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# Design and Implementation of a Web-Based Savings and Loan Information System

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**Abstract**
This study aimed to design and implement a web-based Savings and Loan Information System for Koperasi Konsumen Raudhah Amanah Bunobogu while supporting the improvement of its existing business processes. The study was motivated by operational challenges arising from manual transaction recording, fragmented data management, reporting delays, and limited access to centralized information. Data were collected through observation, interviews, and documentation studies. A Fishbone Diagram was employed to identify the root causes of operational problems, whereas Business Process Model and Notation (BPMN) was used to analyse the existing (As-Is) and proposed (To-Be) business processes. The system was developed using the Software Development Life Cycle (SDLC) Waterfall model and evaluated through Black Box Testing to verify its functional requirements. The developed system successfully integrates key cooperative operations, including member management, savings transactions, loan processing, installment payments, and financial reporting within a centralized web-based platform. The Black Box Testing results confirmed that all implemented functionalities operated in accordance with the specified system requirements. These findings demonstrate that integrating BPMN-based business process redesign with information system development provides a structured approach to supporting the digitalization of savings and loan cooperative operations. Future studies are encouraged to evaluate the organizational impact of the system through quantitative performance measurements and user-based assessments.

**Keywords**: *Savings and Loan Information System, Cooperative, BPMN, Waterfall Method, Web-Based System*

## 1 Introduction

In recent years, there has been growing recognition of the importance of cooperatives in promoting community welfare and supporting financial inclusion, particularly in developing countries [1]. As community-based financial institutions, cooperatives play a significant role in mobilizing and distributing financial resources among their members while contributing to local economic development and social well-being [2]. Among the various business activities undertaken by cooperatives, savings and loan services represent one of the most essential functions, as they facilitate savings mobilization, loan provision, installment management, and financial reporting. Given the increasing complexity of cooperative operations, the effectiveness of business processes and information management has become a critical factor in ensuring service quality, operational efficiency, and organizational sustainability. In this regard, accounting information systems are widely recognized as important tools for supporting organizational activities by providing accurate, relevant, and timely information for managerial decision-making processes [3].

At the same time, the rapid advancement of digital technology has transformed the way organizations manage information and deliver services [4]. A growing body of literature suggests that digitalization can improve operational efficiency, enhance transparency, strengthen accountability, and increase organizational competitiveness [5]. In the cooperative sector, digital transformation has become increasingly important as organizations seek to improve service delivery and respond to growing operational demands [4]. Nevertheless, despite the potential benefits offered by digital technologies, many cooperatives continue to face challenges associated with technological infrastructure, digital literacy, and the adoption of integrated information systems [4][5].

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Previous studies have shown that many savings and loan cooperatives in Indonesia still rely on manual or semi-manual administrative procedures [6]. Transaction records are frequently maintained using paper-based documents and spreadsheet applications that are not fully integrated, creating various operational problems. Such practices often lead to duplicated records, delays in transaction processing, difficulties in retrieving historical information, and increased risks of recording and calculation errors [7]. Furthermore, the reliance on manual procedures limits access to real-time information, making it difficult for management to monitor operations effectively and support timely decision-making [8].

These issues are particularly relevant in the context of Koperasi Konsumen Raudhah Amanah Bunobogu. Based on preliminary observations and an analysis of the existing business processes (As-Is), savings, loan, and installment activities were primarily managed through manual recordkeeping using administrative books and separate spreadsheet files. As a result, several operational inefficiencies were identified, including lengthy data retrieval processes, delays in reporting transactions, difficulties in monitoring loan and installment activities, and a high dependence on specific personnel responsible for maintaining records. These conditions indicate that the existing business processes are no longer adequate to support the cooperative's growing operational requirements

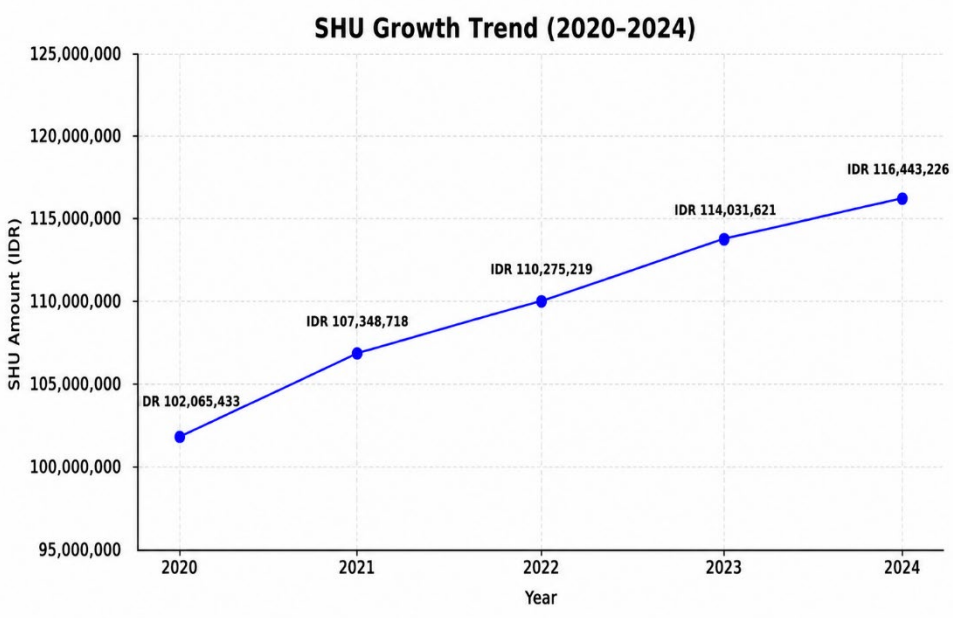



*Figure 1 Grafik SHU Koperasi Raudhah Amanah Bunobogu 2020-2024*

Although the cooperative has experienced sustained financial growth, as evidenced by the consistent increase in its Surplus Hasil Usaha (SHU) between 2020 and 2024, the development of administrative procedures and supporting information systems has not kept pace with this growth. As transaction volumes continue to increase, challenges associated with information management have become more apparent. Consequently, a mismatch has emerged between operational demands and the cooperative's capacity to manage data efficiently and accurately. If left unaddressed, this situation may increase the likelihood of data inaccuracies, reporting delays, and weaknesses in internal control as operational activities become more complex.

Recent regulatory developments have further highlighted the need for improved information management within cooperative organizations. According to the Regulation of the Ministry of Cooperatives and SMEs of the Republic of Indonesia Number 2 of 2024, cooperatives are required to maintain financial information that is transparent, accountable, and properly documented [1]. These requirements underscore the importance of adopting integrated digital solutions capable of supporting operational activities while enhancing information quality and strengthening internal control mechanisms [9]. In this respect, information systems are increasingly recognized as essential tools for managing transaction processing, data administration, and reporting activities [10]. Moreover, they facilitate more effective managerial decision-making by providing centralized and real-time access to organizational information [11].

A number of studies have investigated the development of web-based information systems for savings and loan cooperatives using a range of technologies and system development approaches. Gea et al. [8] presented a web-based savings and loan information system developed using the SDLC methodology, highlighting its role in improving transaction management and reporting processes. In a related study, Wiranata et al. [11] developed a cooperative information system based on the Web Engineering approach and found that it contributed to greater operational effectiveness and improved access to information. Likewise, Kurniawan et al. [12] also proposed a web-based transformation of savings and loan cooperative services, demonstrating improvements in data management and service efficiency.

Previous research has also focused on the application of technologies such as PHP, MySQL, CodeIgniter, and mobile platforms to support cooperative digitalization. For instance, Ekowati et al. [13], Susilowati et al. [14], Muku et al. [15], Ikhwan et al. [16], and Aji et al [17]. showed that web-based information systems can enhance transaction processing, increase reporting

accuracy, improve data accessibility, and support overall operational efficiency. Taken together, these findings suggest that digital technologies are increasingly being adopted to strengthen cooperative management and service provision. However, most of these studies primarily focused on technology implementation and transaction digitalization, while discussions regarding business process improvement through a Business Process Management approach remain limited. Furthermore, many studies have not comprehensively examined the transformation of existing business processes (As-Is) into proposed business processes (To-Be) as a foundation for information system development.

Despite the growing body of research on cooperative information systems, relatively little attention has been paid to the integration of business process improvement and information system development. Existing studies have largely focused on technological implementation and transaction digitalization, whereas the systematic analysis and redesign of operational workflows prior to system development remain underexplored. Furthermore, a review of the literature reveals that only a limited number of studies have employed BPMN-based As-Is and To-Be process modelling as a foundation for developing web-based information systems in savings and loan cooperatives. This represents an important gap in the existing literature, as business process redesign plays a crucial role in ensuring that information systems effectively address organizational needs and operational challenges.

To address this gap, the present study focuses on the design and implementation of a web-based Savings and Loan Information System using the Software Development Life Cycle (SDLC) Waterfall model. Unlike previous studies that primarily emphasized the implementation of web-based cooperative systems, this research integrates BPMN-based business process redesign with information system development. Business process analysis is employed as the foundation for system design to ensure that system functionalities are aligned with organizational workflows and operational requirements. Therefore, this study contributes by proposing a structured framework that combines business process modelling and information system development to support the digitalization of savings and loan cooperative operations.

Unlike previous studies that mainly focused on implementing web-based cooperative systems, this study integrates BPMN-based business process redesign with information system development. The proposed approach uses business process analysis as the foundation for system design, thereby providing a structured framework for aligning system functionalities with organizational workflows.

## 2 Research methods

### *2.1 Research Approach*

This study adopted a Research and Development (R&D) approach to design, develop, and implement a web-based Savings and Loan Information System for Koperasi Konsumen Raudhah Amanah Bunobogu. An R&D approach was employed because it enables the development of practical solutions that address specific organizational problems while simultaneously supporting the implementation of practical solutions within a real-world cooperative environment. The purpose of this study was not only to develop a software application but also to improve the existing business processes associated with member management, savings transactions, loan applications, installment payments, and financial reporting.

### *2.2 System Development Method*

The system was developed using the Software Development Life Cycle (SDLC) Waterfall model. The Waterfall approach was selected because the cooperative's business processes were relatively stable and well-defined, making them suitable for a sequential development methodology. In addition, the Waterfall model provides structured documentation throughout the development process, thereby facilitating system evaluation, maintenance, and future enhancement activities [18].

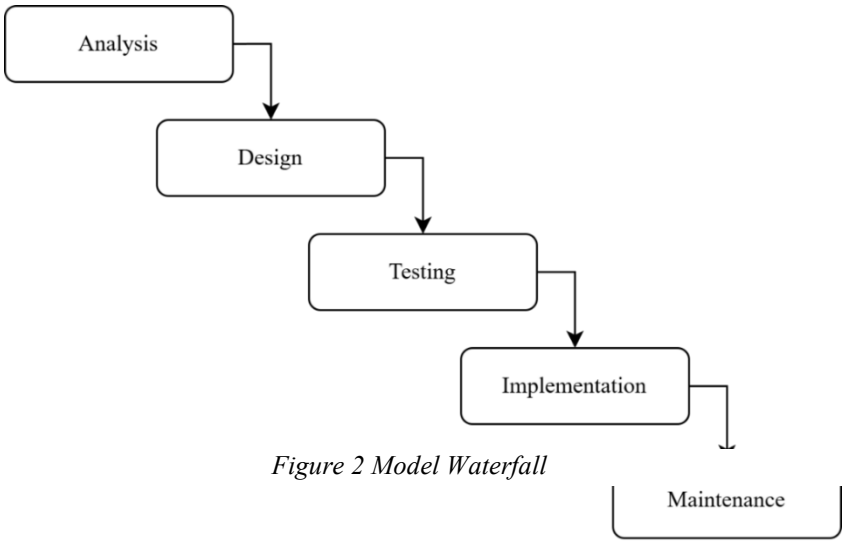



*Figure 2 Model Waterfall*

The development process was carried out in five stages [15], namely requirement analysis, system design, implementation, testing, and maintenance.

1. Requirement Analysis
   The first stage involved identifying operational problems within the existing business processes and gathering user requirements. Information was obtained through observations, interviews, and document analysis. The results of this stage were used to define the functional and non-functional requirements of the proposed system.
2. System Design
   During the design stage, the system architecture, database structure, user interfaces, and business process models were developed. BPMN was used to model both the existing business processes (As-Is) and the proposed business processes (To-Be). In addition, Use Case Diagrams were developed to identify system functionalities and describe interactions between users and the system.
3. Implementation
   The proposed system was implemented as a web-based application using Laravel as the primary development framework. Inertia.js and React.js were utilized to develop the user interface, while MySQL was employed as the database management system. CSS was used to support responsive and user-friendly interface design.
4. Testing
   System functionality was evaluated using the Black Box Testing method. The purpose of the testing phase was to determine whether each system function operated according to the specified requirements. The testing process covered user authentication, member management, savings transactions, loan processing, installment payments, and financial reporting functionalities.
5. Maintenance
   The final stage involved monitoring system performance after implementation. Activities performed during this stage included correcting identified issues, optimizing database performance, and implementing future improvements based on user feedback and operational requirements.

### *2.3 Data Collection Techniques*

Data were collected through observations, semi-structured interviews, and documentation studies. Observation was conducted to gain an understanding of the cooperative's existing business processes and operational activities. Semi-structured interviews were carried out with cooperative administrators and management personnel to identify operational challenges and gather system requirements.

In addition, relevant organizational documents were examined to support the analysis process. These documents included financial reports, member records, loan documents, and installment records. The purpose of reviewing these documents was to understand existing data structures and reporting requirements that would inform the development of the proposed information system.

### *2.4 System Modeling*

System modeling was conducted using Business Process Model and Notation (BPMN) and Unified Modeling Language (UML). BPMN was utilized to analyze and redesign the cooperative's business processes, while UML Use Case Diagrams were used to define system functionalities and interactions between users and the proposed system [19].

The modeling process focused on two core business processes within the savings and loan unit, namely loan applications and installment payments. For each process, both As-Is and To-Be models were developed. The purpose of the As-Is models was to identify operational inefficiencies, manual procedures, delays in information flow, and potential sources of human error within the existing processes. The To-Be models were subsequently developed to represent the redesigned business processes following the implementation of the proposed web-based information system.

### *2.5 System Architecture and Deployment Environment*

The developed application adopts a client-server architecture to support centralized data processing and information management. Laravel and Inertia.js were used for backend development, while React.js was employed to develop the frontend interface. Data storage and processing were managed through a MySQL database management system.

The deployment environment supports various development technologies, including Laravel, Composer, Node.js, PHP, Python, CodeIgniter, and terminal access. This infrastructure was selected to ensure system scalability, maintainability, and compatibility with future development requirements.

## 3 Results

### *3.1 Root Cause Analysis of Operational Problems*

The Fishbone Diagram analysis identified four major categories contributing to operational inefficiencies within the cooperative, namely technology, human resources, data management, and business processes. Figure 3 shows the root-cause analysis of the existing operational problems.

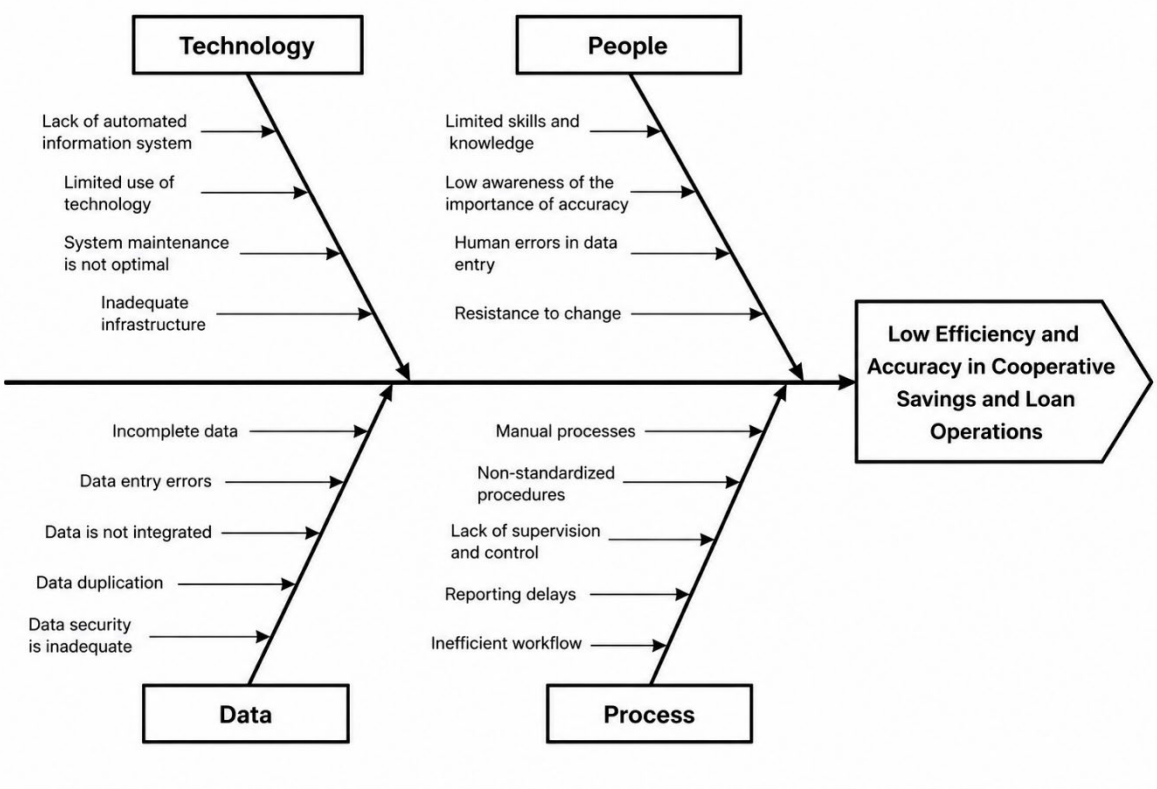



*Figure 3 Fishbone Diagram Root Cause Analysis of Cooperative Operations*

With regard to technology, the cooperative relied on manual recordkeeping using administrative books and spreadsheet files that were not integrated into a centralized information system. In terms of human resources, transaction processing activities were highly dependent on specific personnel responsible for maintaining records and preparing reports. Concerning data management, member, savings, loan, and installment information were stored in separate files, resulting in fragmented data storage. Regarding business processes, loan approval, installment monitoring, and report preparation were performed manually through multiple administrative procedures.

The results indicate that operational constraints were mainly associated with information accessibility, transaction monitoring, reporting activities, and data management within the cooperative. Overall, the findings reveal several inefficiencies that may hinder the effectiveness of daily operational activities.

### 3.2 *BPMN Analysis of Existing Business Processes (As-Is)*

1. Loan Application Process (As-Is)

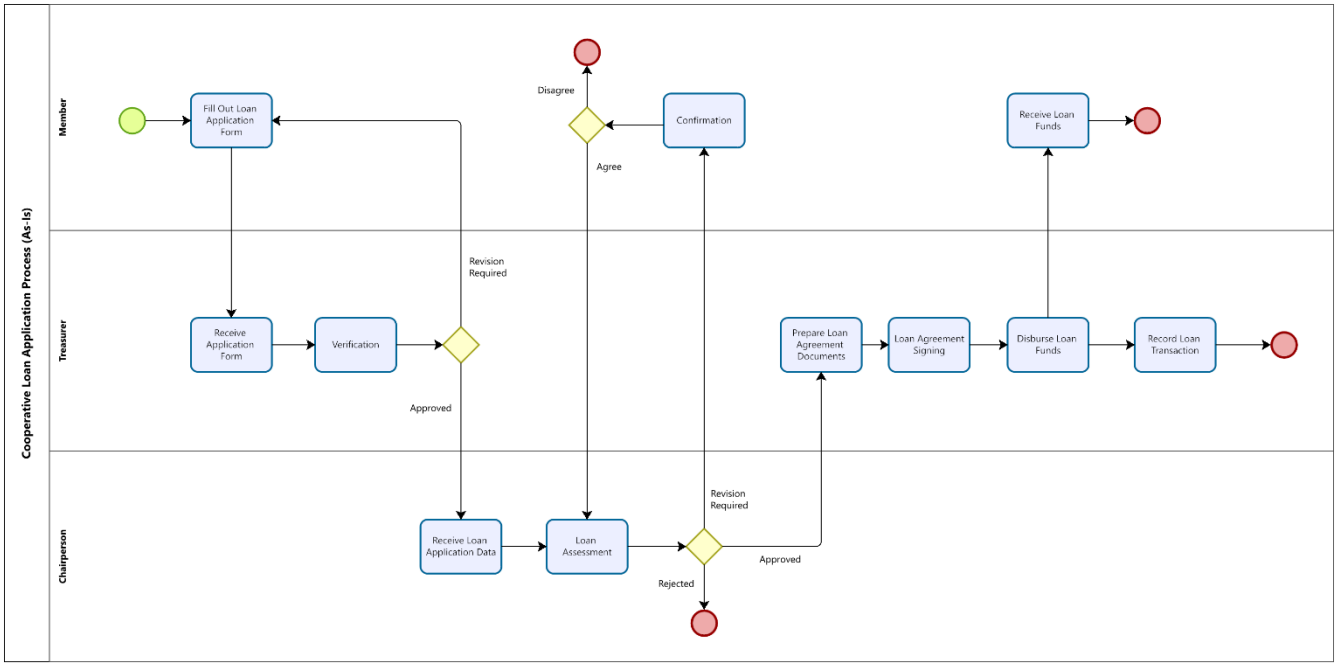



*Figure 4 Loan Application Process (As-Is)*

Figure 4 illustrates the existing loan application process. As can be seen from the diagram, the process begins when a member submits a paper-based loan application form. The application is subsequently verified by the treasurer and forwarded to the cooperative chairman for evaluation and approval. If revisions are required, the application must be returned to the member and resubmitted manually. Once approved, administrative staff prepare loan documents, conduct the loan agreement process, disburse funds, and manually record the transaction.

This workflow results in lengthy processing times, repetitive verification activities, and a high dependence on physical documents. Consequently, delays, document loss, and data inconsistencies frequently occur during the loan approval process.

2. Installment Payment Process (As-Is)

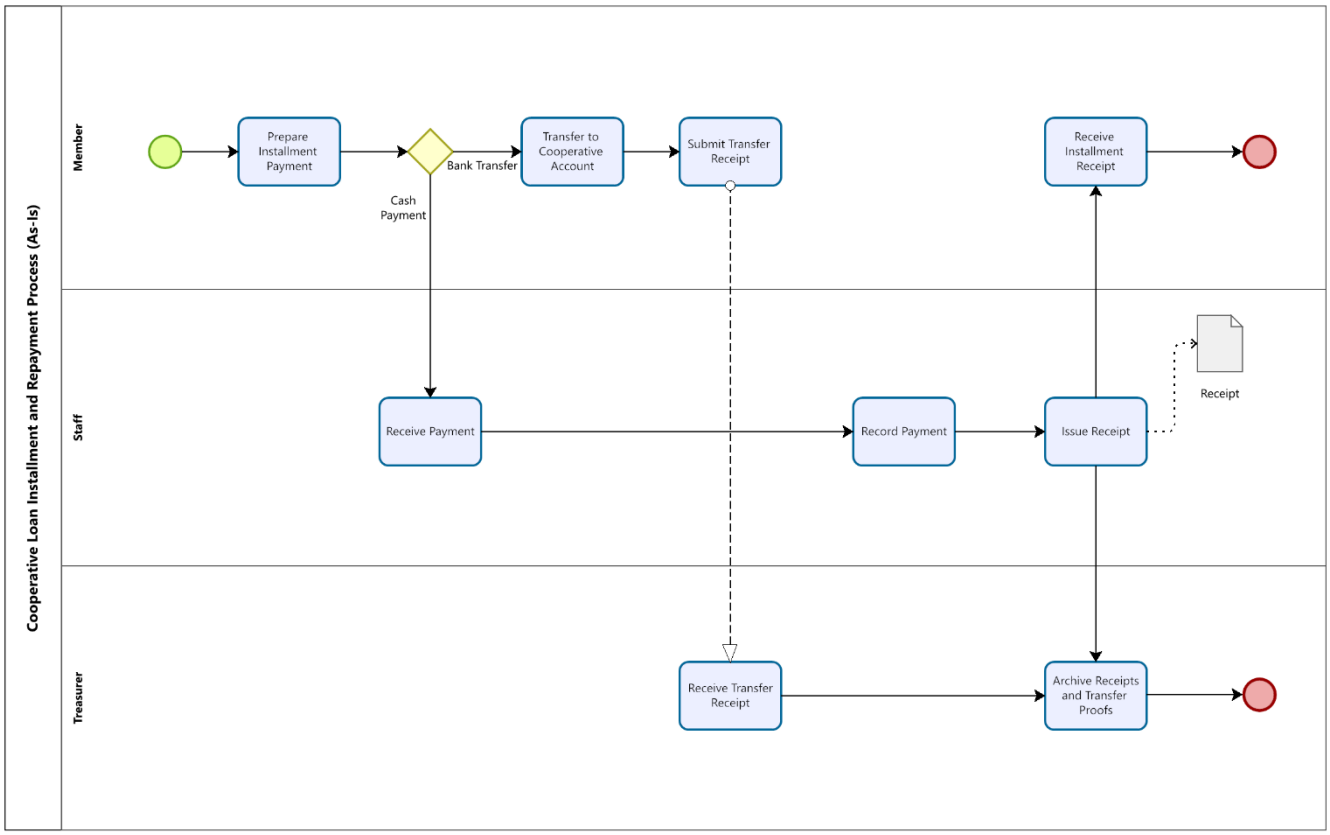



*Figure 5 Installment Payment Process (As-Is)*

Figure 5 presents the existing installment payment process. Members make installment payments either directly or through bank transfers and provide proof of payment to cooperative staff. The staff manually verify the payment, record the transaction, issue a receipt, and prepare reconciliation reports. All payment records are maintained through manual administrative procedures.

As shown in Figure 5, the process depends heavily on manual data entry and verification activities. This finding suggests that the existing workflow may be vulnerable to delays and data inconsistencies.

### *3.3 BPMN Analysis of Proposed Business Processes (To-Be)*

Based on the identified problems, a redesigned business process was developed to support digital business process implementation through the implementation of a web-based information system.

1. Loan Application Process (To-Be)

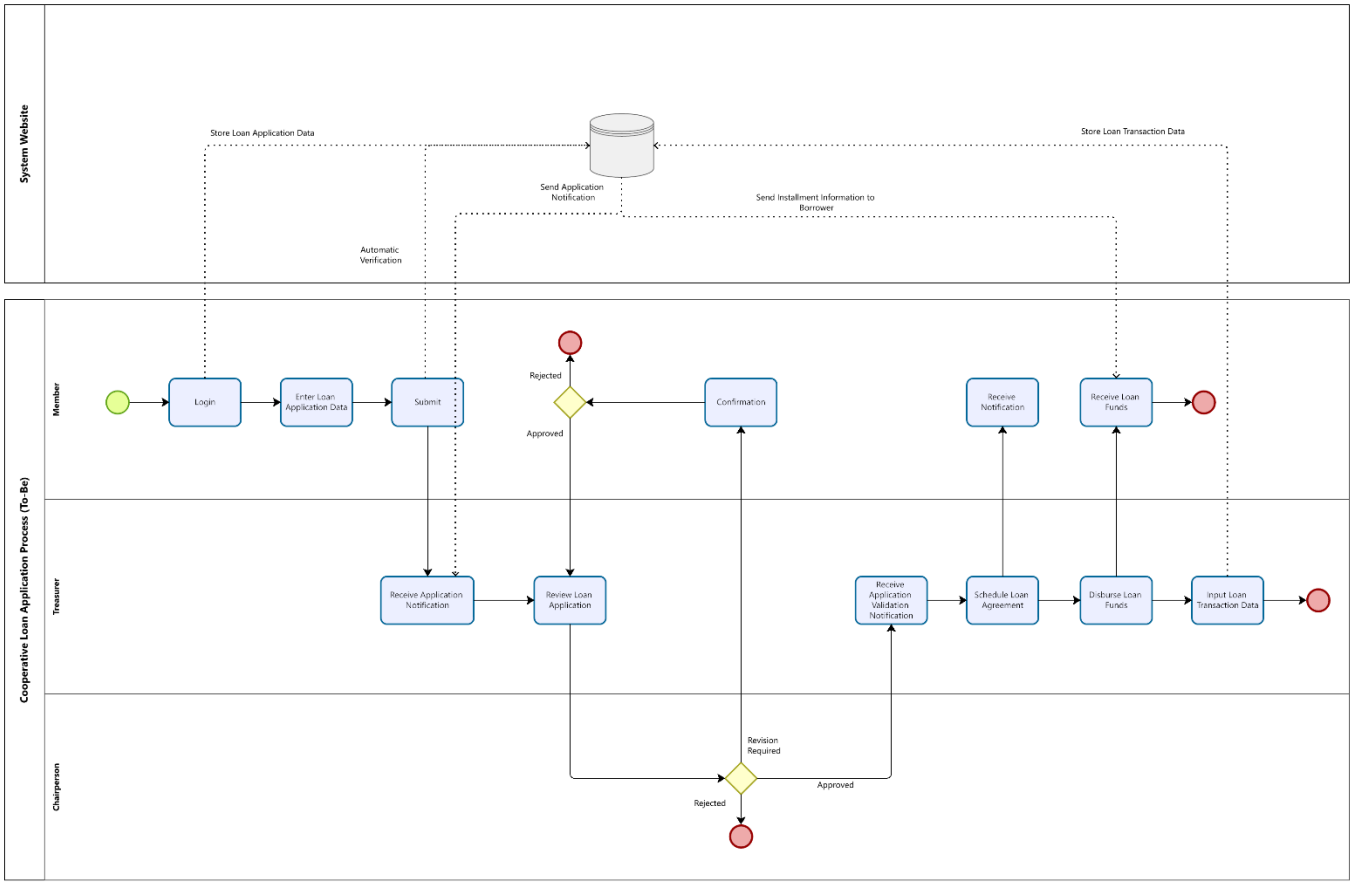



*Figure 6 Loan Application Process (To-Be)*

Figure 6 illustrates the redesigned loan application process. Members submit loan applications directly through the web-based information system. Submitted data are automatically stored in the database, and notifications are generated for authorized personnel. The treasurer and chairman perform verification and approval activities digitally through the system interface. Approved applications proceed to the loan disbursement stage, while rejected applications are communicated electronically to members. All transaction data are recorded automatically within the database.

The redesigned process demonstrates a reduction in manual administrative activities and introduces a digital workflow for loan processing.

2. Installment Payment Process (To-Be)

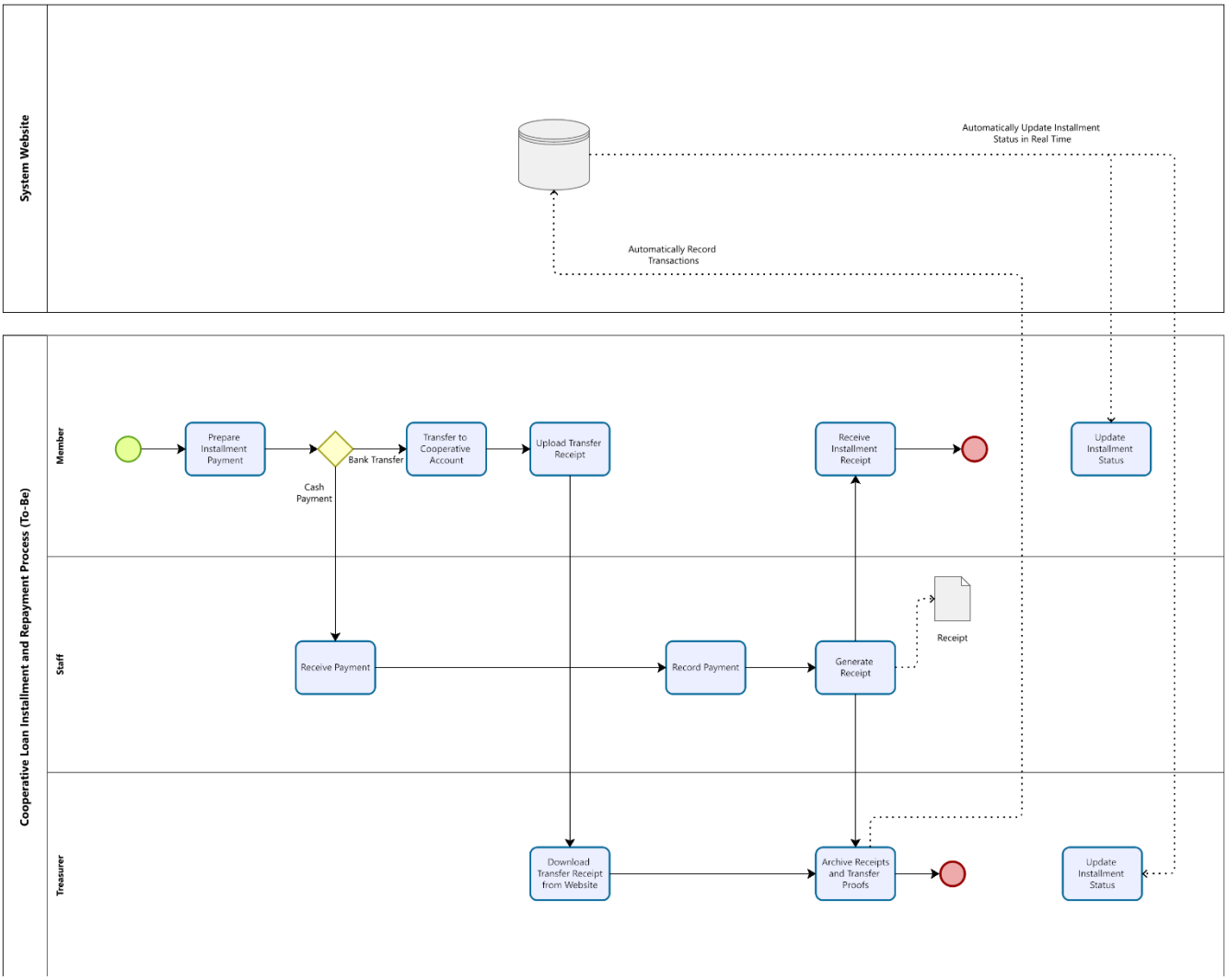



*Figure 7 Installment Payment Process (To-Be)*

Figure 7 presents the redesigned installment payment process. Members upload proof of payment through the system. After verification by authorized personnel, installment records are automatically updated in the database. Digital receipts are generated electronically and can be accessed through the system interface. The system also records installment histories and outstanding balances within a centralized database.

The results show that the proposed process enables automated transaction recording and centralized data management, thereby providing centralized access to transaction information and transaction traceability

*3.4 System Implementation*

The proposed system was implemented as a web-based application using Laravel Framework, Inertia.js, React.js, and MySQL. The application adopts a client-server architecture to support centralized data management and system scalability.

The developed system consists of several functional modules, including member management, savings management, loan management, installment payment management, and financial reporting. These modules support the operational activities of the cooperative through an integrated platform. The implementation results demonstrate that all core cooperative activities can be managed through a single information system, providing a centralized environment for transaction processing and reporting.

The system implements role-based access control by separating administrator and member interfaces. Administrators are authorized to manage master data, transaction records, and financial reports, whereas members are provided with access to personal savings, loan information, installment submission, and transaction history. This separation of user roles supports secure access to system functionalities according to users' responsibilities.

1. Login Interface

Figure 8 presents the login interface of the developed Savings and Loan Information System. The system provides authentication for both cooperative administrators and members through username and password verification. After successful authentication, users are redirected to their respective dashboards according to their assigned roles. This role-based authentication mechanism ensures that users can only access functionalities authorized for their responsibilities within the cooperative.

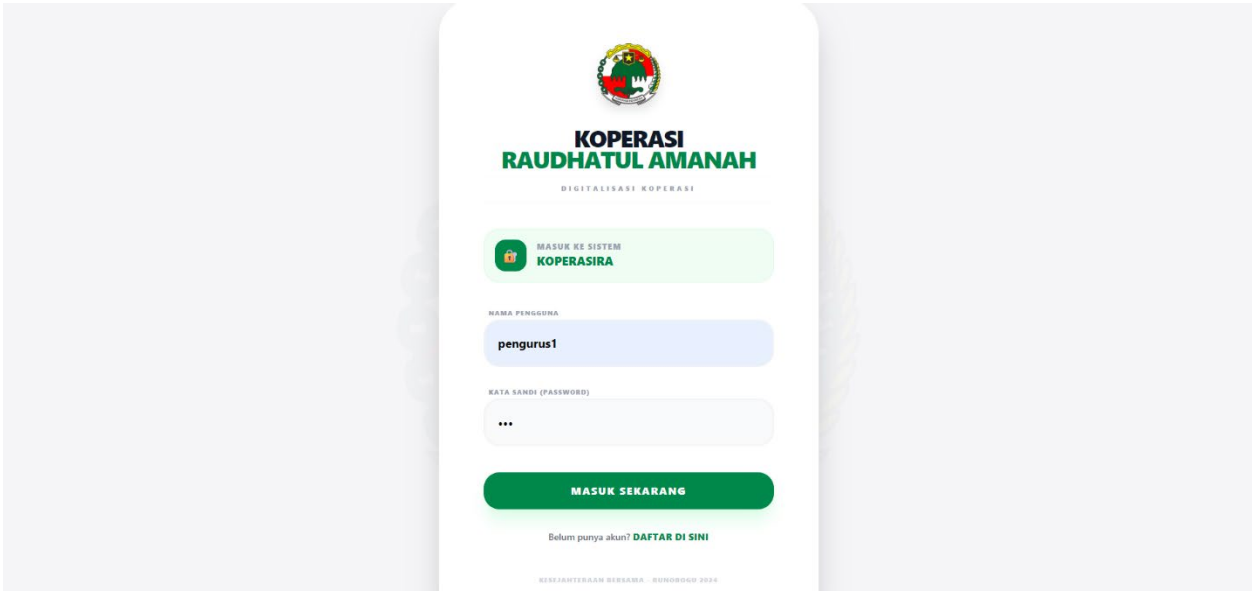



*Figure 8 Login Interface*

2. Administrator Dashboard

Figure 9 illustrates the administrator dashboard, which serves as the main interface for cooperative management. The dashboard provides summary information, including total cooperative cash, total loan disbursement, registered members, and active loan contracts. These indicators enable administrators to monitor operational activities through a centralized interface.

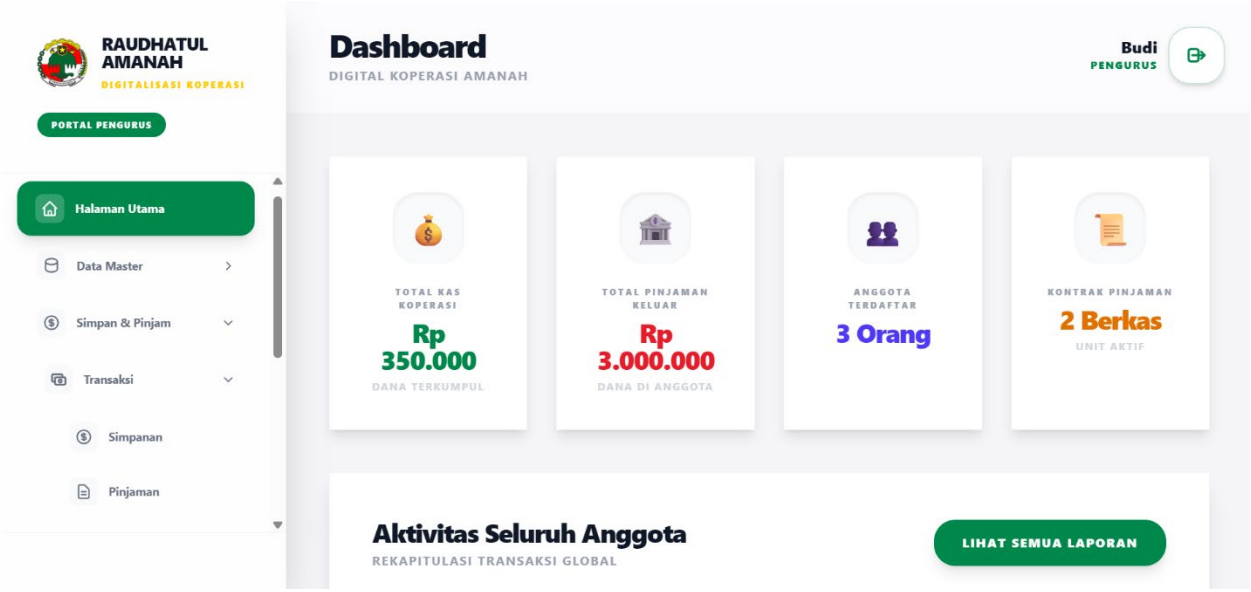



*Figure 9 Administrator Dashboard*

3. Member Dashboard

Figure 10 shows the member dashboard, which provides users with an overview of their personal financial information. Members can view their savings balance, remaining loan balance, active loan contracts, and recent transaction activities. The dashboard allows members to access their financial information through a single integrated interface.

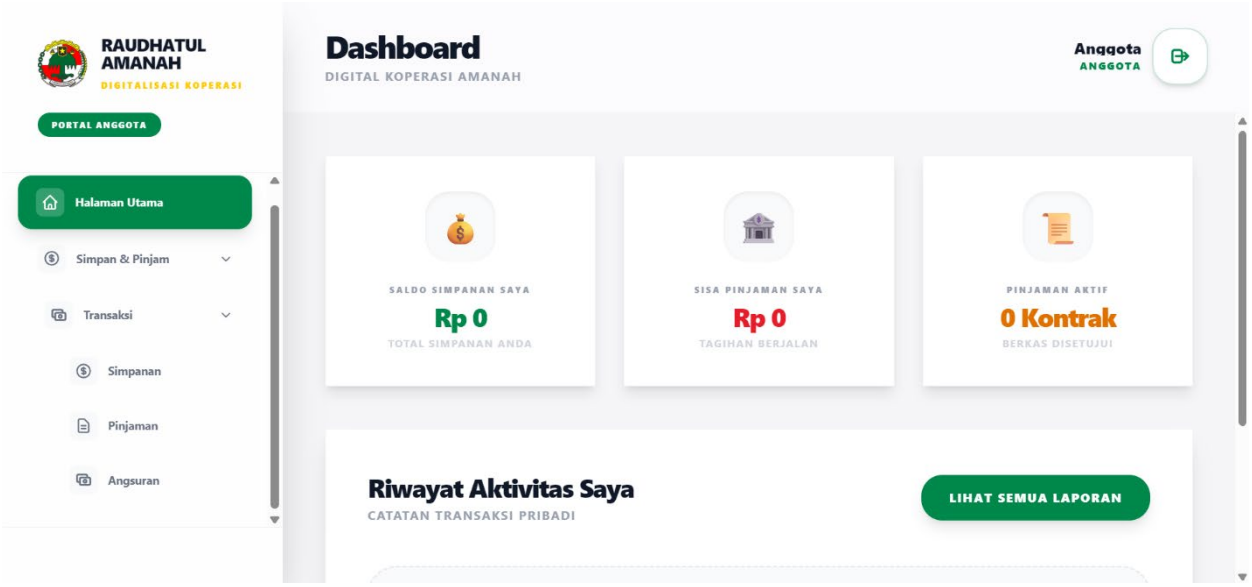



*Figure 10 Member Dashboard*

4. Saving Management

Figure 11 presents the savings management module. The system displays information regarding mandatory, principal, and voluntary savings, together with a transaction history for each member. The module enables members to monitor their savings records through a centralized database.

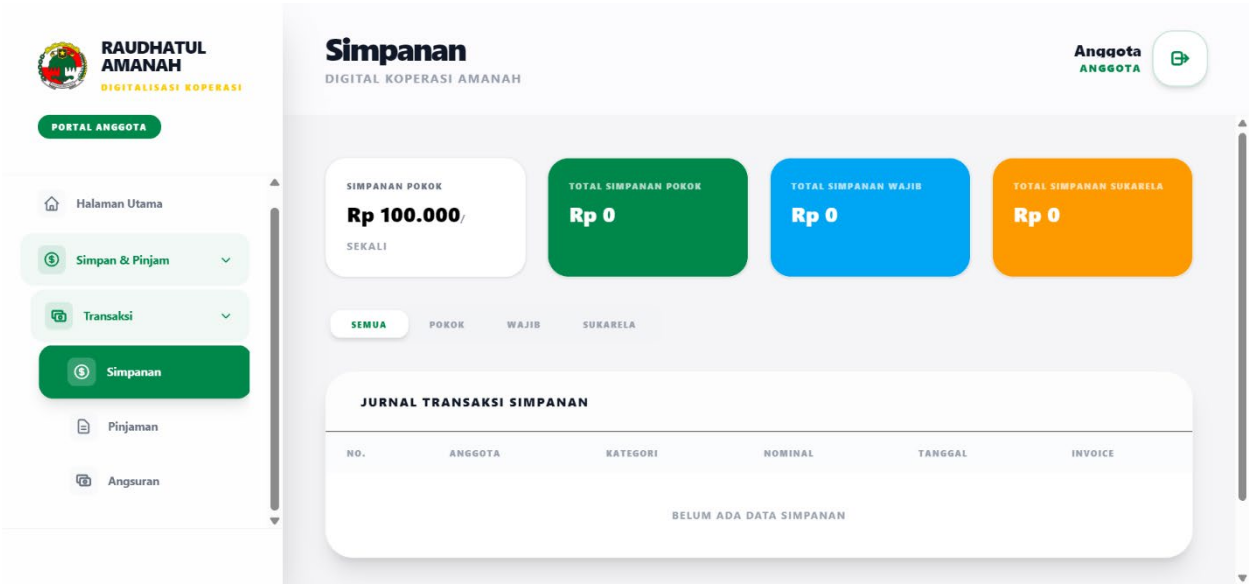



*Figure 11 Saving Management*

5. Loan Application

Figure 12 illustrates the loan application module. Members can submit loan requests by specifying the loan amount, repayment period, and supporting information. The submitted application is recorded in the system for further review by cooperative administrators.

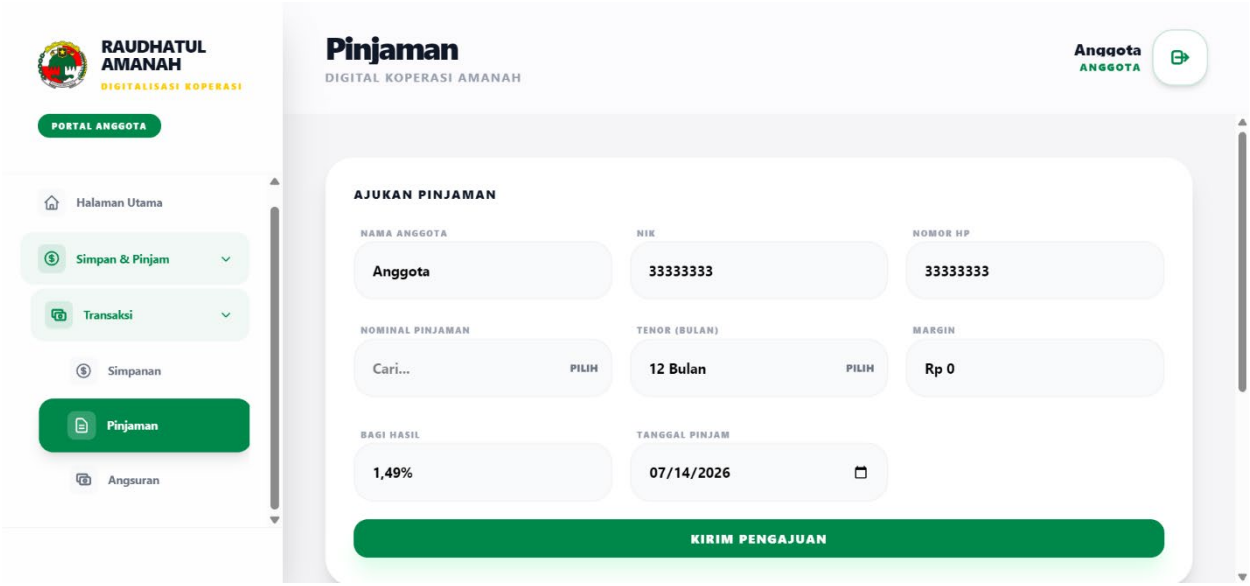



*Figure 12 Loan Application*

6. Installment Management

Figure 13 and 14 show the installment management module. The system supports installment recording by displaying borrower information, installment amount, payment sequence, and proof of payment. Administrators can review submitted installment records and verify payment information before updating the transaction status

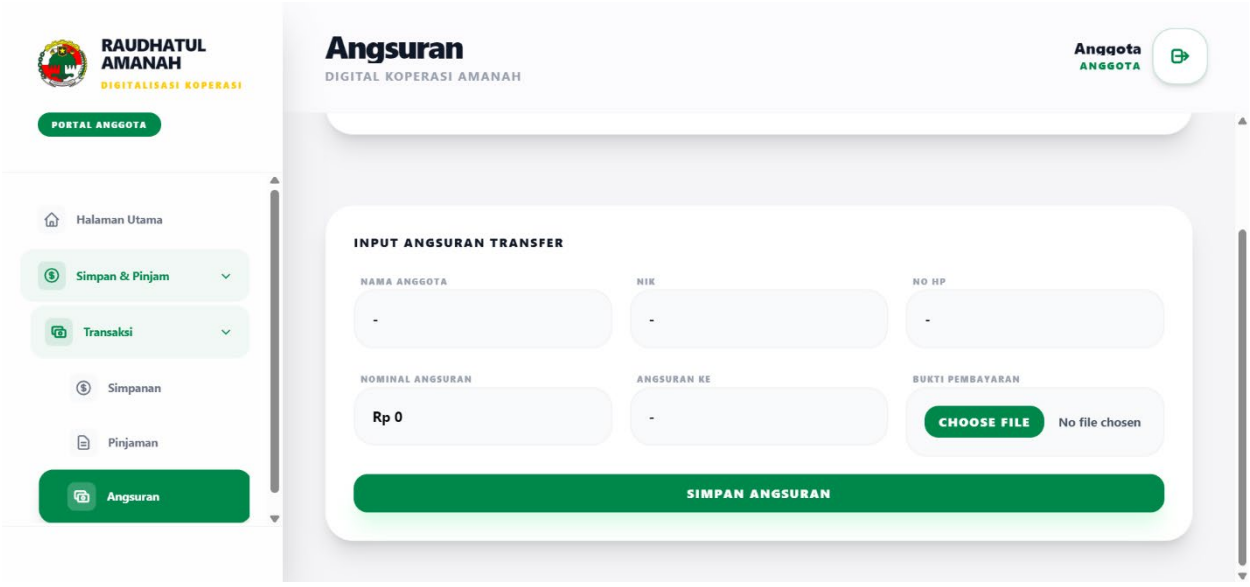



*Figure 13 Loan Installment (Member)*

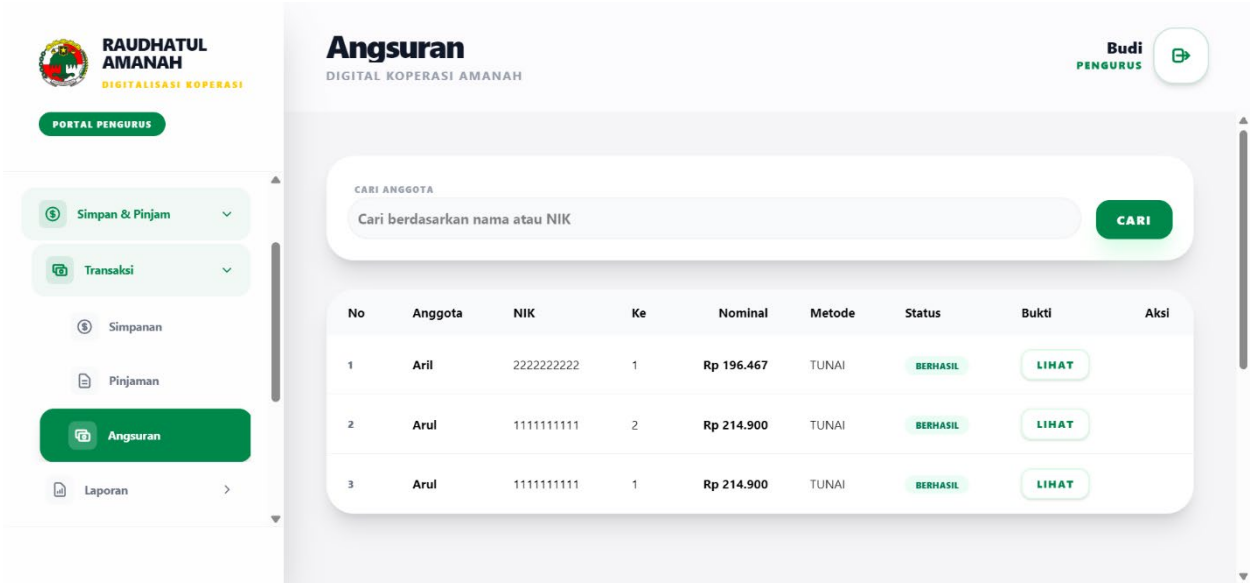



*Figure 14 Loan Installment (Administrator)*

7. Financial Reporting

Figure 15 presents the financial reporting module. Users can generate reports by selecting a reporting period and member information. The generated reports can be exported to spreadsheet format to support cooperative administrative activities and financial documentation.

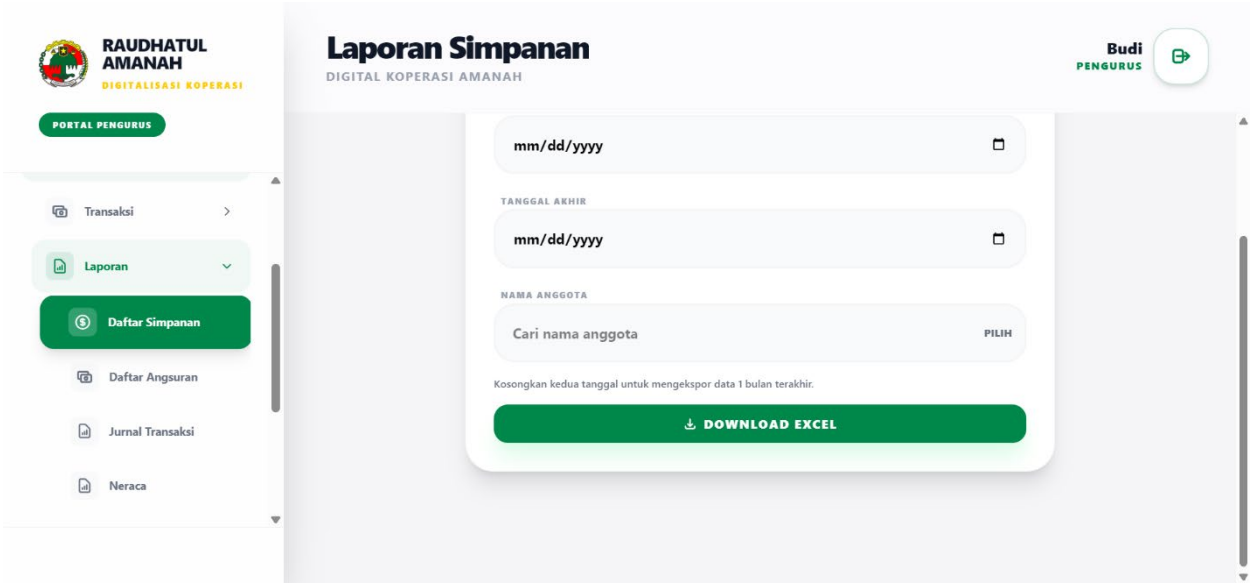



*Figure 15 Reporting*

### *3.5 System Testing*

System functionality was evaluated using the Black Box Testing method. The testing process focused on validating whether each system function operated according to the predefined requirements.

*Table 1 Website Testing*

| No | Function | Test Scenario | Expected Result | Result |
|---|---|---|---|---|
| 1 | Login | Enter a valid username and password | User is successfully authenticated and redirected to the dashboard | Pass |
| 2 | Logout | Click the logout button | User session is terminated and redirected to the login page | Pass |
| 3 | Change Password | Enter the current password, a new password, and confirm the new password | Password is successfully updated and can be used for subsequent login | Pass |
| 4 | Add Member | Enter valid member information and submit the form | New member data are successfully stored in the database | Pass |
| 5 | Edit Member | Modify existing member information and save the changes | Member information is successfully updated | Pass |
| 6 | Delete Member | Delete an existing member record | Selected member data are successfully removed from the database | Pass |
| 7 | Savings Transaction | Record a savings transaction with valid data | Savings transaction is successfully recorded and reflected in the member balance | Pass |
| 8 | Loan Application | Submit a loan application with valid information | Loan application is successfully recorded and awaits approval | Pass |
| 9 | Installment Payment | Record an installment payment | Installment payment is successfully recorded and the outstanding balance is updated | Pass |
| 10 | Financial Report | Generate a financial report for a selected period | Financial report is successfully generated and displayed | Pass |
| 11 | Search | Search for member or transaction data using keywords | Relevant search results are displayed correctly | Pass |
| 12 | Export Excel | Export the financial report to PDF format | Financial report is successfully generated and downloaded as a Excel document | Pass |

As shown in Table 1, presents the results of the Black Box Testing conducted to verify whether each functional module of the developed system operated according to the predefined functional requirements. The evaluation covered twelve core functionalities, including authentication, member management, savings transactions, loan processing, installment payments, financial reporting, search functionality, and PDF export. All test scenarios produced the expected outputs without functional errors, resulting in a 100% success rate. These findings indicate that the implemented system satisfies its specified functional requirements and is ready for operational use within the cooperative environment.

### *3.6 User Acceptance Testing (UAT)*

In addition to Black Box Testing, User Acceptance Testing (UAT) was conducted to evaluate users' perceptions of the developed Savings and Loan Information System. Unlike Black Box Testing, which focuses on verifying system functionality, UAT assesses whether the implemented system meets users' operational needs and expectations. The evaluation involved 20 respondents, consisting of cooperative administrators and members who had direct experience using the developed system. Respondents were asked to perform representative operational tasks, including member management, savings transactions, loan applications, installment payments, and financial reporting, before completing the evaluation questionnaire.

*Table 2 Likert Scale Used in User Acceptance Testing*

| Score | Response |
|---|---|
| 1 | Strongly Disagree |
| 2 | Disagree |
| 3 | Neutral |
| 4 | Agree |
| 5 | Strongly Agree |

The UAT questionnaire employed a five-point Likert scale to measure respondents' level of agreement with each statement. Higher scores indicate a more positive evaluation of the developed system in terms of usability, functionality, efficiency, and overall satisfaction.

*Table 3 User Acceptance Testing Questionnaire*

| No | Statement |
|---|---|
| Q1 | The login process and system access are easy to use and operate. |
| Q2 | The member management feature makes it easier to manage member information. |

| | |
|---|---|
| Q3 | The savings transaction feature is easy to use and supports daily transaction processing. |
| Q4 | The loan application and approval process is easier to perform using the developed system than the previous manual procedure. |
| Q5 | The installment payment feature simplifies recording and monitoring installment transactions. |
| Q6 | The financial reporting feature provides the information needed and is easy to understand. |
| Q7 | The interface design, menu structure, and navigation are clear and easy to understand. |
| Q8 | Overall, I am satisfied with the developed Savings and Loan Information System and consider it suitable for supporting cooperative operations. |

The questionnaire was designed to evaluate users' perceptions of the developed information system across several important aspects of system quality. These aspects include usability, functionality, operational efficiency, information quality, interface design, and overall user satisfaction. Each statement corresponds to one or more core functionalities of the developed Savings and Loan Information System.

*Table 4 User Acceptance Testing Responses*

| No | Statement | SD | D | N | A | SA | Weighted Score |
|---|---|---|---|---|---|---|---|
| Q1 | Login process and system access | 0 | 0 | 0 | 7 | 13 | 93 |
| Q2 | Member management feature | 0 | 0 | 1 | 3 | 16 | 95 |
| Q3 | Savings transaction feature | 0 | 0 | 0 | 2 | 18 | 98 |
| Q4 | Loan application feature | 0 | 0 | 0 | 1 | 19 | 99 |
| Q5 | Installment payment feature | 0 | 0 | 0 | 5 | 15 | 95 |
| Q6 | Financial reporting feature | 0 | 0 | 0 | 1 | 19 | 99 |
| Q7 | Interface design and navigation | 0 | 0 | 0 | 4 | 16 | 96 |
| Q8 | Overall satisfaction | 0 | 1 | 2 | 4 | 13 | 89 |

Table 4 presents the distribution of respondents' answers for each questionnaire item. The weighted score was calculated by multiplying the number of responses for each Likert scale category by its corresponding score and then summing the results. Since the questionnaire was completed by 20 respondents, the maximum possible weighted score for each statement was 100.

*Table 5 User Acceptance Testing Results*

| No | Weighted Score | Mean | Percentage | Interpretation |
|---|---|---|---|---|
| Q1 | 93 | 4.65 | 93% | Very Good |
| Q2 | 95 | 4.75 | 95% | Very Good |
| Q3 | 98 | 4.90 | 98% | Very Good |
| Q4 | 99 | 4.95 | 99% | Very Good |
| Q5 | 95 | 4.75 | 95% | Very Good |
| Q6 | 99 | 4.95 | 99% | Very Good |
| Q7 | 96 | 4.80 | 96% | Very Good |
| Q8 | 89 | 4.45 | 89% | Very Good |
| **Overall** | **764** | **4.78** | **95.5%** | **Very Good** |

The weighted scores were converted into mean scores and percentages to facilitate interpretation of the evaluation results. The findings indicate that all questionnaire items achieved acceptance levels above 89%, with an overall acceptance score of 95.5%, which falls within the Very Good category. These results suggest that respondents generally perceived the developed system as easy to use, functionally appropriate, and capable of supporting the operational activities of the cooperative.

*Table 6 Summary by Evaluation Aspect*

| Evaluation Aspect | Questions | Mean | Percentage | Interpretation |
|---|---|---|---|---|
| Usability | Q1 | 4.65 | 93% | Very Good |
| Functionality | Q2–Q3 | 4.83 | 96.5% | Very Good |
| Efficiency | Q4–Q5 | 4.85 | 97.0% | Very Good |
| Information Quality | Q6 | 4.95 | 99% | Very Good |
| Interface Design | Q7 | 4.80 | 96% | Very Good |
| Overall Satisfaction | Q8 | 4.45 | 89% | Very Good |
| **Overall Acceptance** | Q1–Q8 | **4.78** | **95.5%** | **Very Good** |

To provide a more comprehensive evaluation, the questionnaire items were grouped into six evaluation aspects. Among these aspects, Information Quality obtained the highest score (99%), indicating that respondents considered the generated information and reports to be clear and useful. Efficiency also received a high score (97%), suggesting that respondents perceived the developed system as supportive of operational activities such as loan processing and installment management. Although Overall Satisfaction recorded the lowest score (89%), it remained within the Very Good category, indicating a generally positive level of user acceptance.

The UAT results complement the Black Box Testing by providing evidence from the users' perspective. While Black Box Testing verified that all system functions operated according to the specified requirements, the UAT findings indicate that users

positively accepted the developed system in terms of usability, functionality, efficiency, and overall satisfaction. Together, these evaluations provide both functional and user-oriented evidence supporting the implementation of the proposed Savings and Loan Information System.

## 4 Discussion

### *4.1 Business Process Improvement Analysis*

The comparison between the As-Is and To-Be BPMN models indicates that the proposed business process redesign reduces manual activities and simplifies operational workflows by introducing integrated digital procedures. A comparison of the As-Is and To-Be BPMN models revealed a reduction in manual procedures, repetitive verification activities, and document-based administrative tasks.

One possible explanation for this observed differences is the integration of digital workflows into previously manual processes. In the loan application process, manual form submission and document circulation were replaced by online submission, automated notifications, and digital approval mechanisms. Similarly, the installment payment process was transformed through electronic payment verification, automatic transaction recording, and digital receipt generation. The proposed workflow is designed to reduce the number of manual activities required to complete each transaction and support information accessibility for both administrators and cooperative members.

Taken together, these results suggest that BPMN-based business process redesign provides a structured approach for identifying inefficiencies and developing more streamlined operational workflows prior to system implementation. These observations are consistent with previous studies emphasizing the importance of business process analysis prior to system implementation.

### *4.2 Impact of System Implementation*

Following implementation, operational data were centralized within a single database, enabling centralized information access and supporting transaction monitoring, report generation, and information retrieval. The system was designed to reduce data fragmentation compared with the previous manual process.

Following implementation, operational data became centralized within a single database, enabling real-time access to information and which may reduce the risk of data inconsistency. The system also supports transaction monitoring, report generation, and information retrieval processes.

*Table 7 Comparison of Operational Activities Before and After System Implementation*

| **Activity** | **Manual Process** | **Proposed System** |
|---|---|---|
| Loan Application | Paper-based submission | Online submission |
| Data Retrieval | Manual search through books/spreadsheets | Centralized database search |
| Report Generation | Manual compilation | Automated report generation |
| Transaction Monitoring | Manual monitoring | System-supported monitoring |

Table 7 presents a conceptual comparison between the manual business processes and the functionalities provided by the proposed information system. The comparison describes how the redesigned system supports digital workflows and centralized data management. It does not represent a quantitative measurement of organizational performance.

## 5 Conclusion

This study presented the design and implementation of a web-based Savings and Loan Information System for Koperasi Konsumen Raudhah Amanah Bunobogu by integrating BPMN-based business process redesign with the SDLC Waterfall development approach. The resulting system supports essential cooperative functions, including member management, savings transactions, loan processing, installment payments, and financial reporting through a centralized web-based platform.

The comparison between the As-Is and To-Be business process models illustrates how BPMN can be used to systematically redesign operational workflows prior to system development. This approach provides a structured foundation for aligning system functionalities with organizational business processes and operational requirements. In addition, the Black Box Testing results confirmed that all implemented system functions operated successfully according to the predefined functional specifications.

The findings suggest that combining business process modelling with information system development offers a systematic framework for supporting the digital transformation of savings and loan cooperatives. Rather than focusing solely on software implementation, this study demonstrates the value of incorporating business process analysis during system development to ensure that the proposed solution reflects organizational needs and existing operational workflows.

This study has several limitations. First, the system was developed and evaluated within a single cooperative environment, which may limit the generalizability of the findings to other organizational contexts. Second, the system evaluation focused primarily on functional verification through Black Box Testing. Second, although User Acceptance Testing was conducted to evaluate users' perceptions of the developed system, broader organizational impacts such as operational efficiency, processing time, productivity, service quality, and long-term organizational performance were not quantitatively measured. Future research should incorporate performance-based evaluations, user acceptance or usability testing, and implementations across multiple cooperative settings to provide more comprehensive evidence regarding the effectiveness of the proposed system.

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