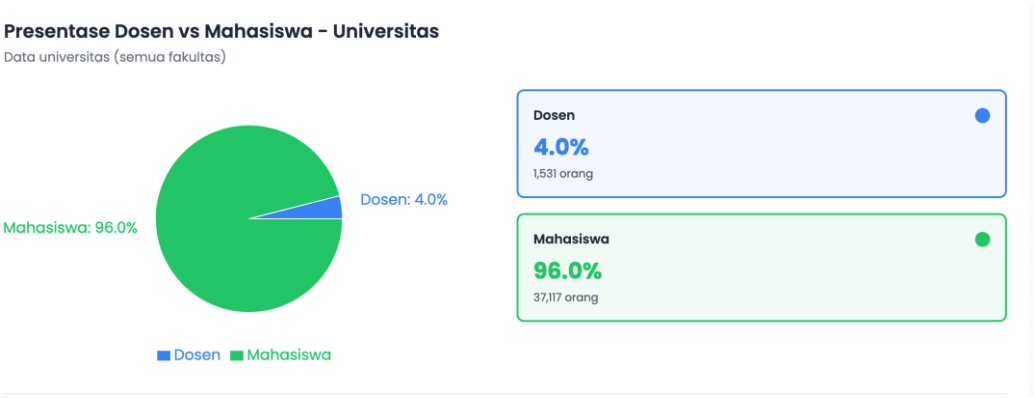


Figure 4. Percentage ratio between lecturer and student.

The lecturer-student profile in the university is presented in Figure 4 using data from all faculties (*Data universitas semua fakultas*). According to the chart, there are 4.0% (1,531 people) of lecturers, which represent the total academic staff, while students are 96.0% (37,117 people). Such high inequality supports the lecturer-student ratio of 1:28 provided in the previous figure. It is apparent that there are far fewer lecturers than students. With the help of this chart, it is possible to evaluate the structure of the academic community without calculating the ratio manually.

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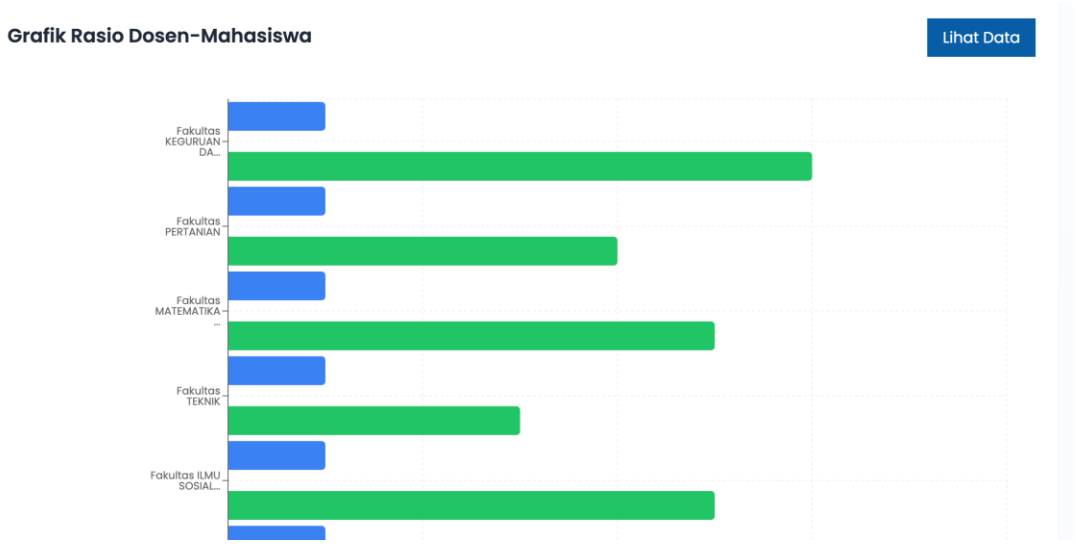


Figure 5. Distribution of the ratio of lecturers and students.

The example is presented in Figure 5 where the feature provides the chart of the ratio between lecturers and students (*Grafik Rasio Dosen-Mahasiswa*) categorized according to faculty (*Fakultas*) including Faculty of Teacher Training and Education, Faculty of Agriculture, Faculty of Mathematics and Natural Sciences, Faculty of Engineering, and Faculty of Social Sciences, etc. In the bar chart, the blue bars represent the number of lecturers, whereas the green bars represent the number of students of each faculty, thus making it possible to compare both values side by side. This categorization serves as a basis for the drill-down functionality of the dashboard that helps university management find faculties having the most evident ratio disparity between lecturers and students.

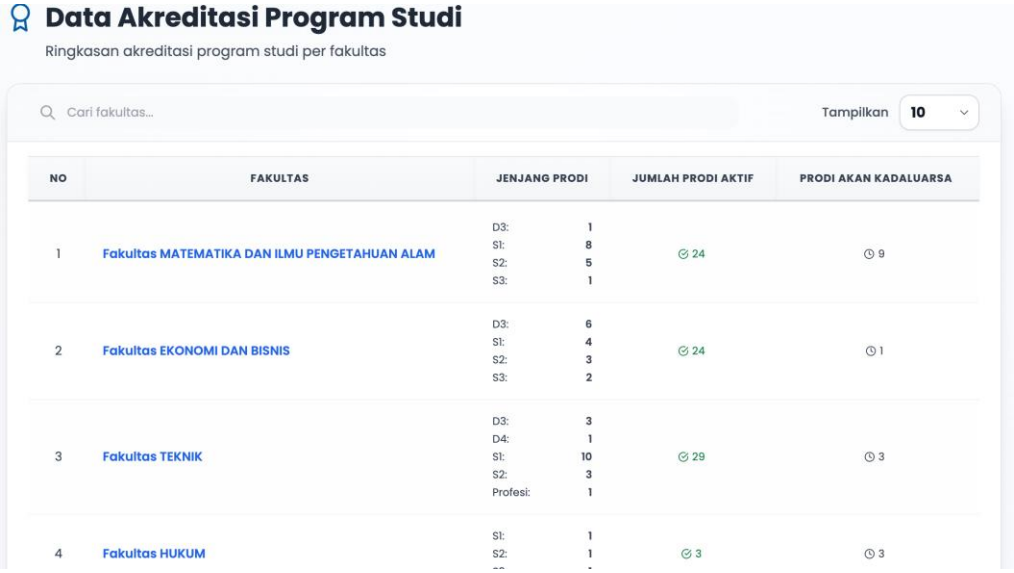


Figure 6. Accreditation dashboard on faculty level.

Figure 6 presents the accreditation data table (*Data Akreditasi Program Studi*), which summarizes the accreditation status of study programs by faculty (*Ringkasan akreditasi program studi per fakultas*). The table enumerates each faculty (*Fakultas*), its respective study program levels (*Jenjang Prodi*), the total number of active study programs (*Jumlah Prodi Aktif*), and the number of study programs with accreditation nearing expiration (*Prodi Akan Kadaluarsa*). For instance, the Faculty of Mathematics and Natural Sciences has 24 active accredited study programs, with 9 approaching expiration, whereas the Faculty of Engineering has 29 active programs, with 3 nearing expiration.

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Figure 7. Accreditation dashboard on study program level.

As can be seen in Figure 7, the Accreditation Dashboard for the Study Program Level in the Faculty of Mathematics and Natural Sciences (*Fakultas Matematika dan Ilmu Pengetahuan Alam*) is shown. The information presented consists of the most recent accreditation rating, year, validity, expiration date, and the current status, either "*Reakreditasi*" or "*Aktif*". History buttons for each study program are available so that users can see the accreditation history of each program. This feature allows the university management to track the accreditation information on the study program level within a particular faculty.

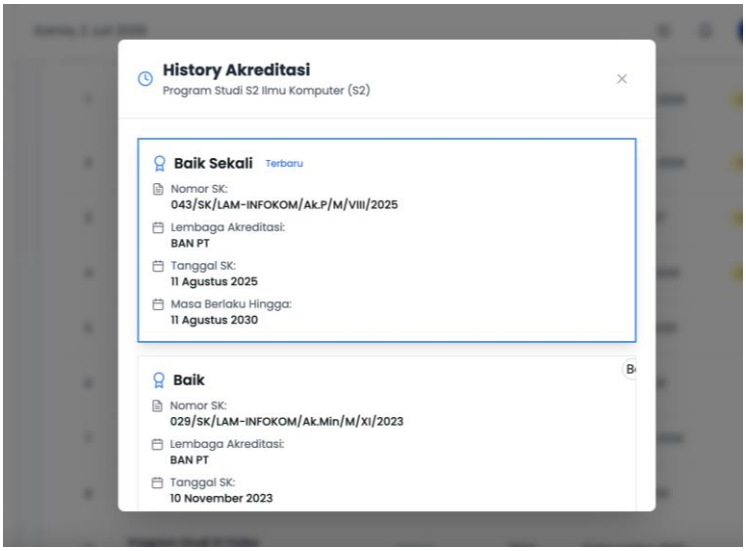


Figure 8. Study program's history on pop-up window.

Figure 8 presents the "Accreditation History" pop-up window, containing information about the history of accreditations of the Master of Computer Science study program *(Program Studi S2 Ilmu Komputer*). To open the pop-up window, one should click the History icon shown in Figure 7. The "Accreditation History" pop-up window presents a chronological list of accreditation decrees, starting from the newest to the oldest one. As can be seen from Figure 8, the newest accreditation grade is "*Baik Sekali*" or Very Good, followed by the decree number (*Nomor SK*), the accreditation body, the date of the decree, and validity expiration *(Masa Berlaku Hingga*). Right below it there is another record of a "*Baik*" or Good grade in 2023, which enables users to trace the changes in accreditation grades of the program. This feature increases the ability of drilling down on the dashboard providing university management with historical information about accreditation status, which is crucial for analyzing the accreditation trends.

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The dashboards of KPIs for lecturers have a standard design, including the data on each indicator in three different visualizations: the line chart representing the trend during the last five years, the pie chart demonstrating the current distribution percentage, and the scatter plot indicating the faculty distribution. For example, Figure 9 shows the dashboard on gender distribution. It contains the pie chart representing the current percentage of male and female lecturers at the university level. The three-visualization design is used in the dashboards of employment status, functional position, rank and grade, and educational level.

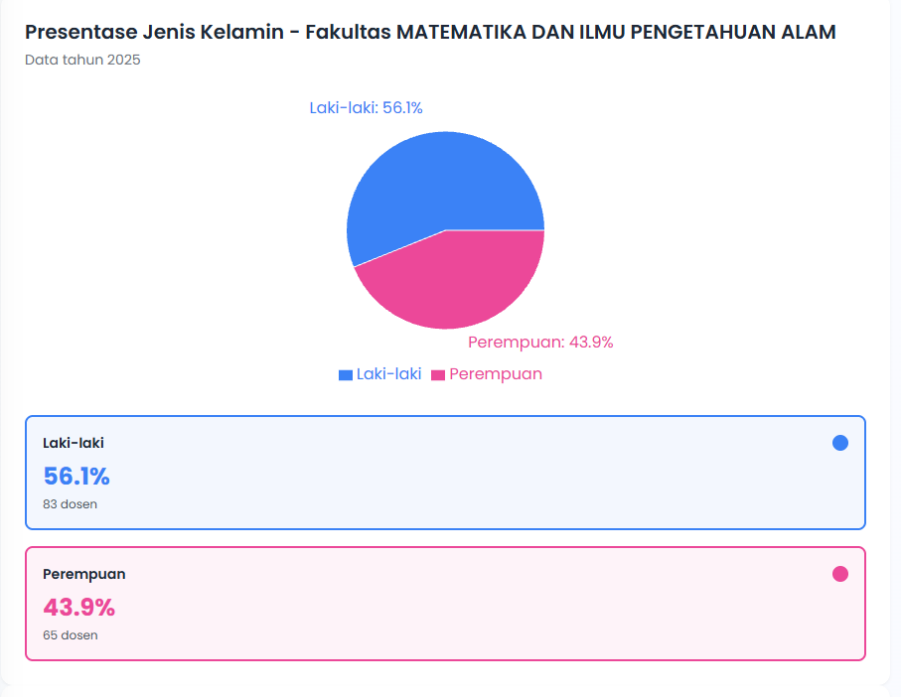


Figure 9. Percentage ratio lecturer's genders.

3.3. User Acceptance Testing Results

The User Acceptance Test (UAT) was conducted through the application of the five-point Likert scale technique in measuring users' acceptance towards the system that was designed. The options included in the test include Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA). The percentage score was calculated through dividing the total score obtained by the maximum possible score. UAT was performed among five participants who were considered as Heads of Study Programs. Testing was done by asking ten questions to the users in accordance with this scale. The overall result is presented in Table 2.

Table 3. UAT results for head of study program role.

No.	Question	SD	D	N	A	SA	Score (%)
1	Gender ratio display per study program	1	0	0	0	4	84%
2	Employment status ratio per study program	0	0	0	0	5	100%
3	Functional position ratio accuracy	0	0	0	1	4	96%
4	Rank and grade categorization clarity	0	0	0	1	4	96%
5	Educational level completeness	1	0	0	2	2	76%
6	Sufficiency for accreditation documentation	1	0	0	0	4	84%
7	Ease of navigation without special training	0	0	0	3	2	88%

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No.	Question	SD	D	N	A	SA	Score (%)
8	Data accuracy vs. other sources	1	0	0	1	3	80%
9	Availability of required information	0	0	0	3	2	88%
10	System response speed	0	0	0	2	3	92%
	Overall Acceptance Rate						**88.4%**

Based on the UAT results, the system obtained a total score of 221 out of a maximum score of 250 across 5 respondents and 10 questions, yielding an overall acceptance rate of 88.4%. According to the UAT scoring criteria, this places the system in the Excellent category (80%–100%), indicating that the developed executive dashboard was very well received by users. It should be noted that this score reflects user acceptance of the system's features as measured through the ten questionnaire items, and should not be interpreted as direct evidence that the system improves strategic decision-making, since this outcome was not explicitly measured in this study.

The highest acceptance scores were recorded for the completeness of employment status data (100%) and the accuracy of functional position and rank/grade data (96% each), demonstrating that the system successfully retrieves and displays core KPI data from myUnila. The lowest score relates to the educational level information, which had a score of 76%. This item specifically asked respondents to rate the completeness of the educational-level data displayed on the dashboard, rather than the dashboard's ability to display it correctly. This result therefore reflects respondents' perception of data completeness, not a limitation of the system's functionality, since the dashboard displays educational-level data exactly as it is stored in myUnila, without any filtering, validation, or modification. Because the data displayed on the dashboard is sourced directly from myUnila, this incompleteness in the underlying data is reflected in the completeness score. From this perspective, the issue does not stem from any inadequacy or limitation of the dashboard system, but from the underlying data itself.

4. CONCLUSIONS

This study successfully developed a web-based executive dashboard module within the myUnila application at Universitas Lampung using Next.JS as the frontend framework and Laravel as the backend, deployed on a microservice architecture. Three categories of strategic information are presented in the dashboard, including lecturer-student ratio information per faculty and study program; accreditation information with history information and lecturer KPI information. The drill-down functionality allows drilling through the hierarchy levels of information for university management to access details starting from university-level overviews to study program-level information. The evaluation of this study, demonstrated through UAT, yielded an acceptance rate of 88.4%, categorized as Excellent, indicating that the system meets its functional requirements and was well received by its intended users. This result suggests the system's potential to support strategic decision-making for university leaders, although this outcome was not directly measured in this study and would require further evaluation to confirm.

However, this study has several limitations. First, the UAT involved only five respondents, all of whom were Heads of Study Programs within the Department of Computer Science. These respondents were selected primarily due to their accessibility and availability within the scope and timeframe of this study, while access to higher-level executive respondents such as the Rector/Vice Rector and Dean/Vice Dean was not yet obtainable at this stage. As a result, the acceptance rate obtained may not fully represent the perspectives of other potential users, and because these respondents represent only one department and one user role, the findings should be interpreted with caution when generalized to the broader claim of an "executive dashboard," which is intended to eventually serve higher-level leadership roles as well. Second, as previously discussed, the completeness of educational level data depends on the source data in the myUnila database, which is beyond the control of the dashboard system itself. Third, this study did not systematically characterize or measure the pre-development reporting and decision-making process; consequently, the improvement offered by the dashboard relative to the previous situation is inferred from the identified institutional problem rather

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than empirically demonstrated through a direct before-and-after comparison. This absence of a baseline should be addressed in future work.

In conclusion, while the system has demonstrated strong performance in terms of functionality and user acceptance, these limitations indicate that further testing with a larger and more diverse group of respondents, including higher-level executive roles, along with baseline comparisons against the pre-development process and improvements in source data quality, are needed to strengthen the validity and generalizability of the results. For future studies, it is recommended to integrate data validation mechanisms and include data export functionality in Excel and PDF formats to facilitate documentation and accreditation reporting.

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