



Implementation of an Integrated Executive Dashboard on the PPMPP Portal as a Digital Instrument for Institutional Quality Assurance at Politeknik Negeri Bali

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Abstract. Digital transformation in higher education requires integrated information systems that can support institutional quality assurance through timely and consistent information. This study develops an integrated executive dashboard within the PPMPP Portal of Politeknik Negeri Bali to address data fragmentation across the e-Monev and e-AMI applications. The system was developed using the Waterfall model, with PHP CodeIgniter, Model–View–Controller (MVC) architecture, RESTful APIs, JSON-based data exchange, and a staging database for data consolidation. The dashboard integrates SPMI audit results, study-program accreditation history, a PPEPP-based document repository, and user access management within a centralized platform. System evaluation was conducted using Black-Box Testing with Equivalence Partitioning to verify authentication, data extraction, synchronization, repository functions, and dashboard visualization. All predefined functional test scenarios were completed successfully, indicating that the implemented functions operated according to the specified requirements. Importance–Performance Analysis (IPA) involving 14 respondents representing the seven departments was also conducted to assess the perceived importance and performance of the implemented features and identify priorities for further improvement. The findings demonstrate the functional feasibility of integrating previously separated quality assurance systems into a unified dashboard. However, technical performance, scalability, and long-term user impact were not quantitatively evaluated and should be investigated in future studies under controlled and longitudinal evaluation conditions at scale.

Keywords: Executive Dashboard, Institutional Quality Assurance, System Integration, RESTful API, Importance–Performance Analysis.

1 Introduction

Digital transformation in higher education governance has shifted from the paradigm of static document digitization toward the development of integrated and responsive data ecosystems (Julianto & Prastyaningih, 2023). At Politeknik Negeri Bali, the Center for Quality Assurance and Learning Development (PPMPP) plays a strategic

role in overseeing the implementation of the Internal Quality Assurance System (SPMI) to support the Continuous Quality Improvement (CQI) cycle. To improve the efficiency of quality assurance management, PPMPP has deployed several web-based supporting applications, including the e-Monev system for learning monitoring and evaluation and the e-AMI system for internal quality audits. However, a fundamental challenge remains the high degree of information fragmentation. The official PPMPP web portal operates independently and is not systematically integrated with the e-Monev and e-AMI systems. As a result, the main portal is unable to provide comprehensive and real-time summaries of institutional quality performance. Consequently, management faces delays in obtaining audit results due to manual data consolidation, increasing the risk of duplication, inconsistency, and administrative inefficiency.

Previous studies in quality assurance software engineering have primarily focused on the digitalization of monitoring instruments. Assidiq et al., (2024) developed an internal quality audit information system using the prototyping approach to digitize faculty-level audit forms; however, the system remained a standalone application. Rindengan et al., (2015) employed the Rapid Application Development (RAD) methodology to transform manual audit data processing into a web-based system, yet interoperability among heterogeneous systems was not addressed. More recently, Bahtiar et al., (2025) designed an interactive dashboard based on the PureShare method to convert static audit data into visual analytics. Nevertheless, these studies have not resolved the challenge of automated cross-platform data integration, leaving a significant research gap in achieving real-time data consolidation while preserving the integrity of existing legacy databases.

To address this gap, this study develops an integrated executive dashboard within the official PPMPP web portal of Politeknik Negeri Bali as a centralized platform for consolidating institutional quality-assurance information. The proposed system integrates data from the e-Monev and e-AMI applications through RESTful APIs and JSON-based data exchange, supported by a staging database for data transformation and standardization and an MVC architecture implemented using the CodeIgniter framework. In addition to presenting integrated SPMI audit information, the system incorporates a PPEPP-based quality-assurance document repository and a module for displaying the accreditation history of each study program (Arlita et al., 2025; Jois Aldof Mendrofa et al., 2025). The main contribution of this study lies in implementing an integration mechanism that enables previously separated quality-assurance information to be consolidated and presented through a unified dashboard while maintaining the existing supporting applications. The developed system is evaluated through functional testing to verify its conformity with the specified system requirements and through Importance–Performance Analysis (IPA) involving representatives from the seven departments at Politeknik Negeri Bali to assess the perceived importance and performance of the implemented features.

2 Methodology

This study adopts a Research and Development (R&D) approach using the Waterfall model (Haniva et al., 2023). The model was selected because the source-system structures, integration requirements, and expected dashboard functions were identified

before implementation, allowing development to proceed sequentially from requirement analysis to design, implementation, and evaluation (Ambara et al., 2023).

2.1 Requirement Analysis

At this stage, structural observations and Focus Group Discussions (FGDs) were conducted with the PPMPP quality assurance team. The objective was to analyze the database schemas of the e-Monev and e-AMI systems, identify the API endpoints for audit score retrieval, examine the archival structure of quality assurance documents for the supporting repository, map the accreditation history of each study program, and define executive user roles and access privileges (Yuniarti et al., 2025).

2.2 System Design

The system architecture was designed by adopting the Staging Database concept (Naryasa et al., 2024). Raw data from the supporting subsystems were first isolated in a temporary storage layer for data transformation and format standardization before being presented on the executive dashboard. This stage also included the design of the supporting quality assurance repository based on the PPEPP classification framework, as well as the development of a historical database scheme to maintain accreditation records for each study program over time. Data communication was implemented through RESTful APIs using the JSON (JavaScript Object Notation) data interchange format. The front-end interface was developed using the Bootstrap framework to ensure responsive performance across multiple devices (Bramantyo et al., 2025).

2.3 System Implementation

The system was implemented using PHP with the CodeIgniter framework following the Model–View–Controller (MVC) architectural pattern (Made et al., 2025). The separation of the Model (database query logic), View (graphical user interface), and Controller (business logic and API routing) was intended to produce clean, secure, and maintainable code for long-term development (Ambara & Sudiarta, 2024). This architecture was also applied in developing the supporting quality assurance repository module and a dedicated page for dynamically visualizing the accreditation history of each study program.

2.4 System Testing

System evaluation was conducted using two complementary approaches: Black-Box Testing with the Equivalence Partitioning technique and Importance–Performance Analysis (IPA). Black-Box Testing was used to verify the functional conformity of the developed system with the specified requirements, including user authentication and access rights, e-Monev data retrieval, e-AMI data synchronization, web content management, PPEPP-based document repository functions, and study-program accreditation information (Pratama et al., 2023). For functions involving data

integration, the evaluation also verified whether data retrieved from the supporting applications were correctly processed and displayed on the executive dashboard.

To complement the functional evaluation, IPA was conducted to assess users' perceptions of the importance and performance of the implemented dashboard features. The evaluation involved 14 respondents representing the seven departments at Politeknik Negeri Bali, with two representatives from each department. Respondents evaluated each feature based on its perceived importance and current performance using the assessment instrument provided. The mean importance and performance scores were subsequently used to position the evaluated features within the four IPA quadrants and identify priorities for further system improvement.

3 Results and Discussion

3.1 Results

The outcome of this development study is an executive dashboard integrated into the PPMPP web portal of Politeknik Negeri Bali, as shown in Figure 1. The system successfully integrates quality audit data from the previously isolated e-Monev and e-AMI applications into a unified platform.

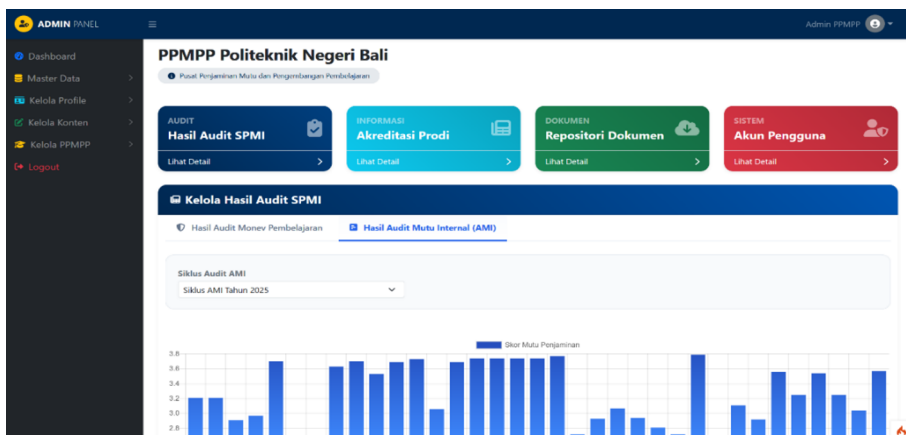


Figure 1. Executive Dashboard PPMPP User Interface

Using a RESTful API with JSON-based data exchange, differences in the database schemas of the two applications are reconciled through an interconnected data architecture. As shown in Figure 1, the administrator panel provides four main modules: SPMI Audit Results, Study Program Accreditation, Document Repository, and User Management. The SPMI Audit Results module includes a management interface that dynamically renders real-time audit performance charts based on the selected annual assessment cycle.

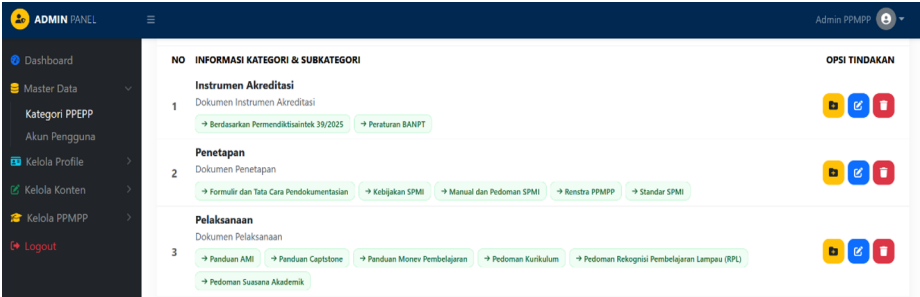


Figure 2. PPEPP Categorical View

Figure 2 presents the PPEPP Category feature within the master data repository, which serves as a centralized repository for quality assurance documents. The repository organizes documents into structured categories, such as Accreditation Instruments, Determination, and Implementation, enabling study programs to efficiently locate the required documents during accreditation processes as shown in **Figure 3**.

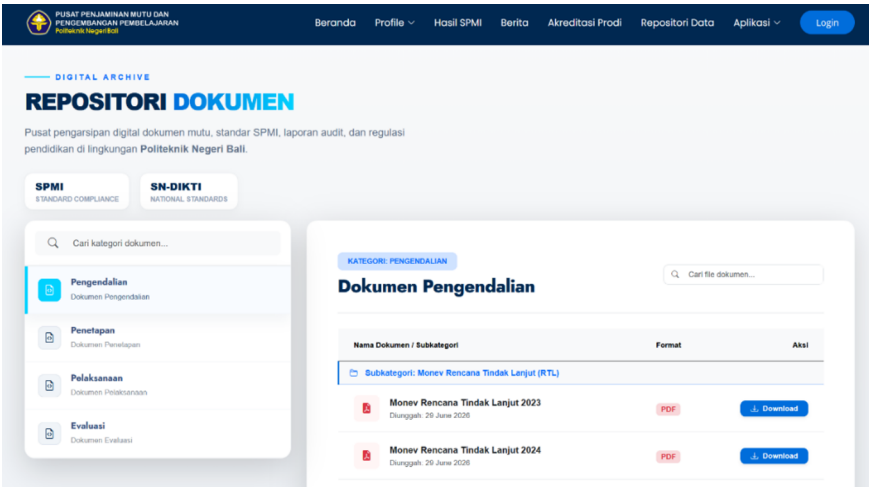


Figure 3. Document Repository View

To ensure information security, document downloads from the repository are restricted through authentication using study program coordinator accounts. In addition to the document repository, the system implements a Study Program Accreditation module on the public portal to enhance institutional transparency (Figure 4). Through this feature, users can monitor accreditation status in real time while tracking the historical accreditation records of each study program over successive accreditation cycles. To support administrative and internal evaluation activities, the system also allows users to download the accreditation certificate history of each study program in digital format.

Before deployment, functional testing was conducted across the predefined scenarios shown in **Figure 5**. All tested scenarios passed, covering multi-user authentication, e-Monev data extraction, e-AMI synchronization, web content management, PPEPP repository functions, and study-program accreditation data. Thus, the reported 100% represents the pass rate of the predefined functional test cases during the test period; it should not be interpreted as evidence of scalability, response-time performance, or long-term reliability under varying operational loads.

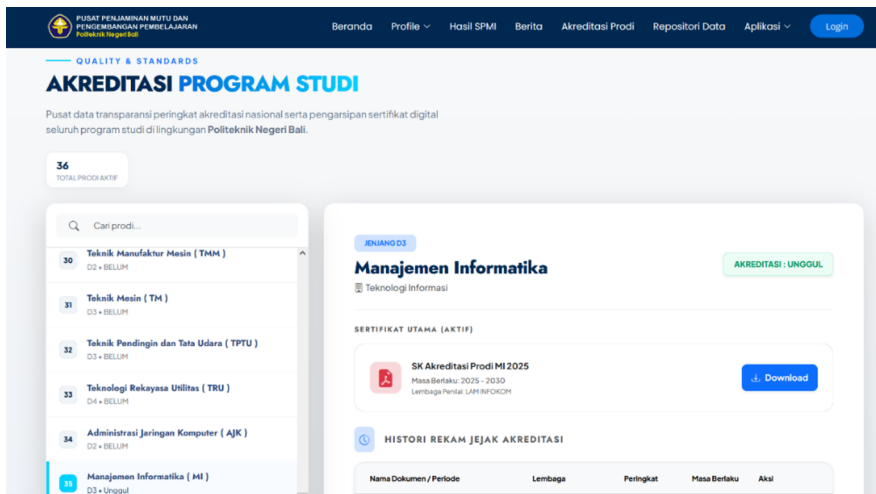


Figure 4. Study Program Accreditation History View

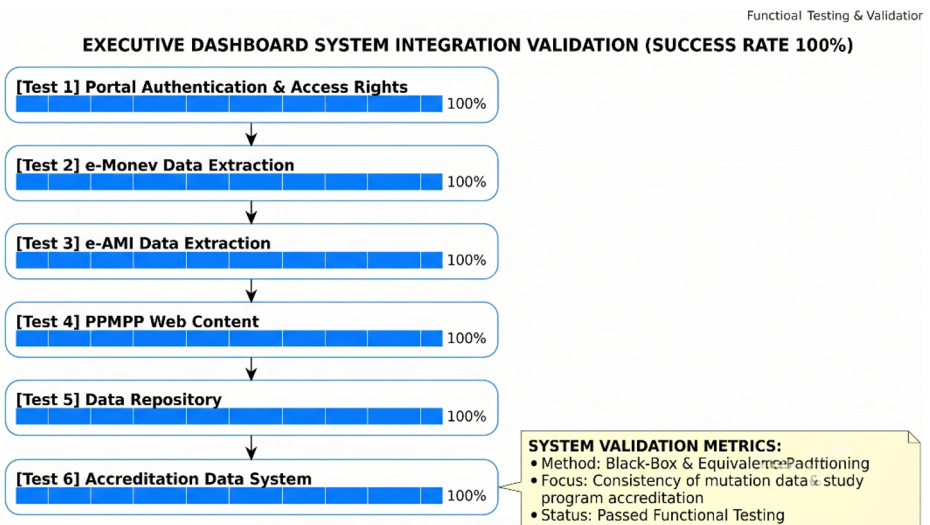


Figure 5. Validation Metrics

3.2 Discussion

The findings show that RESTful API-based integration can connect the PPMPP portal with the previously separate e-Monev and e-AMI systems while retaining the existing source applications. MVC separates data access, business logic, and presentation, while the staging database provides an intermediary layer for transforming and standardizing data before visualization. In the tested scenarios, this architecture enabled the dashboard to retrieve, consolidate, and present quality-assurance information through a single interface. These findings support the feasibility of the integration design, but do not establish low latency, memory efficiency, or scalability because those aspects were not measured through controlled benchmarks.

To complement the functional testing results, an Importance–Performance Analysis (IPA) was conducted with 14 respondents representing the seven departments at Politeknik Negeri Bali, with two respondents representing each department. The involvement of representatives from all departments was intended to capture perceptions across the institutional units associated with the quality-assurance process. Rather than measuring technical system performance, IPA was used to examine the perceived importance and perceived performance of individual dashboard features. The analysis therefore provides a feature-level perspective for identifying which functions should be maintained or prioritized for further improvement.

For each system feature j , the mean importance score (I_j), and mean performance score (P_j), were calculated as:

$$I_j = \frac{1}{n} \sum_{i=1}^n I_{i,j} \quad (1)$$

$$P_j = \frac{1}{n} \sum_{i=1}^n P_{i,j} \quad (2)$$

Where n denotes the total number of respondents, while $I_{i,j}$ and $P_{i,j}$ represent the importance and performance ratings assigned by respondent i to system feature j , respectively. The conformity level for each system feature was then computed as:

$$TK_j = \frac{P_j}{I_j} \times 100\% \quad (3)$$

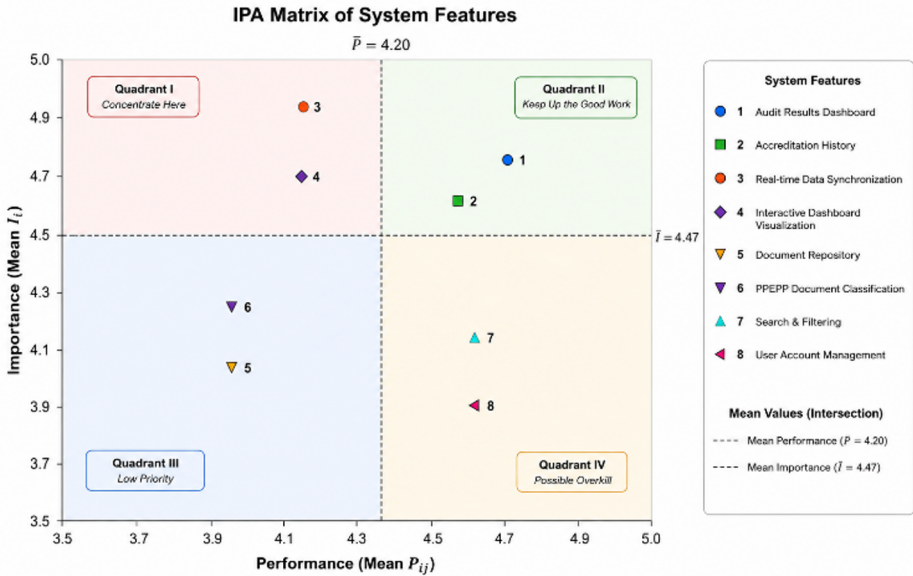


Figure 6. Importance–Performance Analysis (IPA) matrix of the evaluated system features.

The IPA results produced an overall mean importance score of 4.47 and a mean perceived performance score of 4.20, indicating that the evaluated dashboard features were generally considered important and positively perceived by the respondents (as shown in **Figure 6**). Using these mean values as the quadrant intersection points, the evaluated features were distributed across the four IPA quadrants. Features positioned in Quadrant I indicate areas that require improvement because their perceived importance is relatively high while their current performance is comparatively lower. Features in Quadrant II represent functions that are both important and perceived to perform well and therefore should be maintained. Meanwhile, features in Quadrants III and IV represent lower-priority improvement areas and features whose perceived performance is relatively higher than their importance, respectively. These findings provide an initial basis for prioritizing feature refinement across the institutional departments represented in the evaluation.

During interface use, a responsiveness issue was observed in which chart layouts could become misaligned on smaller mobile screens. The issue was addressed by triggering dynamic chart re-rendering through JavaScript so that the visualization could adapt to different screen dimensions. This is reported as an implementation refinement rather than as evidence of overall usability effectiveness. Beyond audit-data integration, the system provides a PPEPP-based document repository and a module for tracking study-program accreditation history. These functions demonstrate the practical applicability of the proposed integration approach in the institutional setting.

Nevertheless, the evaluation has several limitations. The IPA involved 14 respondents representing the seven departments at Politeknik Negeri Bali and was

intended as an initial feature-level assessment rather than a comprehensive usability or user-impact evaluation. Therefore, the findings should be interpreted within the institutional context of the present implementation. In addition, technical performance indicators such as response time, throughput, concurrent-user capacity, and server-resource utilization were not quantitatively measured. Future studies should involve a larger number of users, standardized usability instruments, controlled performance testing under different workloads, and longitudinal evaluation to determine the system's impact on quality-assurance processes and managerial decision making.

4 Conclusion

This study successfully developed and implemented an integrated executive dashboard within the PPMPP web portal of Politeknik Negeri Bali to address the fragmentation of institutional quality-assurance information across the e-Monev and e-AMI systems. The proposed system integrates data through RESTful APIs and JSON-based data exchange, supported by a staging database and MVC architecture, and provides a unified platform that includes SPMI audit information, a PPEPP-based document repository, and study-program accreditation history. Functional evaluation using Black-Box Testing with Equivalence Partitioning showed that all predefined test scenarios were successfully completed, indicating that the implemented functions operated in accordance with the specified requirements. In addition, Importance–Performance Analysis involving 14 respondents representing the seven departments at Politeknik Negeri Bali provided an initial assessment of the perceived importance and performance of the implemented features and identified priorities for further system improvement. These findings demonstrate the functional feasibility of integrating previously separated quality-assurance information into a centralized institutional dashboard. However, the present study does not quantitatively evaluate technical performance, scalability, or the system's long-term impact on quality-assurance processes and managerial decision making. Future research should therefore include controlled performance testing, larger-scale usability evaluation, and longitudinal assessment to examine system performance and institutional impact under broader operational conditions.

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