Proposed Architecture and Design for AgriFinance: An Integrated Cooperative System for Savings, Loans, and Farm Product Marketing for ACAC

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ABSTRACT

This study proposes AgriFinance, an integrated cooperative system designed to improve the operations of the Alaminos City Agriculture Cooperative (ACAC) in Alaminos City, Pangasinan. Existing ACAC processes involving membership, savings, share capital, loans, repayments, farm-product purchases, and farm-input management rely on manual checking, paper-based records, multiple transaction steps, and office-based procedures, which may complicate record-keeping and transaction processing. To address these challenges, the study designed a Progressive Web App (PWA)-based system that integrates these services while retaining the existing roles and responsibilities of cooperative members and personnel. The study employed a descriptive-developmental research design guided by the Agile Software Development Life Cycle. A total of 66 respondents were selected through purposive sampling, including farmer-members, new applicants, the General Manager, Loan Officer, Credit Committee members, Board of Directors members, and the System Administrator. Data were collected through structured questionnaires, interviews, and a review of relevant ACAC forms and documents to identify existing processes, operational challenges, and system requirements.

The proposed AgriFinance system includes digital membership registration, savings and share capital management, loan eligibility checking, loan application and approval routing, repayment and renewal, a digital passbook, QR Ph payment through PayMongo, farm-product and farm-input management, notifications, and role-based functions. For approved loans, members may designate a GCash, Maya, or bank account as the preferred destination for loan proceeds, while the actual transfer remains manually processed by authorized cooperative personnel. The system adopts a three-tier architecture comprising the Presentation, Application, and Data tiers. Selected components, including user login, email-based account verification, the member dashboard, membership registration, and QR Ph payment in a demonstration environment, are available in the current implementation, while several modules remain at the interface prototype or proposed stage and require further development and testing. ISO/IEC 25010 is proposed as the basis for future system quality evaluation. Deployment and user acceptability evaluation remain future work.

Keywords: Agricultural Cooperatives, Cooperative System, Loan Management, Digital Transformation, Finance

INTRODUCTION

Agricultural cooperatives play an important role in supporting farmers by providing access to financial resources, agricultural inputs, and markets. In the Philippines, agricultural cooperatives commonly provide services such as credit provision, commodity procurement and distribution, and agricultural input facilitation, while also contributing to farmers' participation in agricultural markets. However, cooperatives continue to face challenges related to access to finance, market competition, governance, and other operational constraints [10]. Agricultural

credit is particularly important to agricultural production because it supports the purchase of farm inputs and helps improve the productivity of smallholder farmers. Despite government lending efforts, small farmers and fisherfolk in the Philippines continue to experience challenges related to credit access, transaction costs, market conditions, and repayment capacity [2].

The increasing use of digital technologies has created opportunities to improve agricultural and cooperative services. In the Philippines, digital technologies are being applied in areas such as agricultural information services, finance, e-commerce, online marketplaces, and mobile and web-based platforms that can improve access to information, markets, and financial services [4]. Digital technologies have also been applied to cooperative financial activities, with research on farmers' cooperatives identifying digital credit as an emerging financing mechanism that may simplify credit procedures and improve access to cooperative loans [11]. Recent research on agricultural cooperative management further identifies digital transformation as involving technological infrastructure, organizational readiness, human-resource capacity, and institutional conditions, highlighting the importance of digital systems in improving cooperative management and operational efficiency [6].

Despite these developments, there remains a need for integrated systems that address multiple cooperative operations within a single platform. Basir et al. found that manual agricultural recordkeeping can introduce errors, data gaps, and inconsistencies, while paper-based records may be time-consuming to maintain and difficult to retrieve. This highlighted the growing need for integrated and user-friendly digital technologies for agricultural recordkeeping [1]. Previous Philippine research has demonstrated the use of information systems to automate specific agricultural cooperative processes. Devero et al. developed the CATAFA Management Information System to address manual processes involving membership registration, loan applications and transactions, savings account management, and member transaction records [5]. These studies show how information systems can improve specific cooperative processes. However, there is still a need for a system that combines financial services and farm-related transactions based on the operational needs of ACAC.

This study proposes AgriFinance: An Integrated Cooperative System for Savings, Loans, and Farm Product Marketing for ACAC, a Progressive Web App (PWA)-based system designed to connect farmer-members with cooperative financial and agricultural services while providing authorized cooperative personnel with a centralized management platform. The proposed system applies role-based access control to assign functions according to the responsibilities of members and cooperative personnel. Member services include digital membership registration, savings and share capital management, loan eligibility checking, loan application and monitoring, repayment and renewal, digital passbook, digital payment support, farm-product transaction records, farm-input information, and notifications. For cooperative personnel, the system provides functions for membership approval, savings and share capital processing, loan verification and approval, repayment and renewal management, farm-product and farm-input management, user and role administration, system configuration, and audit log monitoring.

The proposed AgriFinance system also incorporates QR Ph-based online payment through PayMongo for applicable cooperative transactions. For approved loan proceeds, members may provide a preferred GCash, Maya, or bank account as the destination for disbursement. However, the system does not automatically transfer or disburse loan proceeds. Authorized cooperative personnel, particularly the General Manager/Cashier, review the approved loan transaction and manually process the corresponding transfer using the member's registered payment or bank details. Through these functions, the proposed system aims to bring cooperative financial and agricultural services together in one digital platform.

This study aims to: (1) identify the existing processes and operational requirements of ACAC related to membership, savings, share capital, loans, and farm-product marketing; (2) determine the challenges encountered by cooperative members and personnel in the existing processes; (3) design the proposed architecture and integrated system features based on the identified needs and requirements; and (4) propose a framework, based on the ISO/IEC 25010 software quality standard, for evaluating the user acceptability of AgriFinance once deployed. In identifying the operational requirements that shaped the proposed architecture and design, the study involved 66 respondents consisting of 50 farmer-members, 5 new applicants, 1 General

Manager, 1 Loan Officer, 3 Credit Committee members, 5 Board of Directors members, and 1 System Administrator. The study is limited to the operations of ACAC and focuses on the design and development of the proposed system; long-term deployment, post-deployment evaluation, and expansion to other cooperatives are outside the scope of the study.

METHODOLOGY

This study employed a descriptive-developmental research design. The descriptive component was used to examine the existing processes of the Alaminos City Agriculture Cooperative (ACAC) and identify the challenges encountered by members and cooperative personnel in membership, savings, share capital, loan processing, repayment, and farm-product marketing. The developmental component guided the design and development of the proposed AgriFinance: An Integrated Cooperative System for Savings, Loans, and Farm Product Marketing for ACAC. This approach enabled the researchers to examine existing cooperative processes and use the identified requirements as the basis for the proposed system. The Agile Software Development Life Cycle (SDLC) was adopted because it supports iterative development, collaboration, and adjustments based on changing requirements [3]. The development process was organized into six stages: Requirements, Design, Development, Testing, Deployment, and Review. These stages served as a guide for organizing the system requirements, design, and development activities.

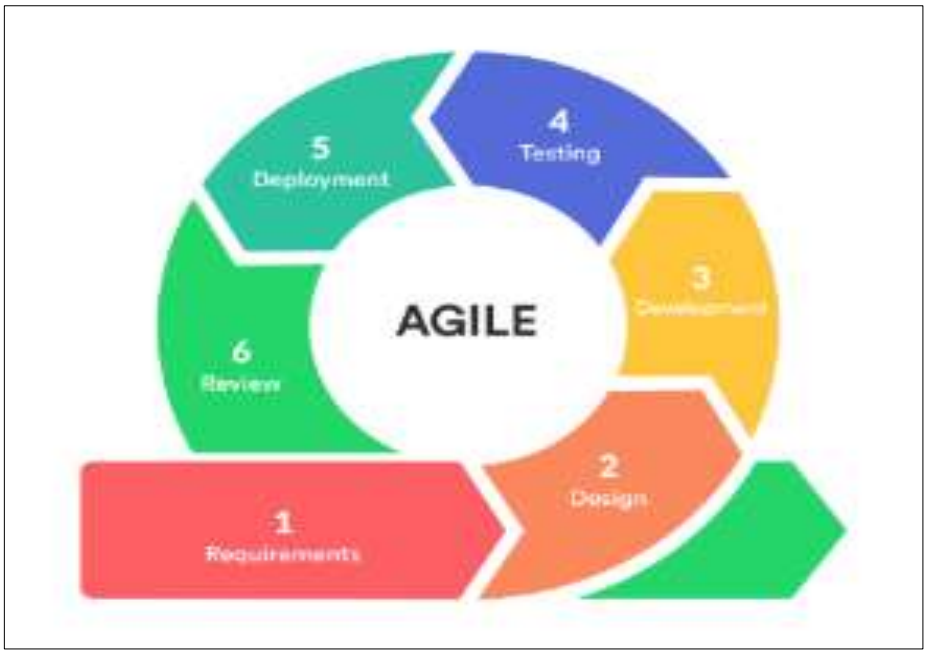


Figure 1. Agile Methodology

The study was conducted at the Alaminos City Agriculture Cooperative (ACAC) in Alaminos City, Pangasinan. A total of 66 respondents were selected through purposive sampling based on their direct involvement in or familiarity with the cooperative processes covered by the proposed system. The respondents included farmer-members, new applicants, the General Manager, Loan Officer, Credit Committee members, Board of Directors members, and the System Administrator. Farmer-members and new applicants provided information about membership and member-related services, while cooperative personnel and officials provided information about administrative procedures, savings, share capital, loan processing and approval, repayment, farm-product purchasing, and system management.

Data collection was conducted from May to September 2026 using structured questionnaires, interviews, and a review of relevant ACAC forms and documents. The questionnaires gathered information about the respondents' experiences and concerns regarding the cooperative's existing processes and services. An interview with Dr. Solomon B. Tablang was conducted to obtain detailed information about ACAC's operational procedures, including membership, savings, share capital, loan application and approval, repayment, renewal, farm-product

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purchasing, farm-input transactions, and payment-related activities. Relevant ACAC forms and documents were also reviewed to understand the requirements, information, financial computations, and records used in the existing processes.

The collected information was organized according to the operational areas covered by the study. Existing process requirements and reported difficulties were identified from the questionnaire responses, interview information, and document review. These findings served as the basis for the functional requirements, system features, and proposed workflows of AgriFinance. The proposed workflows were presented to Dr. Solomon B. Tablang to verify whether they were consistent with ACAC's actual procedures. Respondents provided consent to participate, and the information gathered was kept confidential and accessible only to the research team for purposes of the study.

Table 1. Respondents of the Study

Respondents	Number of Respondents
Farmer-members	50
New Applicants	5
Board of Directors	5
Credit Committee	3
General Manager	1
Loan Officer	1
System Administrator	1
Total Respondents	66

RESULTS AND DISCUSSION

The results of the assessment of the existing processes of the Alaminos City Agriculture Cooperative (ACAC) were organized according to the operational areas covered by the study, including membership, savings and share capital, loan processing and repayment, and farm-product marketing. The findings were derived from the information gathered through questionnaires, interviews, and review of relevant ACAC forms and documents. These results were used to identify the operational requirements that informed the proposed architecture and features of the AgriFinance system.

Table 2. Requirements Traceability Matrix for the Proposed AgriFinance System

Existing Process / Problem	Evidence Source	Identified Requirement	Responsible Stakeholder	Proposed Priority	Design Component / Feature	Planned Acceptance Test
Membership: Applicant needs to visit the office, submit requirements, pay the ₱100	Interview; ACAC forms/documents	Digital membership registration, document submission,	New Applicants; BOD	High	Digital Membership Registration	Verify that an applicant can submit membership information and required documents

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membership fee, and wait for approval.		and approval				and that the application can be routed for approval.
Loan Eligibility: Staff manually checks whether the member has the required ₱2,000 share capital.	Interview; ACAC records	Automated checking of share capital requirement before loan application	Farmer-members; Loan Officer	High	Loan Eligibility Checker	Verify that the system checks the member's share capital before allowing a loan application.
Loan Application: Member obtains and submits an application form and promissory note.	Interview; ACAC forms/documents	Digital loan application and submission of required documents	Farmer-members; Loan Officer	High	Digital Loan Application	Verify that a member can submit a loan application with the required information and documents.
Loan Approval: Loan Officer checks the application and routes it to the appropriate approving authority based on the loan amount.	Interview; workflow verification	Loan approval routing according to the cooperative's approval structure	Loan Officer; General Manager; Credit Committee; BOD	High	Loan Approval Routing	Verify that loan applications are routed to the appropriate approving authority and that Credit Committee and BOD voting decisions are recorded according to the applicable majority requirement.
Financial Records: Cooperative transactions are maintained	Questionnaire; interview; ACAC records	Centralized recording of member financial transactions	Farmer-members; General Manager/Cashier	High	Digital Passbook	Verify that savings, share capital, loan, and repayment records can

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through separate records.						be recorded and retrieved consistently.
Loan Voucher: Loan amounts, deductions, and farm-input amounts are manually written and computed.	Interview; ACAC forms/documents	Digital recording and computation of loan voucher information	General Manager/Cashier; Loan Officer	High	Digital Loan Voucher	Verify that applicable loan amounts and deductions are correctly recorded and reflected in the loan voucher.
Farm Products: Rice, seeds, and other farm-product transactions are manually recorded.	Interview; ACAC records	Digital recording of available farm-product purchases	Farmer-members; General Manager/Cashier	Medium	Farm Product Management	Verify that available farm products and member purchase transactions can be recorded and retrieved.
Farm Inputs: Pesticides, herbicides, fertilizers, and their prices are manually recorded.	Interview; ACAC records	Digital access to farm-input information, prices, and purchase transactions	Farmer-members; General Manager/Cashier	Medium	Farm Input and Price Management	Verify that members can view available farm inputs and prices and that ordinary purchases can be recorded through the system, while farm-input purchases made through a loan are processed through the loan application and loan

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						voucher workflow.
Payment: Members expressed a need for a more convenient payment option.	Questionnaire; interview	Digital payment option for applicable cooperative transactions	Members; General Manager/Cashier	High	QR Ph Payment through PayMongo	Verify that a payment can be initiated and that its transaction status and corresponding record are properly reflected in the system.
Loan Disbursement: Approved loan proceeds are manually transferred by authorized cooperative personnel.	Interview; ACAC records	Recording and monitoring of approved loan disbursement while retaining manual transfer by authorized personnel	General Manager/Cashier	High	Manual Loan Disbursement Monitoring	Verify that approved loan details, the member's preferred receiving account, transfer status, and disbursement records can be recorded and reconciled.

Proposed priorities reflect the researchers' assessment of the operational importance of each requirement. Planned acceptance tests describe the intended validation activities for future testing and do not represent completed test results.

The analysis identified several ACAC processes that still involve manual checking, paper-based records, and multiple transaction steps. The findings were translated into specific system requirements for membership registration, loan eligibility checking, digital loan application, loan approval routing, centralized financial records, digital loan vouchers, farm-product management, farm-input management, and digital payment support. The requirements were derived from the questionnaire responses, interview information, and review of relevant ACAC forms and records, and were further organized according to the stakeholders involved in each process.

The analysis distinguished ordinary agricultural purchases from loan-related transactions. Members may purchase available farm products and farm inputs through the proposed system as regular cooperative transactions. Farm inputs may be purchased as regular transactions or included in an approved loan. When included in a loan, the farm-input amount is recorded in the loan voucher. The ₱2,000 share capital requirement applies to loan eligibility and does not prevent members from making ordinary purchases. For approved loans, members may provide a preferred GCash, Maya, or bank account as the destination for loan proceeds. The actual transfer remains manually processed by authorized cooperative personnel. These requirements formed the basis for the proposed system features and workflows.

Previous research has demonstrated the application of ISO/IEC 25010 in evaluating a loan origination system, particularly in assessing functional suitability through functional appropriateness, functional correctness, and

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functional suitability compliance [9]. ISO/IEC 25010 is proposed as the basis for the future evaluation of AgriFinance once the system is deployed. The standard provides a product quality model that can guide the specification, measurement, and evaluation of software quality [8]. Since the present study focuses on the proposed architecture and system design, actual quantitative evaluation results are not yet available. Future evaluation of AgriFinance may therefore use the applicable quality characteristics of ISO/IEC 25010 as criteria for assessing the system after deployment.

Proposed User Acceptability Evaluation Framework

The proposed user acceptability evaluation framework for AgriFinance is based on applicable quality characteristics of ISO/IEC 25010. It is intended to guide the future evaluation of the system once the relevant modules have been implemented and are ready for testing. The framework identifies the evaluation criteria, indicators, target evaluators, and assessment methods to determine whether AgriFinance meets the operational needs of farmer-members, new applicants, and authorized cooperative personnel.

The proposed framework covers functional suitability, usability, reliability, security, and compatibility. Functional suitability assesses whether implemented functions perform their intended tasks correctly. Usability examines the clarity of the interface and ease of navigation. Reliability considers the consistency of transaction records and the handling of errors. Security evaluates role-based access restrictions and the protection of membership and financial information. Compatibility examines whether the system operates properly in its intended browsers and devices.

The planned evaluators will include representative farmer-members, new applicants, and authorized cooperative personnel. Once the relevant AgriFinance modules have been developed and are ready for testing, the system will undergo evaluation using role-appropriate tasks, a structured questionnaire based on a five-point Likert scale, and functional tests.

Questionnaire ratings will be summarized using appropriate descriptive statistics, while functional and security tests will be assessed against predefined expected results. The acceptance criteria will be established before the evaluation is conducted. Modules that remain at the interface prototype or proposed stage will not be subjected to functional evaluation or treated as evidence of completed system performance.

Since this study focuses on the proposed architecture and design of AgriFinance, the framework serves as a plan for future evaluation rather than a report of completed user acceptability testing. Actual ratings and evaluation results will be determined only after the evaluation has been conducted.

Table 3. Proposed User Acceptability Evaluation Framework for AgriFinance

Evaluation criterion	Indicators	Planned evaluation method	Proposed acceptance criteria	Target evaluators
Functional suitability	Correctness of implemented functions and completion of intended tasks	Role-based task execution and functional testing	All required functional test cases must produce the expected results.	Members, applicants, and authorized personnel
Usability	Ease of navigation, clarity of instructions, and	Five-point Likert questionnaire and task walkthrough	Mean rating of at least 4.00 out of 5.00, interpreted according to	Members, applicants, and authorized personnel

	ease of completing tasks		the proposed rating scale.	
Reliability	Consistency of transaction records and handling of failed or incomplete operations	Transaction test scenarios and record verification	All required test scenarios must produce the expected transaction records, with no unresolved discrepancies in the tested cases.	General Manager/Cashier, Loan Officer, and designated testers
Security	Appropriate role-based access and restriction of unauthorized actions	Role and permission tests	All required access-control tests must pass; unauthorized actions must be blocked.	System Administrator and authorized personnel
Compatibility	Proper operation in intended browsers and supported devices	Browser and device compatibility tests	All designated supported browser and device combinations must pass the predefined compatibility tests.	Designated testers and representative users

The framework and evaluation methods are proposed for future evaluation. Actual results have not yet been obtained. Specific acceptance thresholds and test conditions should be defined before conducting the evaluation.

The proposed acceptance criteria establish measurable conditions for the future evaluation of AgriFinance. For questionnaire-based usability assessment, a mean rating of at least 4.00 out of 5.00 is proposed as the minimum acceptable result. Functional suitability, reliability, security, and compatibility will be assessed through predefined test cases with expected results and pass-or-fail conditions. All required test cases must pass for the evaluated feature to satisfy its corresponding technical acceptance criterion. These thresholds are proposed for the study and must be finalized before evaluation. They do not indicate that the system has already passed the assessment.

Table 4. Proposed Rating Scale and Descriptive Interpretation for User Acceptability Evaluation

Scale	Statistical Limits	Rating	Descriptive Interpretation
1	1.00–1.80	Poor	Needs improvement; not functioning properly.
2	1.81–2.60	Fair	Functioning is fair; needs some changes.
3	2.61–3.40	Good	Works as intended but has minor issues.
4	3.41–4.20	Very Good	Functioning properly and effectively.
5	4.21–5.00	Excellent	Functioning very well and fully accepted.

The rating scale and statistical limits are proposed for the future evaluation of AgriFinance and should be finalized before data collection.

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Table 5. Implementation Status of AgriFinance Components

Component / Function	Implementation Status	Description
User Login / Authentication	Implemented / Working	The current implementation provides functional user login and authentication.
Member Homepage / Dashboard	Implemented / Working	The current implementation provides the member homepage/dashboard interface.
Membership Registration	Implemented / Working	The current implementation allows applicants to complete the membership registration form and proceed to the membership payment process. Document upload is not yet enabled.
QR Ph Payment	Implemented / Demonstration	QR Ph payment through PayMongo is demonstrated using a ₱5 test transaction amount. This amount is for testing purposes and does not represent the actual ACAC membership fee of ₱100.
Savings and Share Capital	Interface Prototype / Proposed	The proposed interface represents the recording and monitoring of savings and share capital transactions.
Loan Eligibility	Interface Prototype / Proposed	The proposed design includes checking the ₱2,000 minimum share capital requirement before loan application.
Loan Application	Interface Prototype / Proposed	The proposed interface represents digital loan application and submission of required documents.
Loan Approval Routing	Interface Prototype / Proposed	The proposed design represents routing loan applications to the appropriate approving authority based on the applicable approval structure.
Digital Loan Voucher	Interface Prototype / Proposed	The proposed design represents the recording of loan amounts and applicable deductions in the loan voucher.
Repayment and Renewal	Interface Prototype / Proposed	The proposed design represents repayment monitoring and loan renewal through a new loan application.
Farm Product Management	Interface Prototype / Proposed	The proposed design supports the recording and management of farm-product purchases.
Farm Input Management	Interface Prototype / Proposed	The proposed design supports farm-input information, prices, and purchase transactions.

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Loan Disbursement Monitoring	Interface Prototype / Proposed	The proposed system records and monitors approved loan disbursement while the actual transfer remains manually processed by authorized cooperative personnel.
Notifications	Interface Prototype / Proposed	The proposed design includes notifications for relevant cooperative transactions and loan-related activities.
Role-Based Management	Interface Prototype / Proposed	The proposed design provides role-specific functions for cooperative personnel and administrators.

Table 5 presents the implementation status of the AgriFinance system components, distinguishing the functions currently working from those presented as interface prototypes or proposed features. Membership registration, user login, the member homepage, and QR Ph payment are functional in the current implementation. The QR Ph payment feature is demonstrated through PayMongo using a ₱5 test transaction amount, while the actual ACAC membership fee identified during requirements gathering is ₱100. The difference reflects the use of a test amount during the demonstration and does not change the actual membership fee. The remaining components, including savings and share capital, loan processing, repayment, farm-product and farm-input management, and loan disbursement monitoring, are presented as proposed interfaces or system functions. The document-upload interface shown as unavailable in the prototype is an incomplete interface element; document submission remains part of the proposed membership and loan application processes. This distinction clarifies the current development status of AgriFinance and avoids presenting proposed functions as fully implemented features.

Proposed Payment and Financial Transaction Controls

The proposed AgriFinance system includes additional controls for payment verification and financial transaction management that require further development and testing. These include the review of submitted payment evidence by the General Manager, proper handling of pending and failed payments, prevention of duplicate payment records, and maintenance of audit records showing who reviewed, confirmed, or updated financial transactions.

The proposed system also aims to support the reconciliation of recorded loan disbursements with the actual transfers processed manually by the General Manager. Transfer details and supporting evidence should be reviewed against the corresponding system records to help ensure accurate and consistent financial records. These controls are intended to improve the accuracy, traceability, and reliability of financial transactions. However, they remain proposed controls and require further implementation and testing before their effectiveness can be assessed.

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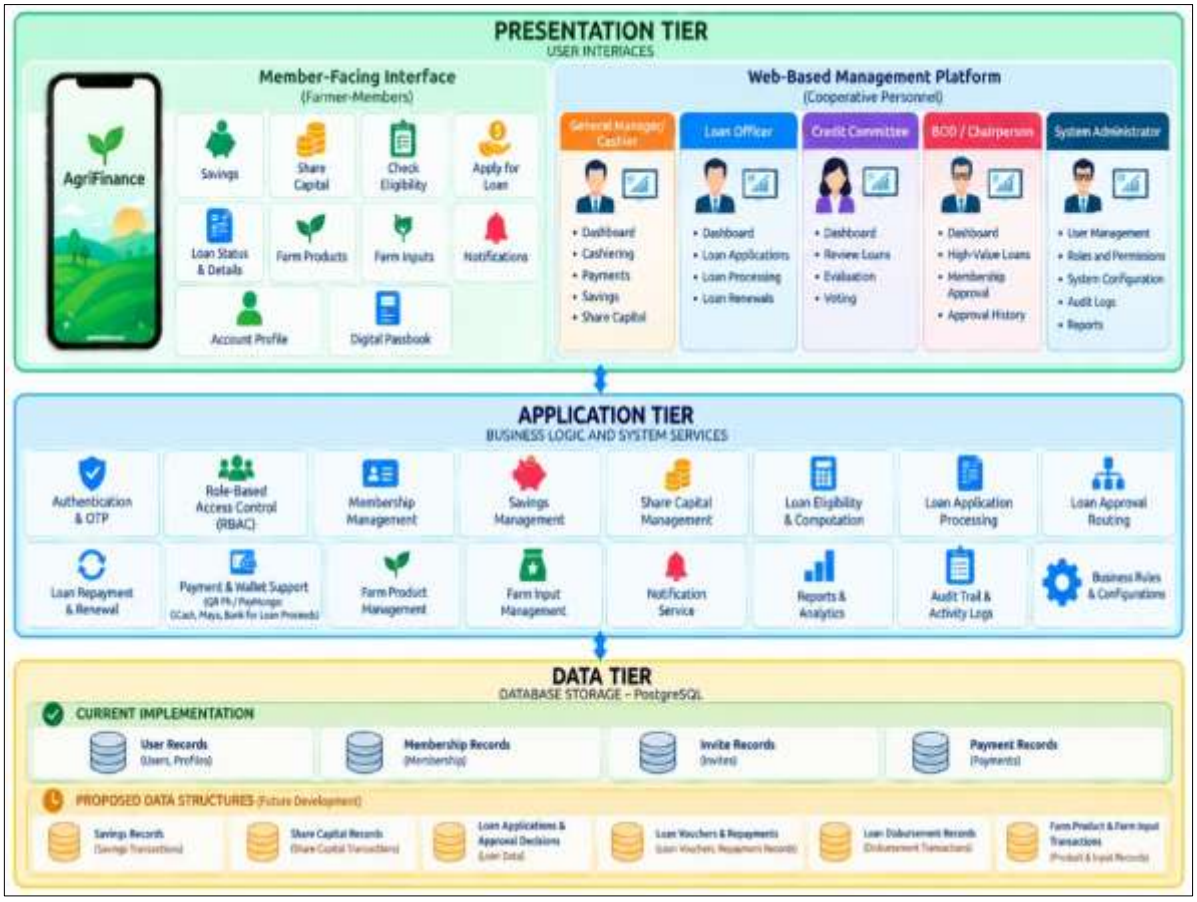


Figure 2. Proposed Three-Tier Architecture

The proposed AgriFinance system adopts a three-tier architecture consisting of the Presentation Tier, Application Tier, and Data Tier. This architecture separates the user interfaces, application processes, and data storage to organize the system's functions and support the management of cooperative operations [7].

The Presentation Tier provides the interfaces through which farmer-members and authorized cooperative personnel access the system. The member interface is designed to provide access to savings, share capital, loan eligibility checking, loan applications, loan status, farm products, farm inputs, notifications, account profiles, and the digital passbook. The web-based management platform is intended for cooperative personnel, including the General Manager/Cashier, Loan Officer, Credit Committee, Board of Directors/Chairperson, and System Administrator. Each interface presents functions according to the responsibilities of its intended users.

The Application Tier contains the business logic and system services that support the proposed cooperative operations. Its modules include authentication and OTP, role-based access control, membership management, savings and share capital management, loan eligibility computation, loan application processing, loan approval routing, repayment and renewal, payment and wallet support, farm-product and farm-input management, notifications, reports, audit logs, and business rules. These modules are designed to process user requests, apply the relevant cooperative rules, and coordinate information between the Presentation Tier and Data Tier. Loan approval follows the applicable cooperative procedures, while the actual transfer of approved loan proceeds remains the responsibility of authorized cooperative personnel.

The Data Tier uses PostgreSQL for database storage. As illustrated in Figure 2, the current implementation includes user records, membership records, invitation records, and payment records. The diagram also presents proposed data structures for savings transactions, share capital transactions, loan applications and approval decisions, loan vouchers and repayments, loan disbursements, and farm-product and farm-input transactions. These proposed structures are intended to support the recording and management of the cooperative's financial and operational data as development progresses.

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The architecture distinguishes currently implemented components from proposed features and data structures. The presence of a module or planned data structure in the architecture does not necessarily mean that its corresponding functions are already operational. Further development and testing are needed for the components identified as proposed. This separation provides an overview of how the AgriFinance system is organized and how its planned functions are intended to work together.

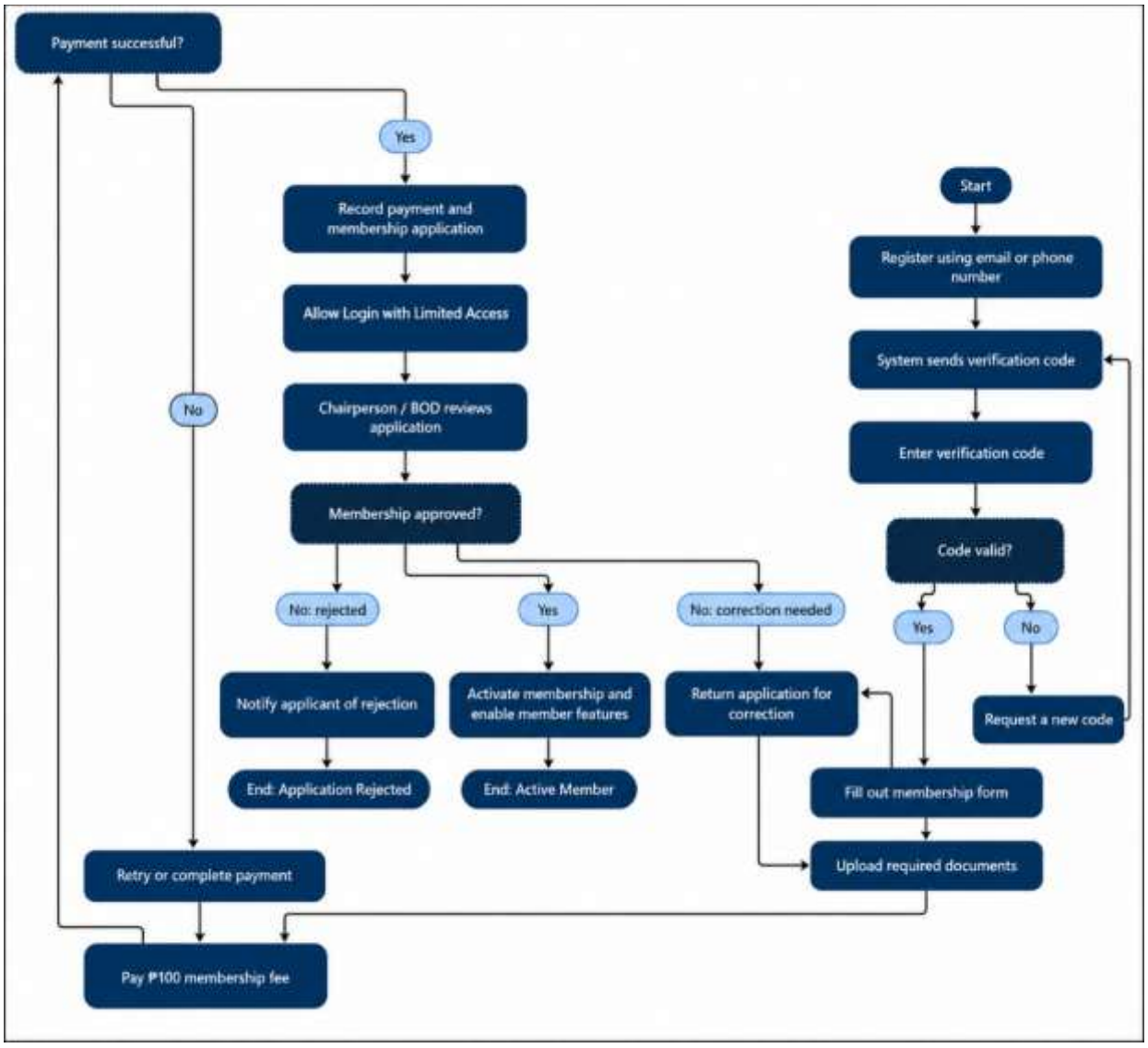


Figure 3. Proposed Membership Registration and Approval Workflow

Figure 3 illustrates the proposed membership registration and approval workflow of AgriFinance. The process begins when an applicant registers using an email address and verifies the account using the verification code sent by the system. Phone-based registration and verification are planned for future development.

The applicant then completes the membership form, provides the required documents, and pays the ₱100 membership fee. Upon successful payment, the applicant may access the dashboard with limited privileges while the membership application is pending approval.

The Board of Directors (BOD)/Chairperson reviews the submitted application and determines whether it should be approved, returned for correction, or rejected. Applications requiring corrections are returned to the applicant for completion, while rejected applications result in a rejection notification. Once approved, the applicant's membership is activated, and access to applicable member services is granted according to cooperative requirements.

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Successful payment of the ₱100 membership fee does not automatically grant access to all financial services. Access to applicable financial services remains subject to membership approval and the minimum share capital requirement of ₱2,000. However, registered members may purchase available farm products and farm inputs without meeting this minimum share capital requirement. These purchases are treated as regular transactions and are separate from loan-related transactions.

This workflow represents the intended membership registration and approval process. Some steps, including document upload, still require further development, as indicated by the current implementation status of AgriFinance.

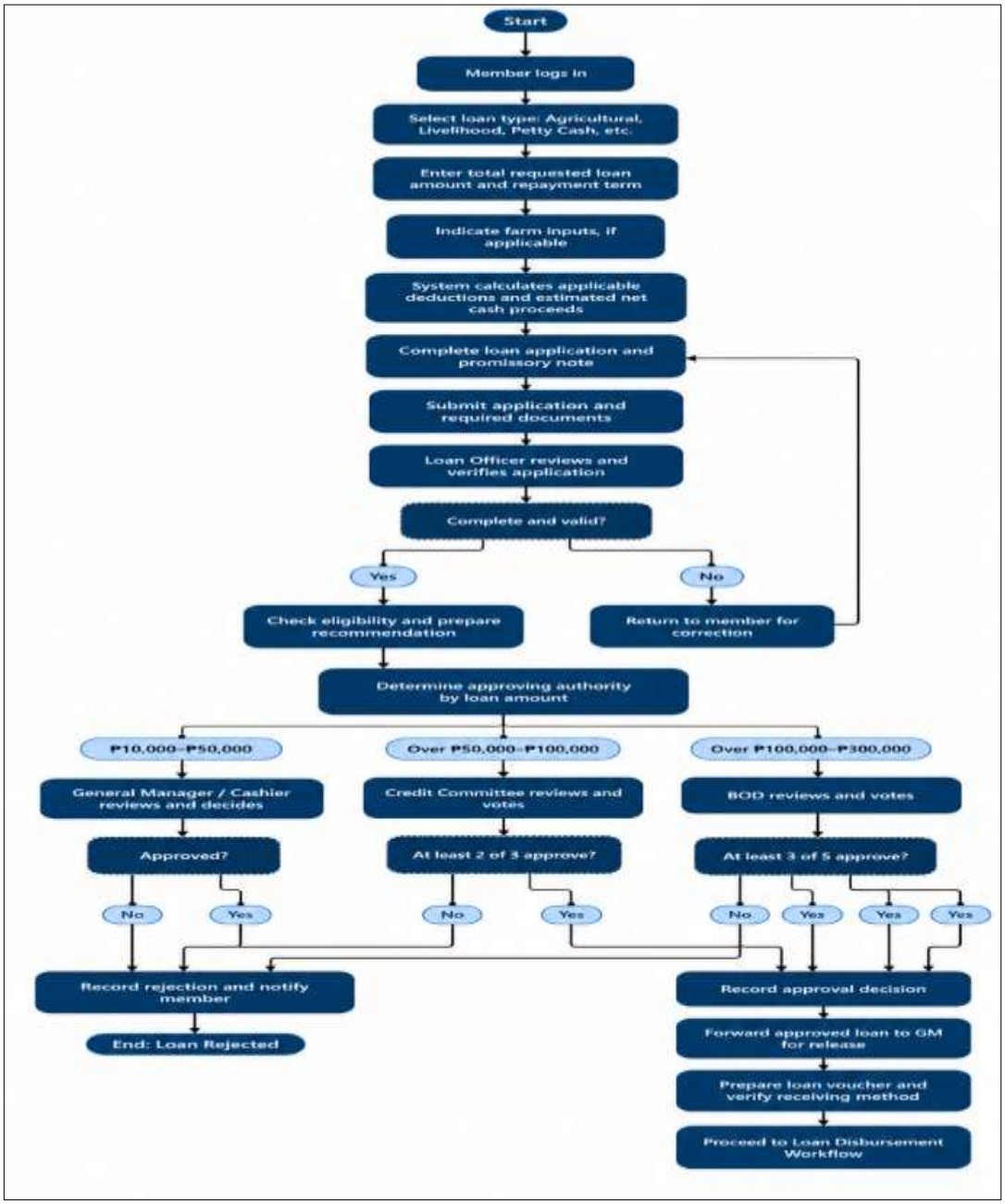


Figure 4. Proposed Loan Application and Approval Workflow

Figure 4 illustrates the proposed loan application and approval workflow of AgriFinance. The process begins when a member logs in, selects a loan type, enters the requested loan amount and repayment term, and indicates any applicable farm inputs. The system calculates the applicable deductions and estimated net cash proceeds.

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The member then completes the loan application and promissory note and submits the application together with the required documents.

The Loan Officer reviews the application and verifies whether the submitted information and documents are complete and valid. Incomplete applications are returned to the member for correction. Once the application is complete, the Loan Officer checks the member's eligibility and prepares a recommendation. The application is then forwarded to the appropriate approving authority based on the requested loan amount: the General Manager/Cashier for loans ranging from ₱10,000 to ₱50,000, the Credit Committee for loans above ₱50,000 up to ₱100,000, and the Board of Directors (BOD) for loans above ₱100,000 up to ₱300,000.

The General Manager/Cashier reviews and decides on applications within the assigned loan limit. For Credit Committee decisions, approval requires at least two of the three members to vote in favor. For BOD decisions, at least three of the five members must approve the application. Rejected applications are recorded, and the member is notified of the decision. Approved applications are recorded and forwarded to the General Manager for loan voucher preparation and release processing. The actual release of loan proceeds is handled through the separate Loan Disbursement Workflow. This workflow represents the proposed process, and some functions still require further development and testing.

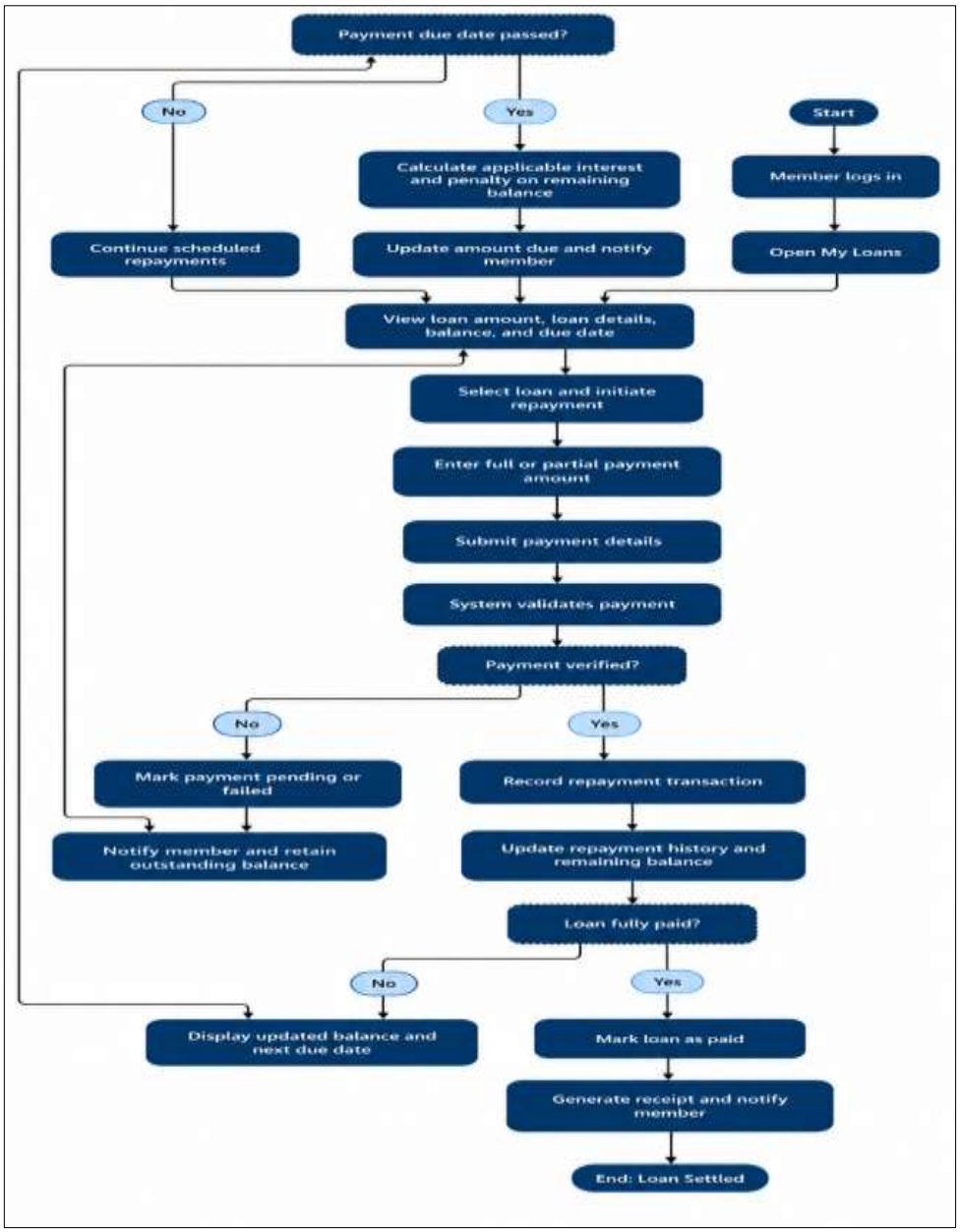


Figure 5. Proposed Loan Repayment Workflow

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Figure 5 illustrates the proposed loan repayment workflow of AgriFinance. The process begins when a member logs in and opens the My Loans section to view loan details, the remaining balance, and the due date. The member may select a loan and initiate either a full or partial payment by entering the payment amount and submitting the payment details. The system validates the payment, and once verified, records the repayment transaction and updates the member's payment history and remaining balance.

If the payment is not verified, the system marks it as pending or failed, notifies the member, and retains the outstanding balance. If the loan is not yet fully paid, the system displays the updated balance and next due date. Once the remaining balance has been fully settled, the loan status is updated to paid, and the system generates a receipt and notifies the member.

For overdue loans, the cooperative applies 1% monthly interest and a 2% monthly penalty to the remaining unpaid balance. These charges apply when the loan remains unpaid after its due date, with the penalty beginning after the due date. This workflow presents the proposed repayment process and does not imply that all repayment functions are fully implemented in the current prototype.

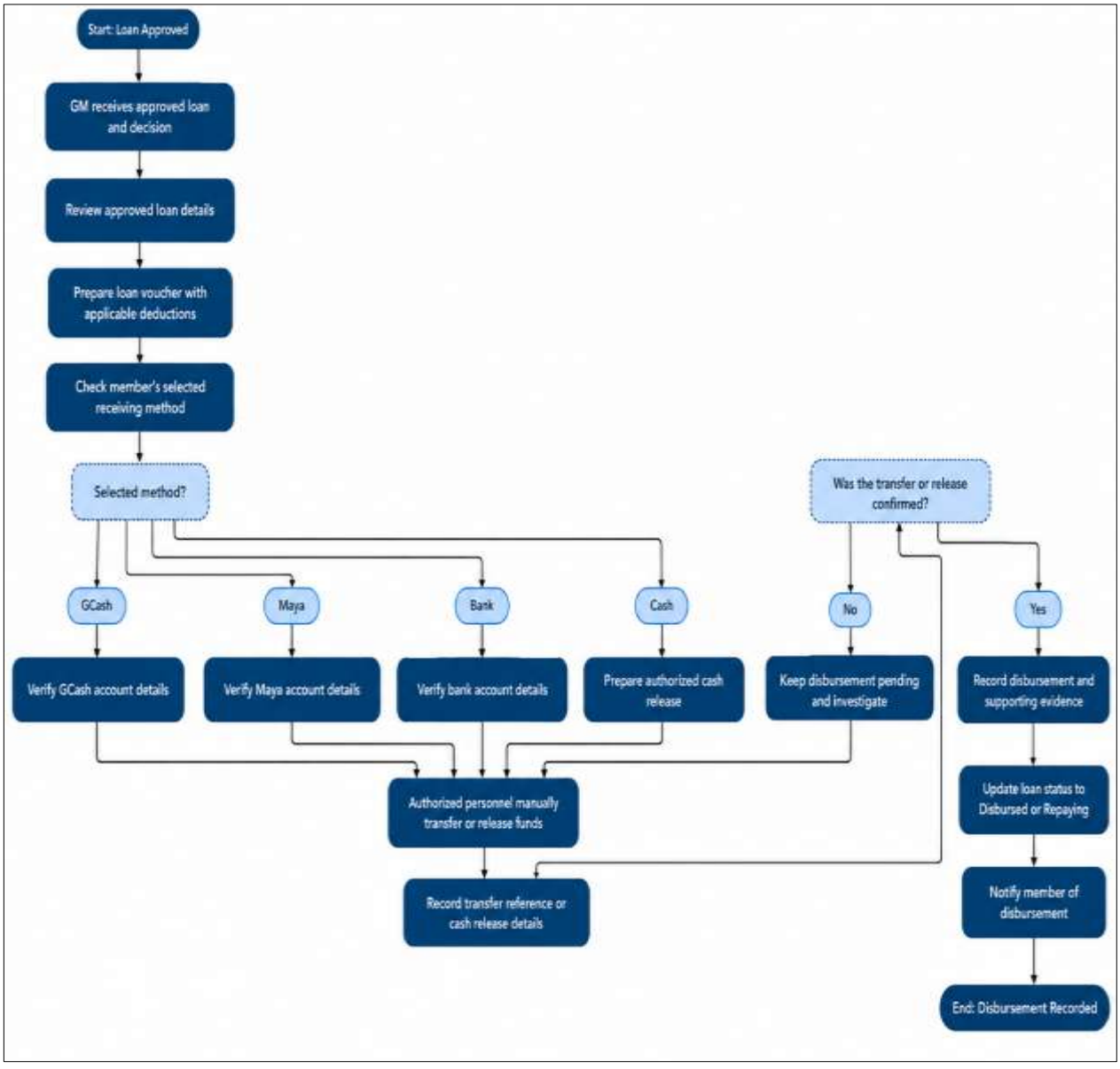


Figure 6. Proposed Loan Disbursement Workflow

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Figure 6 illustrates the proposed loan disbursement workflow of AgriFinance. After a loan is approved, the General Manager (GM) receives the approved loan details and reviews the information before preparing the loan voucher, including the applicable deductions. The member's selected receiving method is then checked, which may be GCash, Maya, bank transfer, or cash.

Authorized cooperative personnel handle the actual transfer or release of the approved loan proceeds. For electronic transfers, the relevant account details are verified, while cash releases are prepared and authorized. The transfer reference or cash release details are recorded as supporting transaction information. If the transfer or release is not confirmed, the disbursement remains pending while the issue is investigated. Once the release is confirmed, the system records the disbursement and supporting evidence, updates the loan status to Disbursed or Repaying, and notifies the member.

This workflow describes the proposed disbursement process. Actual loan releases remain under the responsibility of authorized cooperative personnel, and the corresponding system functions require further development and testing where they are not yet implemented.

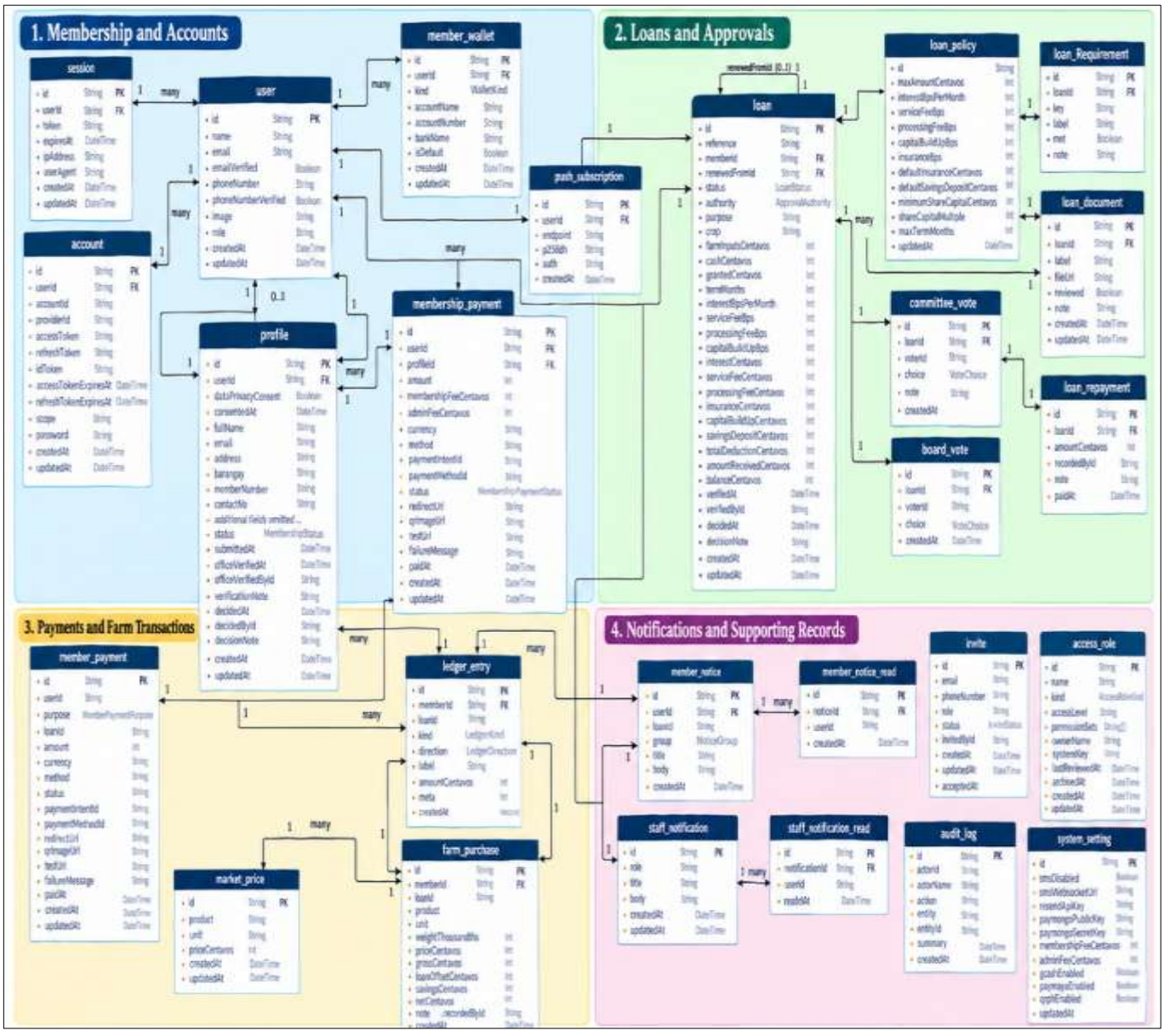


Figure 7. Entity-Relationship Diagram (ERD) of the Proposed AgriFinance System

Figure 7 presents the Entity-Relationship Diagram (ERD) of AgriFinance. It illustrates the database tables, their attributes, and the relationships used to organize information related to membership and accounts, loans and

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approvals, payments and farm transactions, notifications, and supporting records. These relationships provide a structured representation of the data required by the proposed system. The ERD serves as a reference for organizing and managing the system's database records. However, the presence of database tables and relationships does not necessarily indicate that all corresponding functions are fully implemented or operational. The implementation status of the system components is presented separately in Table 5.

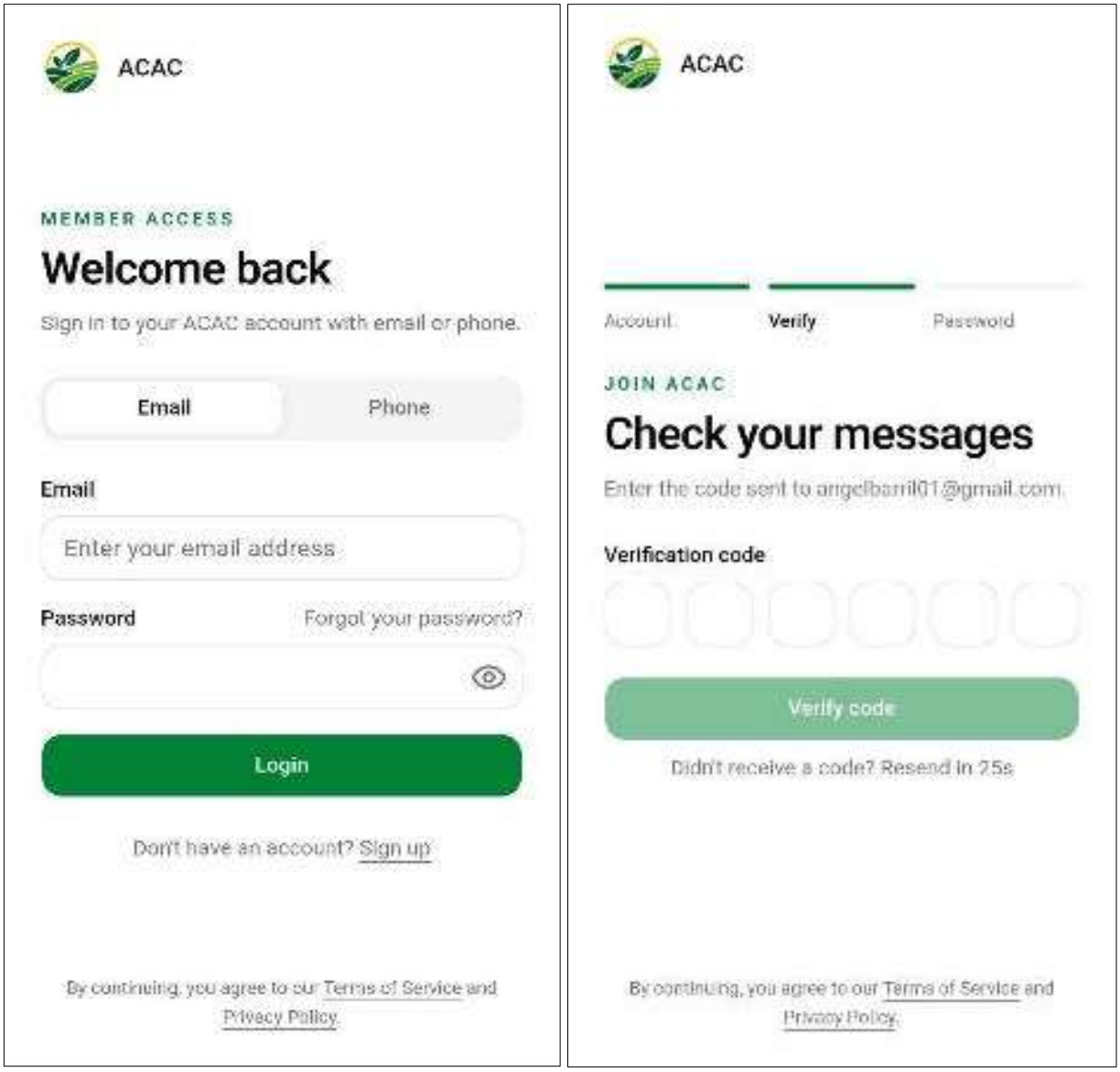


Figure 8. Member Login and Account Verification

Figure 8 presents the member login and account verification interfaces of AgriFinance. The login interface allows members to access their accounts using their email address or phone number and password. It also provides a password recovery option and a registration link for users who do not yet have an account.

The account verification interface allows users to enter the verification code sent to their registered email address during account registration. An option to request a new verification code is also provided. Email-based verification is currently functional, while phone-based verification has not yet been implemented or verified. These interfaces represent the implemented login and email verification features of AgriFinance.

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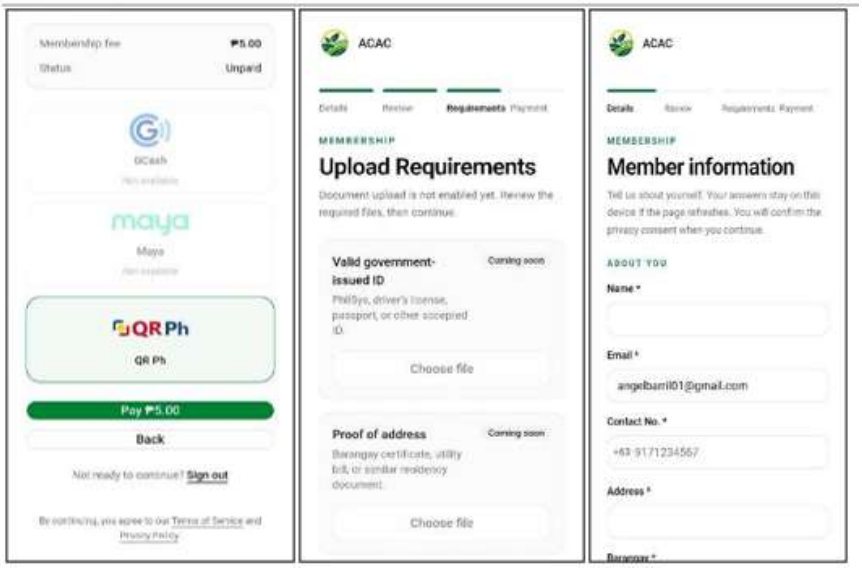


Figure 9. Membership Registration

Figure 9 presents the membership registration interfaces of AgriFinance. These interfaces guide applicants through the member information form, review of submitted details, document requirements, and membership fee payment. The registration process allows applicants to provide their personal information and proceed to the payment stage. QR Ph payment is available for demonstration using a ₱5 test transaction amount, while GCash and Maya are currently unavailable. However, document upload is not yet enabled, as indicated in the requirements interface. These features reflect the current implementation status of membership registration, with document submission requiring further development.

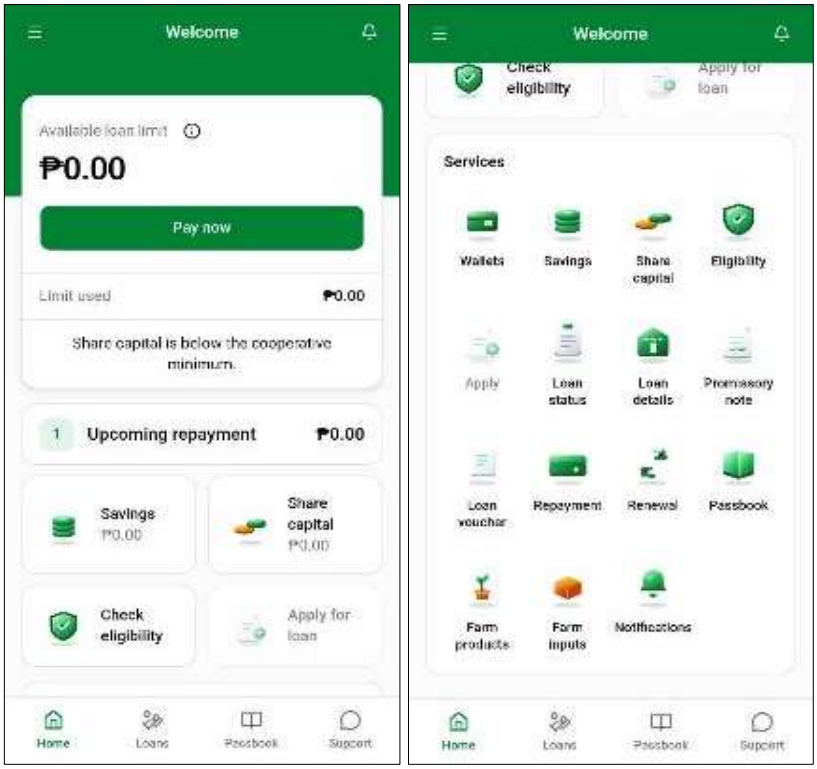


Figure 10. Member Dashboard and Services

Figure 10 presents the member dashboard and services interface of AgriFinance. The dashboard provides a centralized view of the member's available loan limit, upcoming repayment, savings, and share capital. It also

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displays shortcuts to services such as loan eligibility checking, loan applications, loan status, repayment, passbook, farm products, farm inputs, and notifications.

Although these services are displayed in the interface, some modules are not yet fully functional or accessible. The dashboard currently serves as the main interface for members to view account information and access the available features. The implementation status of individual modules is distinguished in Table 5, which identifies the functions that are working and those that still require further development.

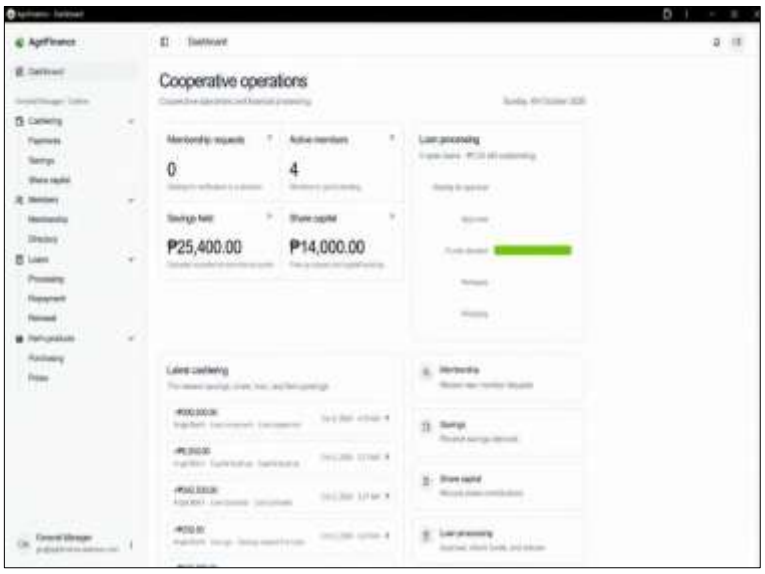


Figure 11. General Manager/Cashier Management Interfaces

Figure 11 presents the proposed General Manager/Cashier management interface of AgriFinance. The dashboard is designed to provide a centralized view of membership requests, active members, savings, share capital, loan processing, and cashiering activities. It also displays shortcuts to membership management, savings, share capital, and loan processing functions to support the organized management of cooperative operations.

Although the interface has been developed, the functions displayed in the dashboard remain subject to the implementation status of their respective modules. As indicated in Table 5, savings and share capital management, loan processing, repayment, and other related functions remain at the interface prototype or proposed stage and require further development and testing.

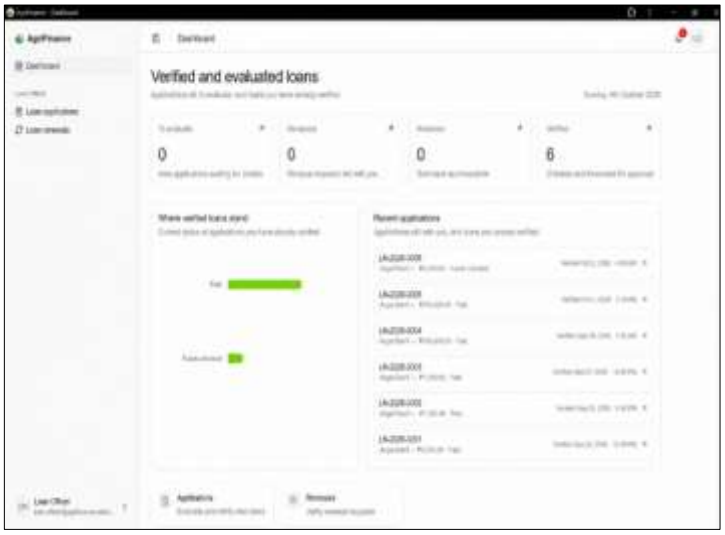


Figure 12. Loan Officer Dashboard

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Figure 12 presents the Loan Officer dashboard of AgriFinance. The interface provides an overview of loan applications awaiting evaluation, renewal requests, returned applications, and verified applications forwarded for approval. It also displays recent application records and their current statuses to help the Loan Officer monitor loan-related activities.

Although the dashboard interface has been developed, the availability of its displayed information does not necessarily indicate that the complete loan processing and verification workflow is fully operational. As indicated in Table 5, loan application processing, approval routing, repayment, and renewal remain at the interface prototype or proposed stage and require further development and testing.

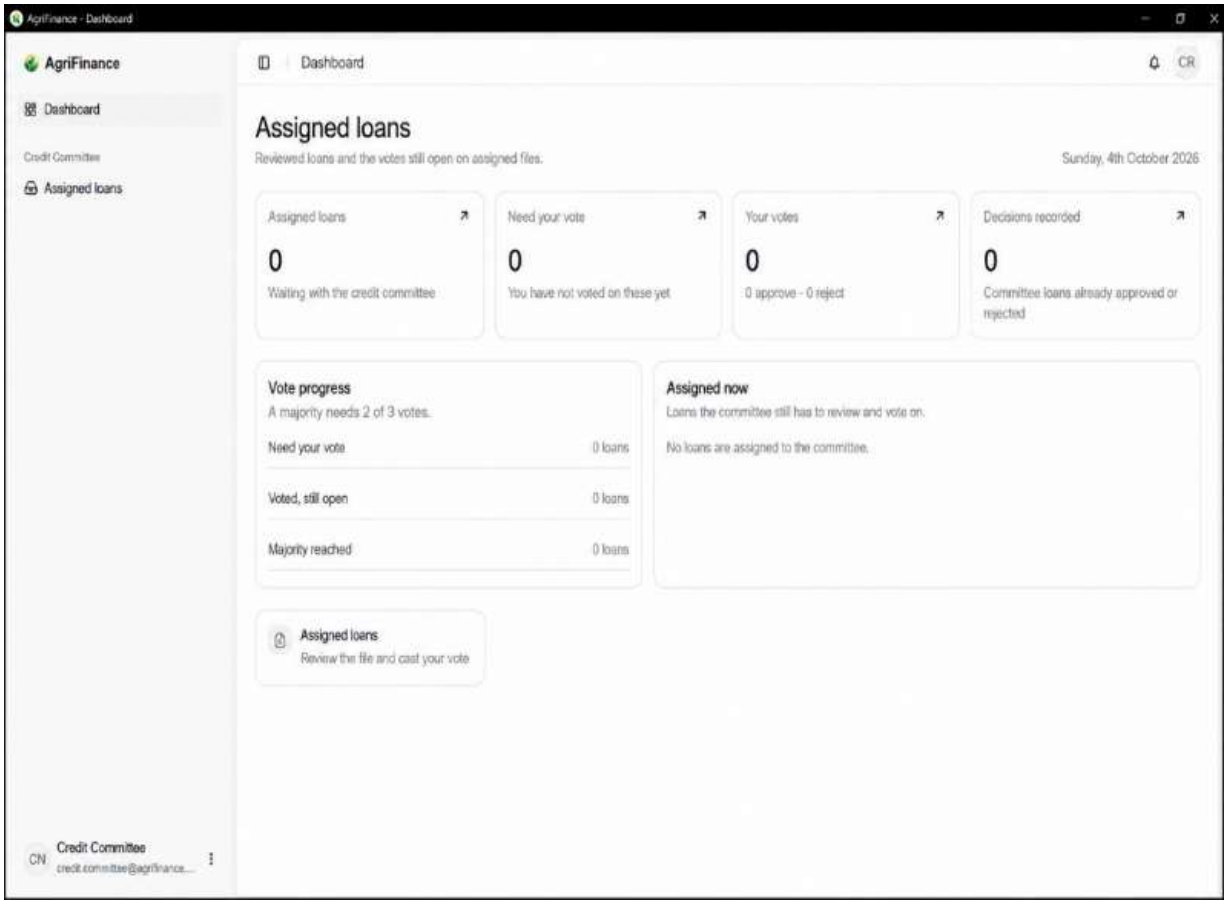


Figure 13. Credit Committee Dashboard

Figure 13 presents the Credit Committee dashboard of AgriFinance. The interface provides an overview of assigned loan applications, pending votes, votes cast, and recorded decisions. It also displays vote progress and the loan applications assigned to the committee for review. These features are designed to help Credit Committee members monitor assigned applications and participate in loan approval decisions.

Although the dashboard interface has been developed, the complete loan approval and voting functions remain subject to further development and testing, as indicated by the implementation status in Table 5. The dashboard represents the intended role of the Credit Committee in reviewing loan applications and recording approval decisions according to the cooperative's voting requirements.

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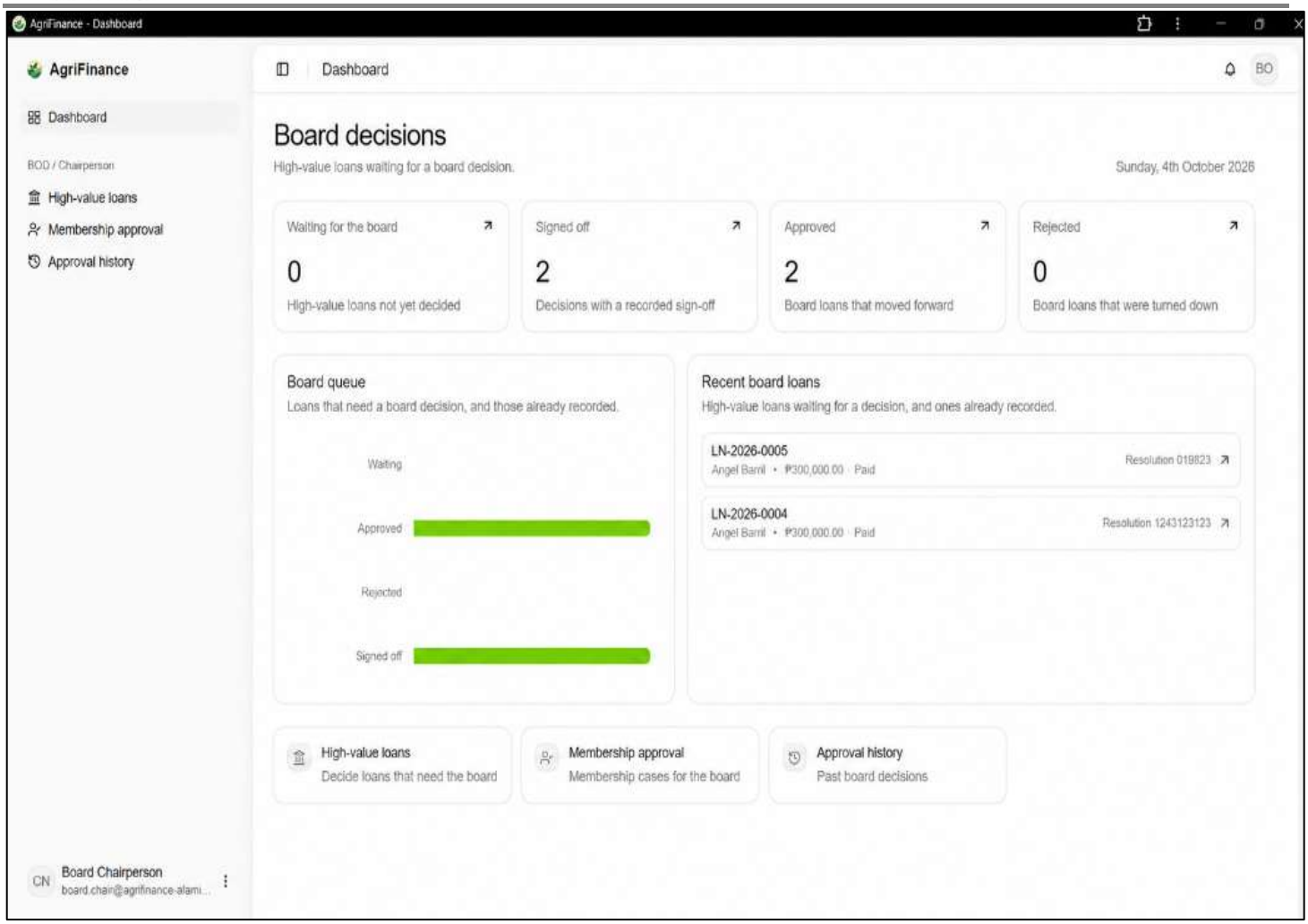


Figure 14. Board of Directors Dashboard

Figure 14 presents the Board of Directors (BOD)/Chairperson dashboard of AgriFinance. The interface provides an overview of loan applications awaiting board decisions, signed-off decisions, approved loans, and rejected loans. It also displays the board queue, recent high-value loan records, membership approval, and approval history. These features are designed to support the BOD/Chairperson in reviewing membership applications, making decisions on high-value loans, and accessing previous board decisions through a centralized management interface.

Although the dashboard interface has been developed, the complete membership approval and loan decision functions remain subject to further development and testing, as indicated by the implementation status in Table 5. The dashboard represents the intended responsibilities of the BOD/Chairperson in the cooperative's approval process.

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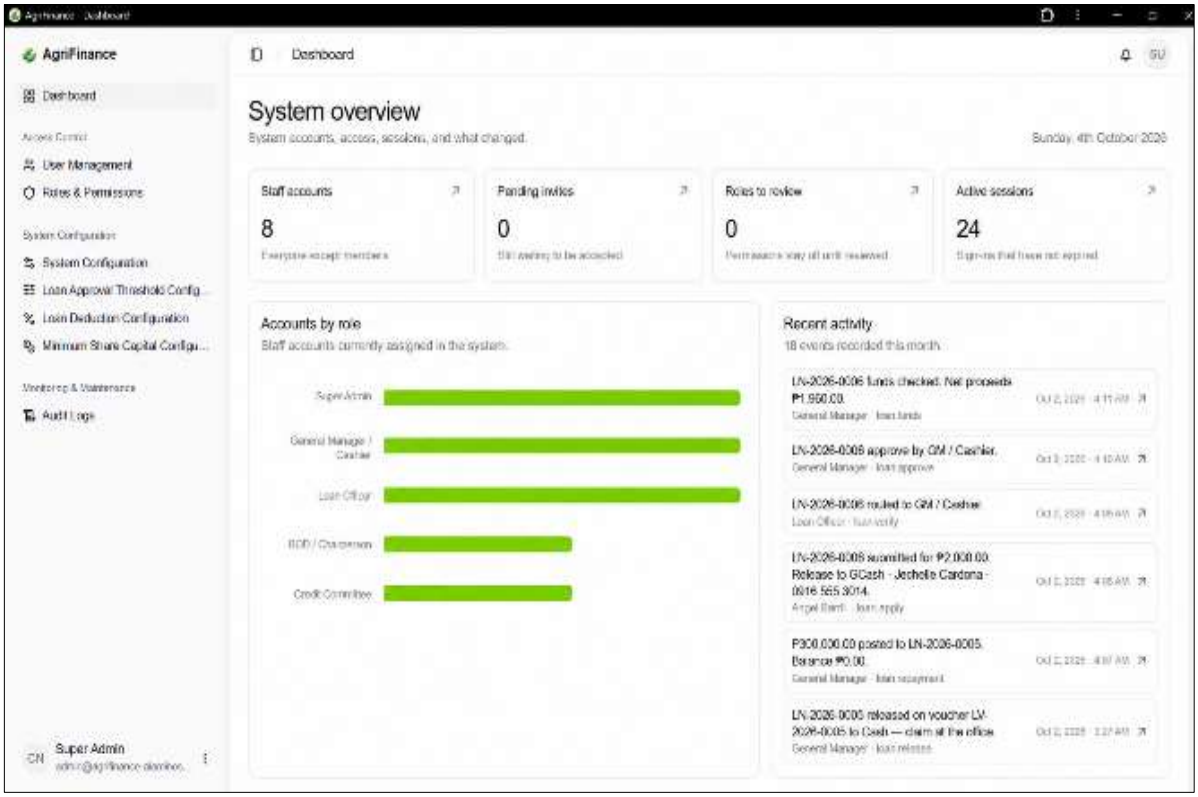


Figure 15. System Administrator Dashboard

Figure 15 presents the System Administrator dashboard of AgriFinance. The interface provides an overview of staff accounts, pending invitations, roles requiring review, and active sessions. It also displays account distribution by role and recent system activities. The sidebar provides access to user management, roles and permissions, system configuration, loan approval threshold configuration, loan deduction configuration, minimum share capital configuration, and audit logs. These features are designed to support centralized management, access control, system configuration, and monitoring of administrative activities.

Although the dashboard interface has been developed, the functionality of its individual modules depends on their implementation status. As indicated in Table 5, role-based management and other proposed functions require further development and testing before they can be considered fully operational.

CONCLUSION

This study presented the proposed architecture and design of AgriFinance, an integrated cooperative system intended to support the membership, savings, share capital, loan processing, repayment, payment, farm-product, and farm-input operations of the Alaminos City Agriculture Cooperative (ACAC). Based on the identified operational requirements, the study designed a three-tier architecture, a requirements traceability matrix, an entity-relationship diagram, and workflows for membership registration and approval, loan application and approval, repayment, and loan disbursement. These design components provide a structured basis for integrating cooperative services while retaining ACAC's existing organizational responsibilities and approval procedures.

The current implementation demonstrates selected working components, including user login, email-based account verification, the member dashboard, membership registration, and QR Ph payment through PayMongo in a demonstration environment. However, document upload is not yet enabled, and several modules, including savings and share capital management, loan processing and approval, repayment and renewal, farm-product and farm-input management, loan disbursement monitoring, notifications, and role-based management, remain at the interface prototype or proposed stage. These components require further implementation, integration, and testing before their intended functions can be considered operational.

The study also proposed an evaluation framework based on applicable ISO/IEC 25010 quality criteria for the future assessment of AgriFinance. User acceptability evaluation has not yet been conducted, and no quantitative evaluation results are claimed. Future work should focus on completing the remaining modules, verifying ACAC's business rules and financial controls, testing the implemented functions, and conducting user acceptability evaluation once the relevant components are ready. Deployment and assessment in the actual cooperative setting are also needed to determine the system's effectiveness in supporting ACAC's operations.

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