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BRYAN N. MALINAO

**DIGITAL FARMERS' PRODUCE SYSTEM: A CLOUD-BASED PLATFORM FOR
OPTIMIZING CROP MANAGEMENT AND MARKET LINKAGES**

Adviser:

KATRINA JOY M. ABRIOL-SANTOS
Faculty of Information and Communication Studies

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KATRINA JOY M. ABRIOL-SANTOS

Adviser

Date Signed

DR. RIA MAE H. BORRAMEO

MIS Program Chair

Date Signed

DR. ROBERTO B. FIGUEROA, JR.

Dean

Faculty of Information and Communication Studies

Date Signed

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ABSTRACT

Farming is the main livelihoods in Municipality of sinacaban, Misamis Occidental. Most farmers are crop producers as indicated by interview surveys with farmers and verified by the Municipal Agriculture Office. Common issues mentioned by farmers include lack of access to real time pricing information, connections to potential buyers, timing of buying transactions, and awareness of produce currently available at the barangay level. These result in smaller than desired profit margins for farmers and occasionally lost crops.

This project aims to develop and deploy the Digital Farmers' Produce System, a cloud- a cloud-based platform that allows farmers to post their available crops by season, request aid from their municipal agriculture office, and connect with buyers interested in their crops. The system allows farmers to post details of their produce availability and schedules, buyers can search for and view crop postings by region and crop category, and DA/MAO officers can view crops stock and request statuses per barangay. The system was built using PHP 8 and the Flight microframework, HTML, CSS, Javascript, Bootstrap, and MySQL it is using RAD development framework. Security and reliability measures included role-based permissions, HTTPS encryption, input validation, prepared queries, password hashing, and a backup strategy. User acceptance was gathered via survey from 12 participants, consisting of 5 farmers, 4 buyers, and 3 DA/MAO officers. With a positive user acceptance was observed, with mean ratings of 4.60 from farmers, 4.83 from buyers, and 4.69 from DA/ORO officers.

While the results of this study are limited by the scope and available resources, they show promise that a localized, farmer-driven agricultural system can help improve market visibility as well as coordination between farmers and government agricultural institutions. More work would have to be done to ensure appropriate training is provided, all stakeholders can consistently connect to the system, and all security risks are mitigated before rollout.

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INTRODUCTION

Background of the Project

Agriculture continues to be one of the main sources of income in the Municipality of Sinacaban, Misamis Occidental. The majority of farmers earn a living from cultivating seasonal crops. Based on what local farmers have said, there are many factors that affect the income and productivity of farmers. These include inadequate reliable buyers, lack of price information and delays in transactions as well as coordination problems between the farmers and the prospective market (Dominguez, 2025).

The problems faced locally reflect wider issues concerning agriculture in the Philippines. Mopera (2016) reported that the high cost of logistics and lack of links to the market result in post-harvest losses of as high as 42% for vegetables and 28% for fruits. Briones, Galang, and Latigar (2023) similarly reported that smallholder farmers are losing out on the possibility of improving their income and better positioning themselves for the next planting season as a result of information asymmetry and poor digital connectivity.

This issue has a wider scope of concern because of the negative impact on the income of farmers, distribution of local products, and the overall agricultural supply chain. It is a problem that can be solved through digital innovations, particularly to improve coordination in rural areas and optimize the utilization of resources in the agricultural sector. The Department of Agriculture has started programs such as *e-Kadiwa* and *eMarketplace* to address these issues and digitize the connection between farmers and consumers.

Still, certain rural locations struggle with connectivity, digital literacy, and barriers to localized agricultural coordination platforms at barangay and municipal levels, which means many national platforms remain untapped (Briones et al., 2023; Pastolero & Sassi, 2022).

This prompted the creation of the *Digital Farmers' Produce System*. It is designed to assist farmers, buyers, and the Municipal Agriculture Office of Sinacaban. The web

application is cloud-based and allows farmers to post produce, specify the quantity and harvest date, communicate with buyers, and submit requests to the office. Buyers are allowed to see what crops are available in the vicinity and communicate their concerns directly with the farmers. As for the agricultural personnel, the application gives them the opportunity to monitor crop listings, resource requests, and available crop information.

The project employed the Rapid Application Development (RAD) methodology for the design and development of the system in such a way that it responds to the actual users' needs. The system is meant to address the context and challenges experienced by farmers in Sinacaban. The system is expected to enhance agricultural product exposure, agricultural supervision, and coordination within the Sinacaban farming community. It is also hoped to encourage the development of localized cloud-based platforms for market connectivity within rural farming communities where gaps and barriers still exist.

Objectives

The general objective of the project is to develop a web application in the cloud that will help coordinate farmers, buyers and the Municipal Agriculture Office of Sinacaban by improving the visibility of the produce, managing the resource requests and communicating market linkages.

The project will in particular focus on:

- To design a module to post produce that allows farmers to post offers with details on price, quantity, harvesting period, and farm location.
- To afford farmers the ability to post requests for resources to the Municipal Agriculture Office.
- To provide an easy and direct means for buyers to view and contact farmers about their produce.
- To manage requests and inquiries about crop listing, resources, and subsidies through the Municipal Agriculture Office of Sinacaban web application.

- To create simple dashboards that provide summaries and alerts to monitor demand and supply of resources as and when crops are available.
- To build a solution that offers a framework to rapidly design, build, and enhance a system Rapid Application Development (RAD) model.
- To assess the system with a functional test and a Likert Scale survey to understand the system's functionality, usability, and performance. Cronbach's alpha will be used to measure reliability.

Scope and Limitations

Scope

This project concerns the development of the *Digital Farmers' Produce System*, a cloud based web application for farmers, buyers and the municipal agriculture department. Misamis Occidental Office, Sinacaban. The system is designed to prioritize smallholder farmers registered with the Municipal Agriculture Office, and on regular produce crops grown within the municipality.

The main features of the system include farmer registration and login, produce posting, crop listing management, buyer search and available crop viewing, direct communication with farmer and buyers; farmer resource requisitions; and monitoring tools for the agriculture personnel. The system also offers role based access to farmers, buyers, agriculture officers and administrators to ensure each user group could access only the functions relevant to its role.

The system offers basic summary and indicator dashboards that enable agricultural staff to verify availability of crops, stock position, farmers listings and patterns of resource requests. It runs in a cloud-based environment and is available in web browsers for desktops and mobiles. The development is centered on responsiveness design, secure user authentication and input validation and simple user interface with users with varying levels of digital literacy.

Limitations

The system lacks online payment, delivery booking, and logistics tracking features. Payments, product pickup, transactions between farmers and buyers, and delivery arrangements are done outside the system. Only supported on platform create visibility, communication and collaboration.

The internet connectivity can also affect the system performance and accessibility, especially in the rural barangays where the network access is not stable. The correctness of crop lists, prices, quantities, harvest schedules and requests for resources are based on information provided by the users. The system does not automatically verify the quality, availability or the condition of the produce posted.

The first rollout will be exclusively for the Municipality of Sinacaban, Misamis Western. Expansion to other municipalities, integration with online payment systems, delivery services, advanced analytics and full mobile app support are to be intended for future releases.

Review of Existing Alternatives

Several digital programs and information systems have been established in the agriculture sector of the Philippines and other developing countries to improve farmer coordination and linkages in the market. For example, the Department of Agriculture's *e-Kadiwa* program is an online marketplace that links local producers directly to consumers. *DA eMarketplace* is an online agri-products marketplace. The government institutionally supports the digitalization of the agriculture sector. However, rural communities do not adopt these platforms due to poor internet connectivity, low digital literacy and lack of localization features for smallholder farmers (Briones et al., 2023; Pastolero & Sassi, 2022).

But the reality is that many smallholder farmers are still selling their produce through social media platforms such as Facebook Marketplace and community chat groups. However, the system doesn't have any structured features to record the data of crops, monitor the availability of the produce and coordination among institutions and track the seasonal harvests. It is difficult for farmers and agricultural workers to check on the price, quantity and transport of goods. These are informal and unregulated channels of transaction. Ma, Renwick, and Singh (2024) also argue that informal digital conversation may be counterproductive for long-term coordination and may discourage participation of institutional actors. The case shows the need for specific agricultural information systems that balance availability and specific characteristics to help facilitate coordination, transparency and market linkage (Abdul Latif Jameel Poverty Action Lab (J-PAL), 2023; Qiang, Kuek, Dymond, & Esselaar, 2012).

Other countries like Philippines have similar problems with farm management apps such as *FarmLogs*, *AgriDigital* and others. These are often custom built tools that allow record keeping, logistics management, inventory tracking and transparent pricing. They can assist in deciding how much time can be saved. Many are for commercial farms or locations with reliable internet. Hence, they may not be relevant to the rural barangays in the Philippines where majority of the farmers are smallholders with limited financial

capacity and intermittent connectivity (Ma et al., 2024).

The main challenges on productivity and profit that rural farmers are facing are digital connectivity and information asymmetry (Briones et al., 2023). Poor coordination and logistics among market actors accounted for 42% and 28% of postharvest losses of vegetables and fruits in the Philippines, respectively (Mopera, 2016). Digital technologies are inclusive, accessible and contextually relevant and can improve agricultural performance (World Bank, 2013). Similar results have been reported by the World Bank and Qiang et al. (2012). Many systems today are market driven and do not take into account seasonality in farming where timing, planning and local monitoring are also important.

The *Digital Farmers' Produce System* seeks to bridge these gaps by offering a local cloud platform for the farmers, the buyers and the Municipal Agriculture Office of Sinacaban. This is not a national platform and not a commercial application, but a system intended for municipal agricultural coordination. Farmers can upload their produce, quantities, harvest dates and contact information for potential buyers. Agricultural personnel compile lists of crops and basic stock and resource needs. Buyers are able to see available crops locally and can contact the farmers directly.

It is a web based platform connecting farmers, buyers and the Municipal Agriculture Office for three-way coordination. It provides visibility of products, management of resource requests, communication with buyers and basic monitoring functions. It serves as a better local option than what is currently available. The system does not include online payment, delivery tracking or complete logistics management. It is designed to meet the need for a user-friendly local agricultural information system in rural municipalities.

Table 1. Summary of Existing Alternatives

System (License)	Platform	Brief Description	Basic Functionalities	Relation to the Proposed System
Proposed System: Digital Farmers' Produce System	Web	Cloud-based agricultural platform for farmers, buyers, and the Municipal Agriculture Office of Sinacaban	Produce posting, buyer viewing, messaging, resource requests, dashboard summaries, and role-based access	Designed specifically for local agricultural coordination in Sinacaban
DA e-Kadiwa (Government platform)	Web	National online marketplace connecting agricultural producers and consumers	Online product catalog, ordering, and basic market linkage support	Useful for broader market access but not focused on municipal-level crop monitoring and resource requests
DA eMarketplace (Government platform)	Web	Digital platform for trading agricultural goods	Product posting, price display, and online agricultural trading support	Similar in supporting produce visibility, but less focused on localized farmer monitoring and LGU coordination
Facebook Marketplace / Group Chats (Proprietary platform)	Web and Mobile App	Informal selling and messaging channels commonly used by farmers and buyers	Product posting, chat-based negotiation, and basic location-based search	Accessible and familiar, but lacks structured crop records, request management, and institutional monitoring
Commercial farm-management applications such as FarmLogs and AgriDigital (Commercial / Subscription)	Web and Mobile App	Farm-management tools mainly designed for larger farms and commercial agricultural operations	Field records, inventory tracking, logistics management, and farm analytics	Feature-rich but may be costly, complex, and not localized for smallholder farmers in rural municipalities

PROJECT DETAILS

Overview

The *Digital Farmers' Produce System* is a cloud-based agricultural coordination and market linkage web application that has been developed in the Municipality of Sinacaban, Misamis Occidental. The system uses a centralized space to ensure that farmers are able to post what produce they have available, buyers are able to view and inquire about produce listings, and agricultural officers are able to view and track basic crop data, as well as support requests entered by farmers.

The system caters to four major user group roles:

- **Farmers** are able to create and manage listings for their produce, indicate what quantity and harvest information they have for sale, view and communicate with buyers, submit requests for farming supplies or assistance, and receive important updates/information via system notifications or SMS alerts.
- **Buyers** are able to view, search, and filter available products, view details and data for produce, and contact farmers for possible physical transactions (buying and selling of produce).
- **Agricultural Officers** are able to view listings for produce, track and review stock information for their area, and respond to resource requests, post and respond to advisories, post notifications and alerts, and create and publish simple reports for decision-making purposes.
- **Administrators** are able to manage (enable/disable) user accounts, access system logs, and manage (set) default values for system parameters.

The system operates in a shared cloud-hosted environment and is designed to be accessible via both desktop and mobile web browsers. The infrastructure for the System has been built to be responsive to the local environment of Sinacaban, slow internet

connectivity, low levels of computer/technical skills and literacy. To cater to those users, the system has SMS notification capabilities and a Bisaya language toggle.

Project Framework

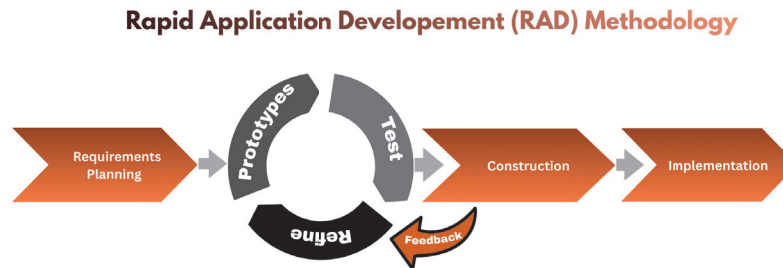


Figure 1. Rapid Application Development (RAD)

The Digital Farmers' Produce System was designed, developed, and evaluated using the Rapid Application Development (RAD) framework. RAD focuses on developing a system using rapid prototyping, continuous iterations, and implementers/user feedback (Martin, 1991). This framework was suited for this particular project as the system needed to incorporate the day-to-day practical needs of farmers, buyers, and agriculture personnel, and be flexible for adjustments after user feedback was collected.

Phases of the RAD Framework

The project followed the four major phases of the RAD framework:

1. **Requirements Planning** – Interviews and surveys were carried out and existing service coordination practices were reviewed to understand the day-to-day needs of farmers, buyers, and agriculture personnel (i.e. the target users of the system). The purpose of this step in the RAD framework was to identify key issues and needs of the users, as well as the functional and non-functional requirements of the system and the limitations of the project.

2. **User Design** – The initial design of the system was developed using wireframes, mockups, and user flows. The main system processes determined included user registration, user login, posting of produce, searching for buyers, sending messages, submitting requests for resources, viewing notifications, selecting language, SMS notification, and monitoring by agriculture personnel.
3. **Construction** – The selected technologies and system design were used to develop the web application. The core modules that were constructed and enhanced on the basis of test and feedback included user management, produce listing, buyer search, the messaging system, notification, SMS alerts, resource requests, dashboard summaries, Bisaya language toggle, and CSV reporting.
4. **Cutover** – At this stage, the system was ready for the pilot use and evaluation in the Municipality of Sinacaban. This included the deployment of the system to the cloud hosting environment, user orientation, user testing, security testing, fixing of reported bugs, and documentation of the findings.

System Models

Infrastructure Architecture

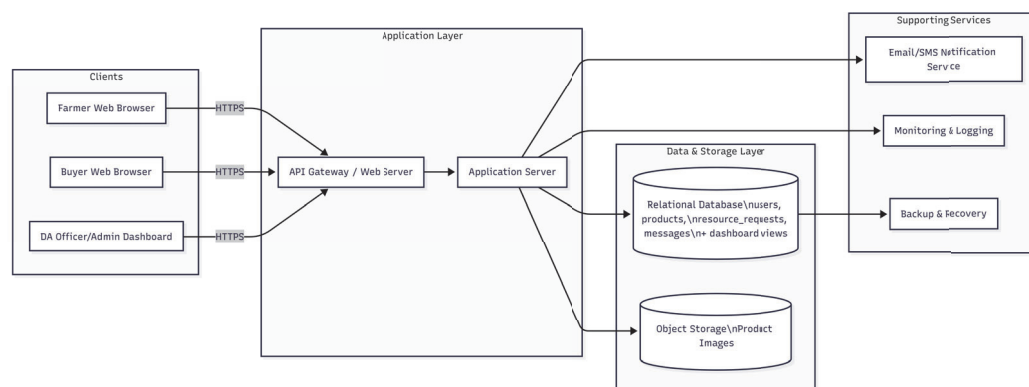


Figure 2. Infrastructure Architecture

Figure 2 shows how the *Digital Farmers' Produce System*. A web and application

server that manages user sessions and handles business requests and inputs sits behind the users. Farmers, buyers and agriculture officers, together with administrators, can access the System via any standard desktop or mobile web browser and can perform their functions with business ease through secure HTTPS connections.

The System's structured data of users, produce, product listings, categories, messages, notifications, resource requests, logs, preferences, and system and user SMS notification messages are managed by a cloud-managed MySQL system. Images of products and other resources uploaded to the System are managed by the System's cloud-based hosting. Embedded in the System are SMS, changes in the status of requests and advisory messages to users. The hosting is monitored to provide requested data and to perform standby data recovery.

The System is constructed to allow centralized management and maintenance. Users of the System can, within a certain authority, easily use the System via their mobile, laptop, or desktop computer as the System is accessible online.

Entity Relationship Diagram

An Entity Relationship Diagram (ERD) for the Digital Farmers' Produce System is exhibited in Figure 3. It identifies an early design schema for a database to help the system. The ERD identifies primary entities along with attributes and relationships among the listed entities. The primary entity for the USERS table has attributes for Farmers, Buyers, and Administrators. Other entities comprise AREAS, POSTS, PRODUCE, POST_IMAGES, POST_INTERESTS, ANNOUNCEMENTS, NOTIFICATIONS, CONVERSATIONS, MESSAGES, RESOURCE_REQUESTS, and SYSTEM_LOGS.

The design logic for the system is divided into functions for user management, product posting, buyer interaction, communication management, notifications, announcements, and management of resource requests. The design logic integrates entities in that Farmers are linked to areas where they post produce, Buyers express interest in the posted produce, and Users are able to converse and send messages to each other. The design of the ERD is optimal and aids in the organization and structuring of a system that

is able to maintain data integrity.

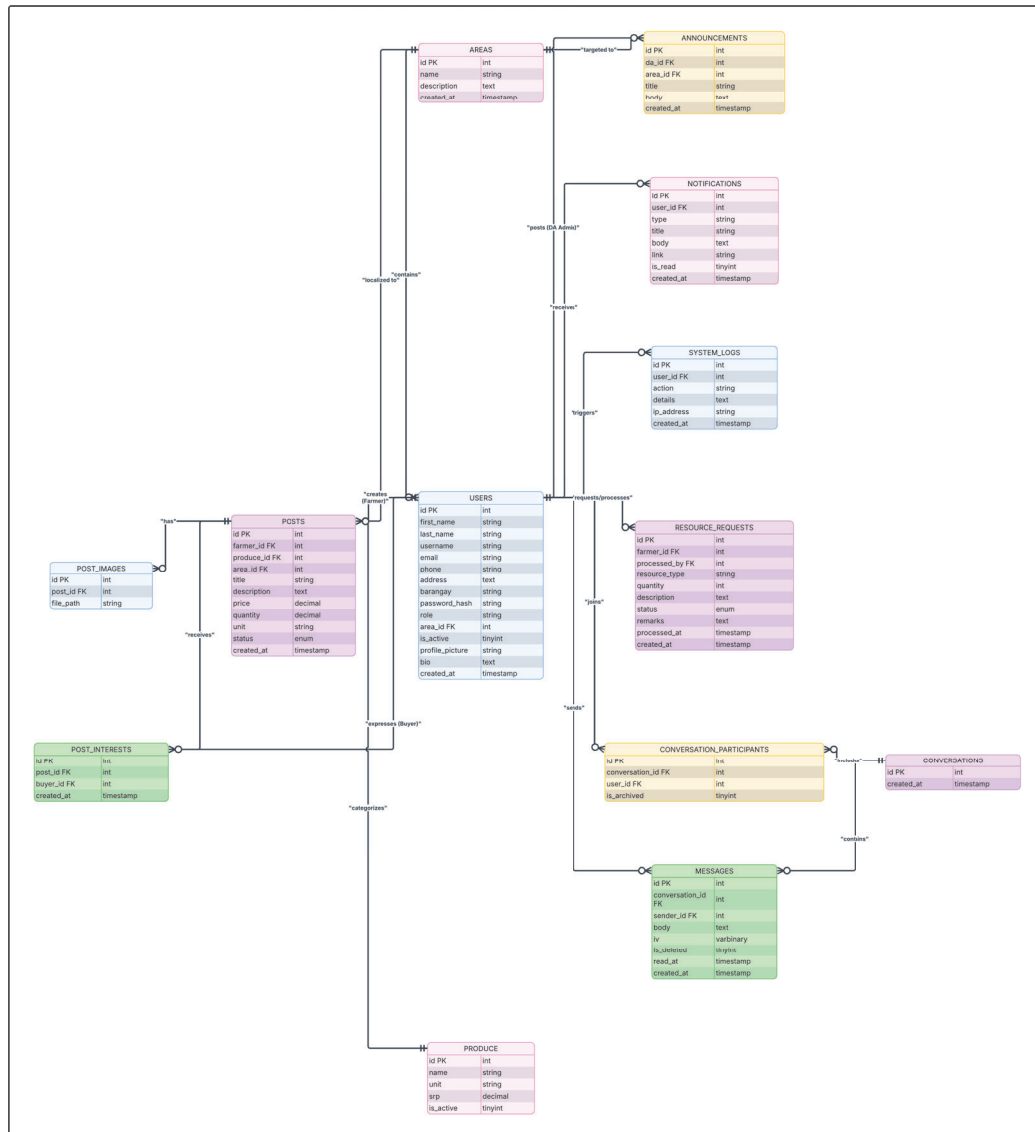


Figure 3. Entity Relationship Diagram

Use Case Diagram

According to Figure 4 the proposed system can be represented by a use case diagram consisting of four primary components including Super Admin, DA Staff, Farmer, and Buyer. The roles of the Super Admin and DA Staff are to manage system users and oversee the platform, respectively. Farmers create, update, and organize listings of agricultural products on the platform, while Buyers can look up and inquire about products

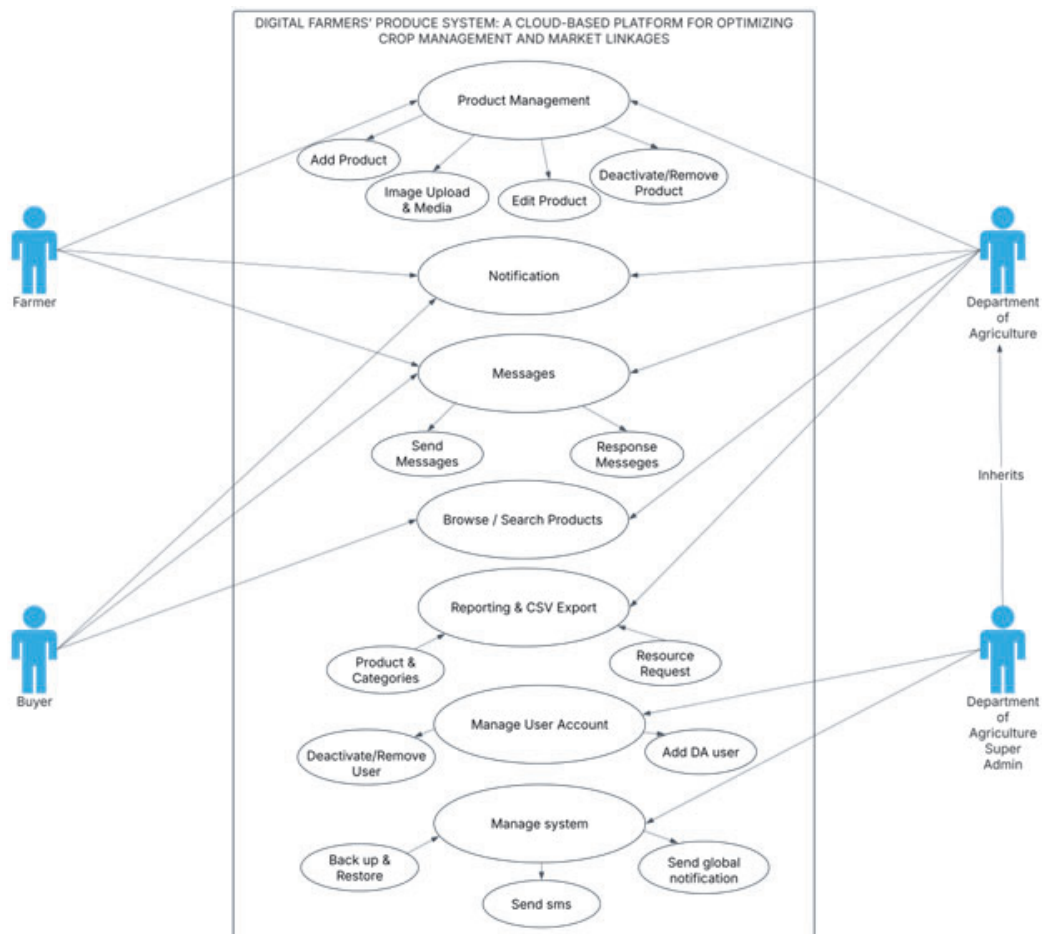


Figure 4. Use Case Diagram

of interest.

The system offers several core functionalities that include product control, messaging, notifications, reports, resource requests, and management of the system. The messaging feature allows Buyers and Farmers to chat and notifications update users regarding the activities on the system. The diagram further shows inclusion dependency in system functions; for example, the activity of product management includes actions of adding, updating, and deleting. In totality, the use case diagram indicates that the system serves a consolidated digital system framework for management of agricultural products, communication activities, and monitoring and administrative services.

Context Diagram

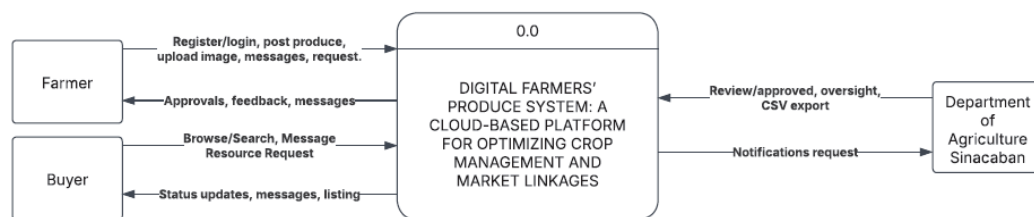


Figure 5. Context Diagram

Figure 5 is a construct of the Digital Farmers' Produce System, outlining the process that interacts with external system users including farmers, buyers, and agricultural officers. Farmers provide registration details and product postings along with photos and messages, resource requests, and language preference. Buyers enter registration details to provide requests for messages and for searching/browsing. Agricultural officers provide messages along with monitoring inputs, requests, and reviews with advisory input.

The system offers product postings, status updates, and system messages through the alerts. Informational summaries, reports, notifications, and requests are available for download along with display texts that are customized and localized to the interface. The flow of information and the limits of the system are explained in the diagram.

Data Flow Diagram

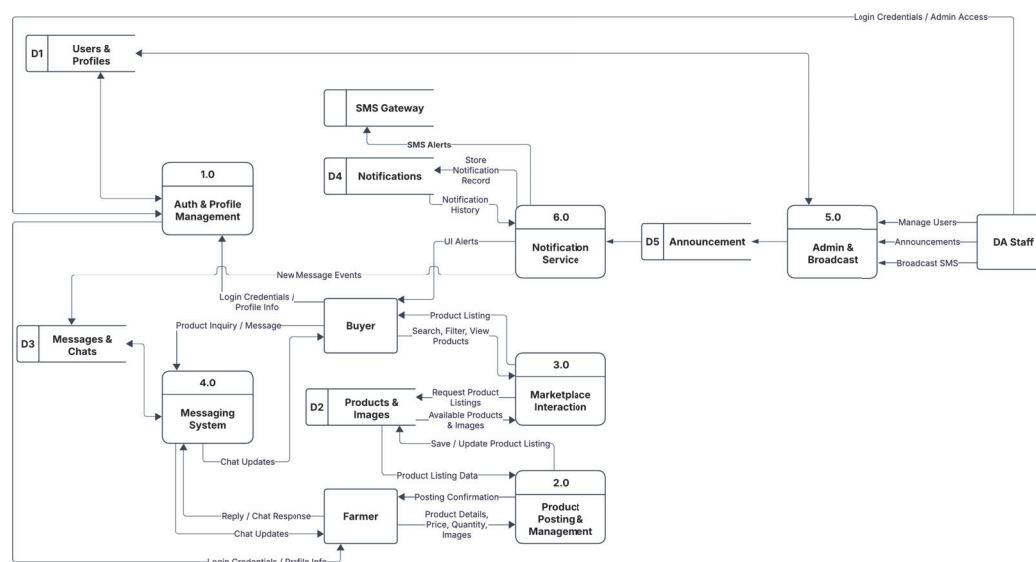


Figure 6. Data Flow Diagram

Figure 6 decomposes the system into major internal processes and data stores. The system manages authentication and account sessions. It allows users to access a storage portal. A user is able to create, edit and view product listings. Users are able to deactivate listings. A user is able to submit a resource request. A reviewer may choose to approve or reject it.

The notification process records and delivers alerts and announcements to users. Alerts are heard and read. Important updates, like status requests, are sent to users via SMS. An advisory displays interface labels and apps in the Bisaya. It allows users to upload product images. The reporting and CSV export process retrieves relevant data from the system and generates summaries or downloadable reports. These processes show how user inputs are stored, processed, and returned as useful information.

Materials/Technologies Used

The system was developed with PHP and MySQL stack that is compatible with shared hosting. This makes it suitable for local government and community-level

deployment. The chosen technologies are used considerably in other implementations, are low-cost, and are suitable for organizations with low infrastructure and budgeting.

Backend Runtime and Framework

- **PHP 8.x** was used as the primary backend runtime.
- The routing and controller dispatch are handled by the **Flight micro-framework**.
- Routes are created by `Flight::route`, are allocated controller disposition, and are rendered.
- To assist with the organization and upholding of the code, **PSR-4** and **Composer** were utilized for autoloading.

Frontend Technologies

- The UI is developed using **HTML5**, **CSS**, **JS**, and **Bootstrap 5**.
- Bootstrap's grid and components are used to develop responsive tables, forms, and cards that change according to the screen utility.
- Basic accessibility is used with good labels, a good order of tab disposition, readable text, enough contrast, good clarity of icons, and a simplified UI.

Localization and Notification Support

- The system includes a **Bisaya language toggle** that allows users to switch selected interface labels, instructions, and messages into Bisaya. This feature supports farmers and local users who are more comfortable using the local language.
- The system supports **SMS notifications** for important updates such as resource request status, advisories, and official agriculture-related announcements. This feature helps reach farmers who may have limited internet access or who do not regularly check the web application.

Database

- A **MySQL** database was used to store the structured data of users, roles, product categories, product listings, messages, notifications, resource requests, language-related entries, SMS notifications, and audit logs.
- To enable efficient filtering and searching, tables were indexed by commonly queried fields such as the product name, category, and barangay.
- Where applicable, foreign keys and constraints were used to maintain referential integrity among related records.

Deployment and Testing Environment

- Because they were beyond the project budget, premium commercial cloud hosting services, such as GoDaddy, were not used in the evaluation phase.
- Instead, the system was hosted on a local server and made available on the internet using a secure, cross-platform, commercial tunneling service, **Ngrok**.
- This provided temporary public URLs and remote access to the hosted system for the respondents and evaluators without incurring the cost of a paid server.
- The setup allowed demonstration of the system, usability testing, User Acceptance Testing (UAT), and remote evaluation while maintaining development constraints.

Development Tools

- Development of the system involved the use of a code editor or integrated development environment (IDE) that supported PHP.
- Versioning of the source code was done using **Git**.
- Simple task lists or lightweight project management tools were used to track implementation of features, bug fixes, and the progress of documentation.

System Design

The system design covers the functional and non-functional scopes of the application. The functional part of the design focuses on the major features and modules of the system. The non-functional part of the design concerns the system's qualities, for example, usability, performance, security, availability, and maintainability.

Functional Design

This section identifies the system's main functional components:

- **User Management and Roles** – Users are categorized into four groups based on their roles with the system: farmer, buyer, agriculture officer, and administrator. Registration and log in are provided to all users, with the system managing role-specific controls.
- **Product Categories and Listings** – There are functionalities that provide product listings to users, with farmers managing creation, editing, archiving, and viewing of listings. Listings also include information on the crops, and listings are categorized to manage consistency and filtering.
- **Buyer Search and Discovery** – The system provides functionality for buyers to search for products, with crop listings provided based on filtering of the product category, name, location, and other factors.
- **Messaging and Inquiries** – The system messaging module facilitates communication to and from the buyer, farmer, and agriculture personnel. This module supports product inquiries and resource requests, as well as system messaging.
- **Resource Requests** – Farmers are able to submit resource requests for farming, and these requests are reviewed by agriculture officers for decision making with the options to comment and update status. Farmers manage their requests and are able to view status updates.

- **Notifications** – The system manages various notifications for messaging, request status and system announcements.
- **SMS Notification** – The system manages SMS messaging for requests and announcements related to farming and agriculture. Alerts and notices are provided to users, particularly regarding status updates for resource requests.

This enables farmers to access important information even when they have minimal internet connectivity or are not using the web application.

- **Language Toggle** – The system provides a Bisaya language toggle that translates some of the interface labels, instructions, and messages into Bisaya. This enables local users, who are more proficient in the Bisaya language, to comprehend the system instructions in their preferred language.
- **Dashboards and Metrics for Agriculture Officers** - Agriculture officers have access to dashboards that summarize total active listings, what produce is available, the number of registered farmers and buyers, and the resource requests. These dashboards aid in the summarization of data for the purpose of basic monitoring and aid in decision making.
- **CSV Export** - Users who have permission to access this function have the ability to download filtered records for product listings as a CSV. This functionality is useful to agriculture personnel for the purpose of data and documentation and reporting activities in an offline manner.
- **Validation, Feedback and Logging** - Certain forms undergo server-side validation. If an action bears success, the system deciphers a message to the user as such. Similarly, for actions that bear failure, a message is displayed. A basic system of logging for actions is implemented to aid in the function of troubleshooting.

Non-Functional Design

A number of non-functional characteristics have been included in the system design and construction.

- **Usability and Accessibility** - For the design of the system, simplicity, clarity, and consistency, as well as a minimal number of fields, have been prioritized. The design of the system aims to provide simultaneous accessibility to both mobile and desktop navigation. For those who have a lower level of digital literacy, a Bisaya language toggle has been implemented to help local users understand various system instructions. Accessibility is further supplemented through SMS notifications which can provide farmers with system updates, even when the internet is inaccessible.
- **Performance** - Page templates, database, and frequent queries have been organized with performance in mind, given that response time was constrained under the development of a shared hosting environment. It was also a priority to limit the data loaded to the system to ensure response times remained optimal.
- **Security** - The system has adopted a design that ensures the use of SHA 256 to ensure encryption of data when transmitted through the system. The system has also been designed to reduce risks and ensure the protection of sensitive information which is stored within the system, through the use of secure hashing mechanisms to store passwords.

Protected routes implement role-based access control. To mitigate SQL injection and XSS, there are measures such as input validation and use of prepared statements and output escaping.

- **Availability and Backup** – For data recovery and availability, the system utilizes hosting-level backup and monitoring services. This minimizes the risk of data loss due to a technical failure.
- **Maintainability** – The project has a defined structure that employs organized folders

and consistent naming. It separates configuration from application code. This makes updates, bug fixes, and expansion of the system easier in the future.

Implementation

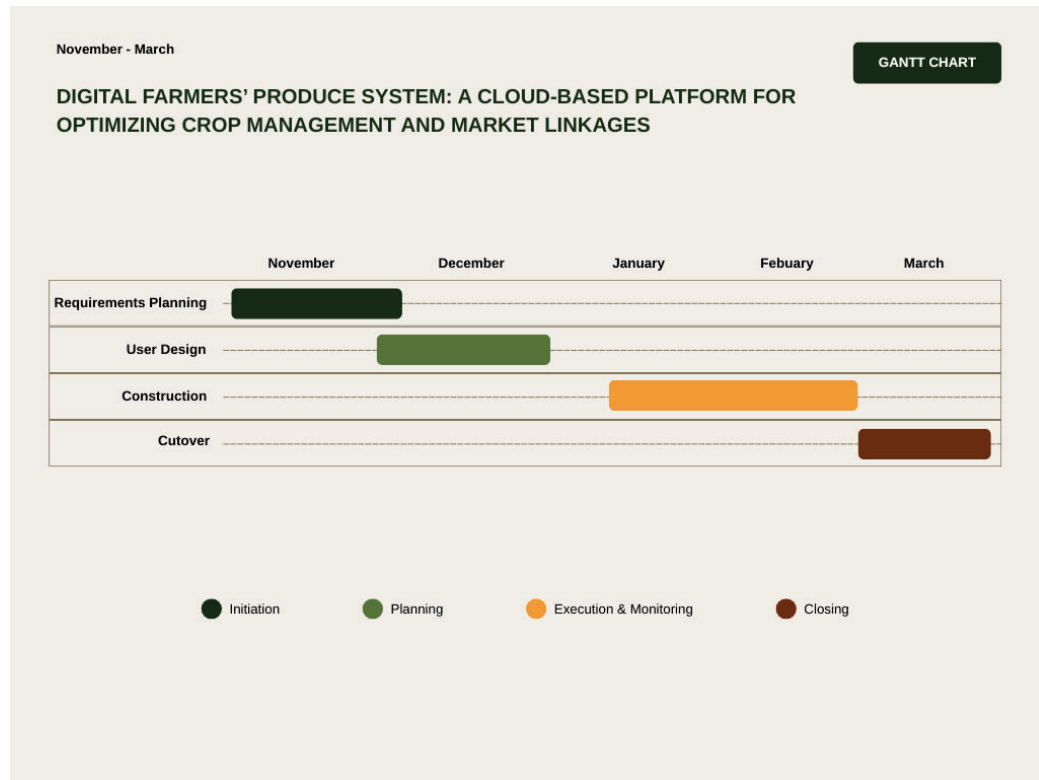


Figure 7. Gantt Chart

The project implementation schedule spans from November to March. Requirements Planning was the first project phase, beginning in November. This phase built up from November 1-27, during which project initiation and planning took place, stakeholder interviews occurred, and relevant documents and literature were collected and reviewed. The project problem, user needs, system requirements, and initial support documentation were developed during this phase.

The User Design phase occurred next, from late November to December. In this phase, information was analyzed, documentation was prepared, and the system outline,

wireframes, and user flows were created along with draft documentation. Construction was the next phase. The User Design phase documentation revisions were made before entering the Construction phase.

The Construction phase took place in January and February. This phase focused on the development of key system modules, including: user management, produce listings, buyer search and messaging, notifications, alerts, requests and a summary dashboard, reporting with a toggle between English and Bisaya, and alerts sent via SMS. The messaging and alerts added modules were developed to enhance system functionality and reliability. Bisaya was incorporated to provide support to local users of the system. Additional SMS alerts were implemented to provide relevant system updates to local farmers. These updates may include new resources that have been requested. This was implemented to assist farmers who do not have internet access.

The Cutover phase was planned for the period spanning late February to March. Activities within this phase included pilot deployment, user orientation, user testing, security testing, User Acceptance Testing (UAT) grounded in the Technology Acceptance Model (TAM), a results review, final documentation preparation, and final defense preparation and submission of requirements.

Project Assessment

User Testing

Twelve (12) participants made up the user testing; five (5) farmers, four (4) buyers, and three (3) Department of Agriculture and/or Municipal Agriculture Office (DA/MAO) personnel. Participants covered the three key user categories of the system. This was vital since the Digital Farmers' Produce System is intended for use among farmers, buyers and agricultural officers.

Table 2. Profile of Respondents by Age Group and Role

Age Group	Farmers	Buyers	DA/MAO	Total f	Total %
18–25 years old	0	0	0	0	0.0
26–35 years old	0	0	2	2	16.7
36–45 years old	1	3	0	4	33.3
46 years old and above	4	1	1	6	50.0
Total	5	4	3	12	100.0

Note. Percentages are based on N = 12.

As shown in Table 2, half of the respondents were 46 and older, and there were no participants in the 18–25 age bracket. It is important to mention this since the system is focused on actual agricultural end-users. Many of these users are likely not digitally literate. Therefore, positive findings on usability from older users demonstrate that such a simplified interface can indeed accommodate the community.

Table 3. Experience in Using Smartphones/Web Applications by Frequency of System Use

Frequency of System Use	Beginner	Intermediate	Advanced	Total f	Total %
Daily	0	0	0	0	0.0
Weekly	0	0	0	0	0.0
Occasionally	0	0	0	0	0.0
First-time user	4	8	0	12	100.0
Total	4	8	0	12	100.0

Note. All respondents evaluated the prototype as first-time users.

Table 3 shows that all respondents were first-time users of the system. Four participants reported beginner level experience in using smartphones or web applications, while eight of them reported the same experience at an intermediate level. These findings further strengthen the meaning of the usability ratings as all participants evaluated a system of which they had no prior knowledge. However, the results do indicate that the system will need to provide proper engagement paired with onboarding, practice, and support from the local agriculture office to ensure its sustainability.

Technology Acceptance Results

The evaluation of user acceptance of the system was based on the Technology Acceptance Model. The model comprises the following dimensions: perceived usefulness, perceived ease of use, attitude towards using, and behavioral intention to use. The model was further expanded to include dimensions to assess system performance and user satisfaction. Before assessing the average scores on each dimension, a reliability analysis was performed on a pilot study of 10 users. The assessment was found to have a high degree of reliability, with a Cronbach's alpha score of 0.837.

Table 4. Summary of Mean Ratings for System Usage by Role

Indicator	Farmers M	Buyers M	DA/MAO M
Perceived Usefulness	4.45	4.81	4.58
Perceived Ease of Use	4.55	4.81	4.75
Attitude Toward Using	4.87	5.00	4.67
Behavioral Intention to Use	4.40	4.50	4.78
System Functionality Evaluation	4.84	4.95	4.67
Overall Satisfaction	4.50	4.88	4.67
Overall Mean	4.60	4.83	4.69

Note. Scale: 1.00–1.80 = Strongly Disagree; 1.81–2.60 = Disagree; 2.61–3.40 = Neutral; 3.41–4.20 = Agree; 4.21–5.00 = Strongly Agree. M = Mean.

As shown in Table 4, all role groups had a positive perception of the system. Farmers reported an overall mean of 4.60, buyers 4.83, and DA/MAO staff 4.69. All of these results registered under the category of *Strongly Agree*. This shows that the targeted users strongly appraised the Digital Farmers' Produce System during the pilot assessment.

With regards to perceived usefulness, farmers scored an overall mean of 4.45, buyers 4.81, and DA/MAO officers 4.58. Overall, these scores imply that the system was considered useful by all user groups. The buyers' scores imply that the system provided a solution to their need of having access to farmers and/or buyers, and that the buyers were able to access the farmers in real-time. The farmers also had a positive perception of the system. However, some variability was noted on the item related to the system of connecting buyers and/or farmers. The variability may have been due to uncertainties in their previous buying/selling activities. The variability may also have been due to their previous expectations related to digital contact.

Perceived ease of use was also high, as farmers gave a mean of 4.55, buyers 4.81, and DA/MAO staff 4.75. With these results, it was concluded respondents felt the system was easy to learn and use. The interface clarity item received high ratings across groups, indicating that even users with little digital experience were able to interpret system designs. However, the farmer group scored a bit lower on the item of use without help,

indicating that guided use may be needed for some farmers for the initial phase of the system after implementation.

The attitude toward using the system was the strongest acceptance dimension. Farmers' mean was 4.87, buyers 5.00, and DA/MAO officers 4.67, which meant the respondents were of the opinion that the system was a good initiative for the community, and they were at ease with using the system. The participants' remarks on having a positive attitude toward the system are a clear indication that they are likely to support and promote the initiative.

The same attitude was demonstrated toward the system when the acceptance dimension was measured using the behavioral intention to use the system. Farmers had a mean of 4.40, buyers 4.50, and DA/MAO staff 4.78. According to these results, when the system goes live, the respondents are likely to use it. The relatively lower farmer score was indicative that the system was intended for long term use, provided that the system was actively being used, buyer participation was visible and support for the system was being provided by the DA/MAO staff.

Functional Test Specifications

The functional test specifications were designed for the purpose of testing a particular function of the system. For each scenario, a step by step procedure was described, together with the ID of the scenario, the preconditions, the expected and actual result of the test, and a pass/fail evaluation of the test. The test scenarios were classified by the major roles of the users of the system.

Table 5. Functional Test Scenarios for Farmers

Test Scenario	Expected Result	Result
Register a farmer account	The farmer account is successfully created after valid information is submitted.	Passed
Log in to the system	The farmer is redirected to the farmer dashboard.	Passed
Create a crop listing	The crop listing is saved and displayed in the farmer's product list.	Passed
Edit an existing listing	The updated crop details are reflected in the system.	Passed
Deactivate a listing	The selected listing is removed from active listings.	Passed
View and reply to messages	The farmer can open and respond to buyer messages.	Passed
Submit a resource request	The request is recorded and becomes visible to DA/MAO staff.	Passed

Table 6. Functional Test Scenarios for Buyers

Test Scenario	Expected Result	Result
Register a buyer account	The buyer account is successfully created after valid information is submitted.	Passed
Log in to the system	The buyer is redirected to the buyer dashboard.	Passed
Search for products	Relevant product listings are displayed based on the search term.	Passed
Filter product listings	The system displays products based on the selected category, location, or availability.	Passed
Open a product listing	The buyer can view product details and farmer information.	Passed
Send a message to a farmer	The message is successfully sent to the selected farmer.	Passed

Table 7. Functional Test Scenarios for DA/MAO Staff

Test Scenario	Expected Result	Result
Log in as DA/MAO staff	The DA/MAO dashboard is displayed.	Passed
View registered farmers	The list of registered farmers is displayed.	Passed
View registered buyers	The list of registered buyers is displayed.	Passed
Review resource requests	Submitted farmer requests are displayed for review.	Passed
Approve or reject requests	The request status is updated successfully.	Passed
Export records to CSV	The system generates a downloadable CSV file.	Passed

When functional requirements are being evaluated, it concluded that the requirement has been satisfied if the task can be executed without resulting in an error, if the result corresponds to what was anticipated, and if the user who was assigned the task was able to successfully complete the scenario with little or no help.

Non-Functional Testing

Non-functional testing was conducted to evaluate usability, performance, reliability, compatibility, and responsiveness.

Table 8. Non-Functional Testing Criteria

Criteria	Description	Result
Usability	Users were observed while completing tasks such as posting, searching, messaging, and submitting requests.	Satisfactory
Performance	Page loading and response times were observed during login, dashboard loading, posting, searching, and messaging.	Satisfactory
Reliability	The system was monitored for crashes, unhandled errors, and repeated failures.	Satisfactory
Compatibility	The system layout was checked on Android smartphones, desktops, and laptop browsers.	Satisfactory
Responsiveness	The interface was checked for proper display on different screen sizes.	Satisfactory

The results showed that the system continued to be stable and usable during the entire period of testing. All of the primary workflows were completed successfully, and no critical errors were reported. The interface scaled appropriately on mobile and desktop devices.

Performance Testing

In order to check that the system offers an optimized user experience, performance testing was done using Lighthouse in the Google Chrome Developer Tools and ApacheBench. The focus was on the user interface and the performance of the system and accessibility as well as the best practices and the response of the server under conditions of different levels of simultaneous users.

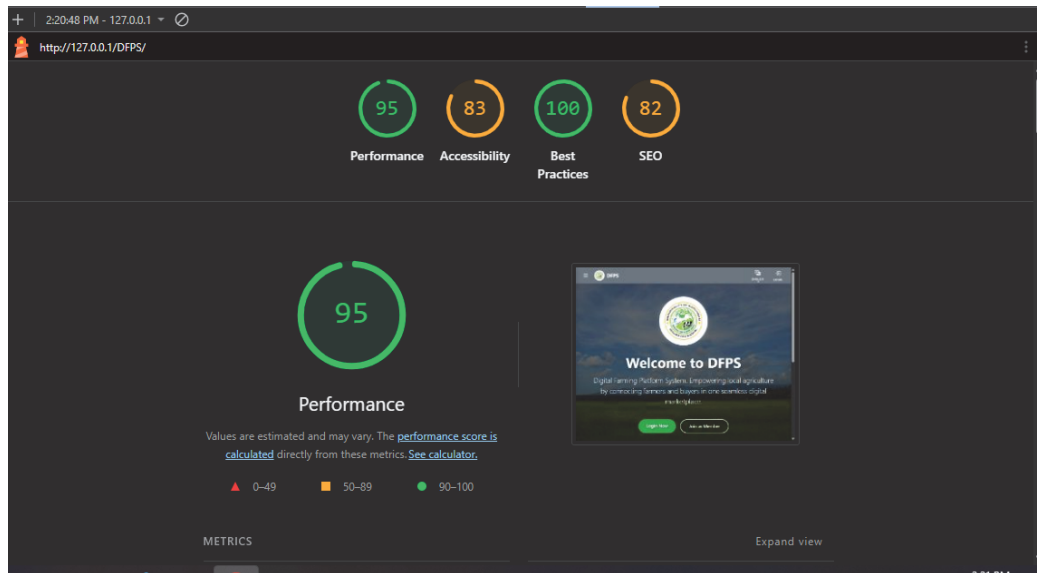


Figure 8. Lighthouse Performance Audit Results

Figure 8 presents the Lighthouse audit results of the system interface. The audit that can be seen as Figure 8 show that the user interface of the system provides stable performance.

Table 9. Performance Simulation under Concurrent User Loads

Simultaneous Users	Tool Used	Server Response Time (Average)	Status / Result
10 Users	ApacheBench	79 ms	Stable, no crashes
20 Users	ApacheBench	143 ms	Stable, no crashes
50 Users	ApacheBench	440.37 ms	Stable, 0 failed requests
100 Users	ApacheBench	804.01 ms	Stable, 0 failed requests

The audit was completed in order to assess the responsiveness of the user interface, the accessibility, and the optimization of the system. The results of the audit show that even under the conditions of one hundred simultaneous users the system was still usable, offering all the features of the marketplace.

```

C:\laragon\bin\apache\httpd-2.4.62-240904-win64-VS17\bin>ab -n 10 -c 10 http://localhost/DFPS/
This is ApacheBench, Version 2.3 <$Revision: 1913912 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking localhost (be patient).....done

Server Software:      Apache/2.4.62
Server Hostname:      localhost
Server Port:          80

Document Path:        /DFPS/
Document Length:      9672 bytes

Concurrency Level:    10
Time taken for tests:  0.112 seconds
Complete requests:    10
Failed requests:       0
Total transferred:    103980 bytes
HTML transferred:     96720 bytes
Requests per second:  88.93 [#/sec] (mean)
Time per request:     112.450 [ms] (mean)
Time per request:     11.245 [ms] (mean, across all concurrent requests)
Transfer rate:        903.01 [Kbytes/sec] received

Connection Times (ms)
              min      mean[+/-sd] median   max
Connect:        0        0   0.0      0      0
Processing:    44        69   9.7     70     79
Waiting:       29        66  14.0     70     79
Total:         44        69   9.7     70     79

Percentage of the requests served within a certain time (ms)
 50%    70
 66%    71
 75%    72
 80%    79
 90%    79
 95%    79
 98%    79
 99%    79
100%    79 (longest request)

```

Figure 9. Frontend Performance Score

Figure 9 shows the results of the performance testing done using ApacheBench, where the system was tested under the condition of ten users simultaneously accessing the system. The test was done to see if the web application was responsive, stable, and hosted on the Apache server.

The test results indicate that the server processed all 10 requests without failing any, which confirms the stability of the server under the given test conditions. The requests processed on average in 69 milliseconds with the server taking on average 112.45 milliseconds for each request. The server recorded a throughput of 88.93 requests per second with a transfer rate of 903.01 KB per second. The server recorded a connection time of 0 milliseconds, which means that there were no connection delays during the test. The server took on average 79 milliseconds to complete a request, which indicates that

the server is capable of serving multiple users at the same time without noticeable delays for users.

The overall results of the ApacheBench test show that the server is stable under a moderate load of users and that the server has quick response times and a low level of latency.

```
C:\laragon\bin\apache\httpd-2.4.62-240904-win64-VS17\bin>ab -n 20 -c 20 http://localhost/DFPS/
This is ApacheBench, Version 2.3 <$Revision: 1913912 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking localhost (be patient).....done


Server Software:      Apache/2.4.62
Server Hostname:      localhost
Server Port:          80

Document Path:        /DFPS/
Document Length:      9672 bytes

Concurrency Level:    20
Time taken for tests:  0.172 seconds
Complete requests:    20
Failed requests:       0
Total transferred:    207960 bytes
HTML transferred:     193440 bytes
Requests per second:  116.02 [#/sec] (mean)
Time per request:     172.389 [ms] (mean)
Time per request:     8.619 [ms] (mean, across all concurrent requests)
Transfer rate:        1178.07 [Kbytes/sec] received


Connection Times (ms)
              min    mean[+/-sd] median    max
Connect:        0      0   0.9      0      3
Processing:    26    85  39.5     93    143
Waiting:       17    83  40.6     92    143
Total:         29    85  39.3     93    143


Percentage of the requests served within a certain time (ms)
 50%    93
 66%   107
 75%   130
 80%   132
 90%   134
 95%   143
 98%   143
 99%   143
100%   143 (longest request)
```

Figure 10. Accessibility and Best Practices Audit

Figure 10 presents the ApacheBench performance test show the server's response times and throughput under the load of 20 concurrent users. This load was created by 20 simultaneous requests to the server.

The test shows that all 20 requests were successfully processed without any request failures. This ensures server stability under higher loads. The system's throughput was 116.02 requests per second with a transfer rate of 1178.07 KB per second. The average

total time taken by the server for a request was 172.389 milliseconds, and the average time taken to process a request by the server was 85 milliseconds.

ApacheBench reported minimal connection delays, and connection times were almost 0 ms. The longest request completion time was 143 ms, which is still acceptable for web-based apps. Completions were fast, and the requests were all processed. The system can handle more users. The system is reliable with no requests failing and response times quick. The system doesn't experience unstable performance.

```
This is ApacheBench, Version 2.3 <$Revision: 1913912 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking localhost (be patient).....done

Server Software:      Apache/2.4.62
Server Hostname:      localhost
Server Port:          80

Document Path:        /DFPS/
Document Length:      9672 bytes

Concurrency Level:    50
Time taken for tests:  0.440 seconds
Complete requests:    50
Failed requests:       0
Total transferred:    519900 bytes
HTML transferred:     483600 bytes
Requests per second:  113.54 [#/sec] (mean)
Time per request:     440.367 [ms] (mean)
Time per request:     8.807 [ms] (mean, across all concurrent requests)
Transfer rate:        1152.94 [kbytes/sec] received

Connection Times (ms)
              min      mean[+/-sd] median    max
Connect:        0        0   0.7         0        2
Processing:    53      226 106.2       231      389
Waiting:       32      224 107.3       231      387
Total:         53      226 106.1       231      389

Percentage of the requests served within a certain time (ms)
 50%    231
 66%    294
 75%    315
 80%    336
 90%    375
 95%    387
 98%    389
 99%    389
100%    389 (longest request)

C:\laragon\bin\apache\httpd-2.4.62-240904-win64-VS17\bin>ab -n 100 -c 100 http://localhost/DFPS/
```

Figure 11. SEO and Optimization Audit

Figure 11 presents the ApacheBench load test with 50 users. Simultaneous access was 50, and requests achieved a target of 0. Each request achieving the goal rated system stability during the test. Throughput was approximately 113.54 requests per second, and the system transferred data at an average rate of 1152.94 KB per second.

The average time for the server to process a request was 226 ms and 440.367 ms for the user, and the longest request took 389 ms. The results proved that the system can handle a significantly higher number of users concurrently accessing the system while considerably decreasing the performance of the system. Minimal connection delays were observed during the test with an average of 0 ms.

The results proved the system can support more users effectively, and requests were flawlessly processed with acceptable response times.

Figure 12 presents the ApacheBench load testing results conducted with 100 simultaneous users accessing the system concurrently. The benchmark was performed to evaluate the server's capability to maintain stability and responsiveness under heavy user load conditions.

The results indicate that all 100 requests were completed successfully with zero failed requests, demonstrating that the system remained stable even under high concurrency levels. The server achieved an average throughput of 124.38 requests per second and a transfer rate of 1262.96 KB per second. The average total time per request was recorded at 804.010 milliseconds, while the average server processing time was 387 milliseconds.

```

Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking localhost (be patient).....done

Server Software:      Apache/2.4.62
Server Hostname:      localhost
Server Port:          80

Document Path:        /DFPS/
Document Length:      9672 bytes

Concurrency Level:    100
Time taken for tests:  0.804 seconds
Complete requests:    100
Failed requests:       0
Total transferred:    1039800 bytes
HTML transferred:     967200 bytes
Requests per second:  124.38 [#/sec] (mean)
Time per request:     804.010 [ms] (mean)
Time per request:     8.040 [ms] (mean, across all concurrent requests)
Transfer rate:        1262.96 [Kbytes/sec] received

Connection Times (ms)
      min   mean[+/-sd] median   max
Connect:    0      0   1.0      0      7
Processing: 58    386 204.7    387    730
Waiting:    30    385 205.4    386    730
Total:      58    387 204.6    387    730

Percentage of the requests served within a certain time (ms)
 50%    387
 66%    500
 75%    567
 80%    598
 90%    672
 95%    713
 98%    730
 99%    730
100%    730 (longest request)

```

Figure 12. System Load Testing Results

The test shows that the longest time taken to process a request was within the acceptable operational limits and was 730 milliseconds. Response times for the extended load also remained within the acceptable operational limits for web-based applications. The delays caused for the system to establish a connection were very short, with an average connection time of almost zero, which shows that the server was handling requests and communicating in a stable manner.

Based on the results of the performed tests, the system was shown to facilitate a large number of concurrent users without usable requests being processed and without a

stable operational server performance, with no failures. The conducted tests further show that the system is able to respond to user traffic with a very responsive and optimized frontend. The Lighthouse audit shows that the Performance score was 95 and the Best Practices score was 100. This shows that the system offers good web optimization with fast page loading and responsive requests.

In addition, with zero failed requests, ApacheBench stress testing showed the server remained stable with a simulated load of 100 concurrent users. Response times did exhibit an increase under heavier testing, yet the system remained functional and showed no signs of failure or critical issues. Given these findings, the platform can be considered reliable and responsive in the context of a pilot deployment and in a real world scenario.

Bug Detection and Tracking

Bugs and usability problems were recognized through developer testing, observation of user sessions, and surveyor feedback. A defect log was utilized to document all problems encountered during testing. Each defect was documented with:

- Defect ID
- Reporting date
- Module/Page
- Severity level
- Steps to reproduce the defect
- Anticipated result
- Result
- Developer
- Status

Issues are categorized as critical, major, and minor. Critical issues are problems that make it impossible for the user to complete a core functionality. Major issues affect critical flows and are likely to have workarounds. Minor issues are problems pertaining to layout, labeling, and usability that do not hinder users from completing a task.

Bug Fixing and Regression Testing

All documented usability issues were prioritized and the identified problems were fixed. Some of the fixes included improving clarity for labels, arranging elements for layout on the mobile view, implementing validation for required fields, and improving the phrasing of error messages.

Regression testing was performed to ensure that the fixes were implemented correctly by executing test cases pertaining to the core flows of the application. The main functionalities of the application were retested as to not introduce any new errors to the application.

It was desired that before the application was deployed, there were no remaining critical issues and no major issues affecting the core flows of the application. Minor issues that remained were captured for future consideration.

User Acceptance Testing

The Technology Acceptance Model (TAM) was employed for User Acceptance Testing. The model's constructs that were the focus of the evaluation included:

- Perceived Usefulness
- Perceived Ease of Use
- Attitude Toward Using
- Behavioral Intention to Use

Besides the constructs of the model, other survey items were included to consider the functionality of the system and the level of satisfaction. After the hands-on testing, the

users were asked to complete a questionnaire on a five-point Likert scale. The respondents were to select one of five options, where one meant Strongly Disagree, and five meant Strongly Agree.

The results were interpreted descriptively, and the means and standard deviations were calculated. Strong user acceptance is reported and interpreted when the mean value is on the higher side. The Likert scale face validity was evaluated by a pilot group of 10. The Likert scale test of the survey items resulted in the Cronbach's alpha result of 0.837; therefore, it was concluded that the survey items on the scale had a good level of reliability and internal consistency.

Security Testing

The focus of the security testing was on the user data and the functions of the system. The security testing was performed to find the potential risks in the system before its full deployment.

Security testing consisted of a configuration review, a code review, a vulnerability scan performed by an automated tool, and a manual verification of the security service. The presence of the risk was evaluated based on the security of a web application.

Security Testing Results

An automated security scan was conducted using OWASP ZAP on May 10, 2026, to identify potential vulnerabilities before full deployment. The scan generated a total of 10 alerts. Notably, the assessment detected zero high-risk vulnerabilities.

The scanner identified two medium-risk alerts and two low-risk alerts:

- **Medium Risk:** The system was flagged for “Content Security Policy (CSP) Header Not Set” and “CSP: Failure to Define Directive with No Fallback”.
- **Low Risk:** The system triggered alerts for “CSP: Notices” and “Server Leaks Version Information via ‘Server’ HTTP Response Header Field”.

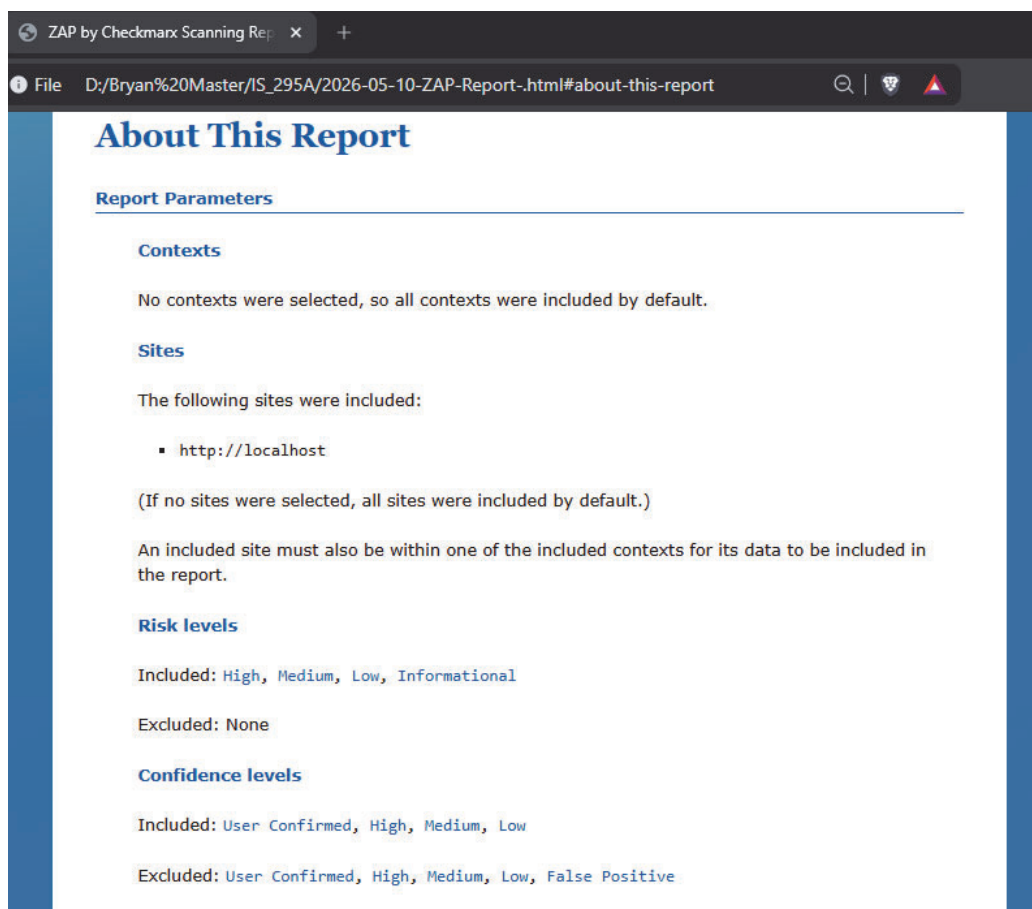


Figure 13. OWASP ZAP Security Testing Results

In addition, six informational alerts were generated. Among the alerts were “Information Disclosure - Suspicious Comments” and “User Controllable HTML Element Attribute (Potential XSS)”.

To address the medium and low risks before the system was rolled out to production, the system's HTTP response headers were configured to include specific CSP rules and server configurations were modified to contain the server version information. In addition, user input was escaped to mitigate possible XSS attacks.

Security Test Coverage

The security testing covered the following areas:

- The system is using SHA 256 for encrypted communication.

- The storage of passwords and the methods used for user authentication were assessed.
- Role-based access control was enforced and validated on the server.
- The inputs of the forms were validated against SQL injection attacks.
- The Text fields were validated against XSS attacks.
- The behavior of sessions and the logout function were assessed.
- The content of the error messages was reviewed to ensure no sensitive internal information was provided.
- The security headers were reviewed to check for their presence and adequacy.

Possible Security Vulnerabilities

The following security vulnerabilities were examined during the assessment.

Table 10. Security Vulnerabilities and Mitigation Measures

Possible Vulnerability	Risk	Mitigation Measure
SQL Injection	Attackers may attempt to manipulate database queries through input fields.	Use prepared statements, input validation, and database query parameterization.
Cross-Site Scripting (XSS)	Attackers may attempt to inject malicious scripts into forms or messages.	Apply output escaping, input sanitization, and content security policies.
Weak Authentication	Unauthorized users may attempt to access protected accounts.	Enforce password hashing, strong password rules, and secure login validation.

Table 10. Security Vulnerabilities and Mitigation Measures – Continued

Possible Vulnerability	Risk	Mitigation Measure
Broken Access Control	Users may attempt to access pages or records outside their role.	Apply server-side role checks for every protected route and resource.
Insecure Session Handling	Sessions may be reused or hijacked if not managed properly.	Use secure session configuration, logout invalidation, and HTTPS-only cookies.
Missing Security Headers	Browsers may not receive instructions to prevent common attacks.	Configure headers such as Content-Security-Policy, X-Frame-Options, and X-Content-Type-Options.
Information Disclosure	Error messages may reveal database details, file paths, or internal configuration.	Replace technical errors with generic user-friendly messages and log detailed errors on the server.

Manual Security Checks

Automated scans were supplemented with some manual testing. The checks that were performed or planned included the following:

- URL parameters were modified to see the resulting effect on user records.
- Script tags were added to input fields to see if the application was vulnerable to XSS attacks.
- Different validation and error messages were observed and recorded after submitting

different invalid form data.

- Protected pages were accessed to see if the application allowed access after the user logged out.
- Pages exclusive to a particular user role were accessed after a role change.

A security issue is present when a medium or high vulnerability is detected and if the automated scanner provides the ability to access a particular function, if input provided is interpreted as code or if the application provides information about the structure and/or internal components of the application.

Mitigation and Re-Testing

The following mitigation actions were taken to eliminate the vulnerabilities:

- Input validation was improved and output escaping was enforced.
- All database actions moved to prepared statements.
- Changes were made to strengthen the password policy, including a change to the password hash.
- CSRF tokens were added to all data modifying forms.
- An enforcement mechanism was put in place for server-side role-based access control.
- HTTP security headers were configured as part of the application's security policy.
- The application used a generic user error message in place of a detailed error message.

The application will be security tested by scanning using OWASP ZAP to perform both automated and manual testing. To ensure that this move did not introduce any other vulnerabilities, the manual testing will be repeated.

The security testing phase will be considered satisfactory when no high-severity vulnerabilities remain, manual attempts to bypass access control fail, and the system behaves securely and predictably under the tested conditions.

RESULTS AND DISCUSSION

This section details findings concerning the informal user testing undertaken for the Digital Farmers' Produce System. Respondent profiling is discussed next, followed by analysis based on the Technology Acceptance Model (TAM), the functionality of the system, overall user satisfaction, and reflections on the implementation of the project. Because the sample was a small, non-random, purposive sample of future users, the findings are viewed as informal/pilot evidence, not as statistically non-inferable results.

System Functionality and Overall Satisfaction

All groups rated functionality of the system positively. Farmers gave a mean of 4.84, buyers gave a mean of 4.95, and the DA/MAO officers gave a mean of 4.67. This means that the respondents, overall, agreed that the functionality of the system was adequate for the listing, searching, and filtering of products, as well as the messaging feature, the notification feature, and the responsiveness of the system.

Overall positive feedback for the messaging and product listing features showed that the system performed its primary function of enabling farmer users to post their produce and engage with prospective buyers. The respondents also positively rated the notification feature, including the SMS feature. This is critical for users who may not own or have access to a smartphone with a stable internet connection.

The DA/MAO group's ratings for the search and filtering functionalities were slightly lower than other ratings. This means that, for future versions, administrative users may have to be provided with more sophisticated and advanced filters, dashboards, and reporting capabilities. This finding is significant as DA/MAO staff utilize the system beyond normal browsing for monitoring, reporting, and support for decision making.

Overall satisfaction ratings were also positive. Farmers provided an average satisfaction rating of 4.50, while Buyers rated 4.88, and DA/MAO Officers rated 4.67. Overall, based on demand, the prototype addressed the target users' initial needs. However, the amount of participants in the study and the fact that the users were all first

time users, coupled with the fact that the study did not take into account possible long term use of the system, also speaks to the need for the utmost caution when making conclusions based on the results of the study

System Interface and User Workflows

The *Digital Farming Platform System (DFPS)* is a web based system developed as a marketplace to connect local farmers to online, DA supervised, buyers with the aim of modernizing and facilitating agricultural coordination and improving the ease of market accessibility to the local community.

Specifically, the system:

- Updates agricultural prices based on Suggested Retail Prices (SRPs);
- Enhances market access for small farmers;
- Provides agricultural staff with real time monitoring; and
- Facilitates telecommunications between farmers and buyers.

The system has four key roles: Farmer, Buyer, DA Official, and Super Admin. Each role has different features and workflows that are determined by their responsibilities and the access privileges that the system grants them.

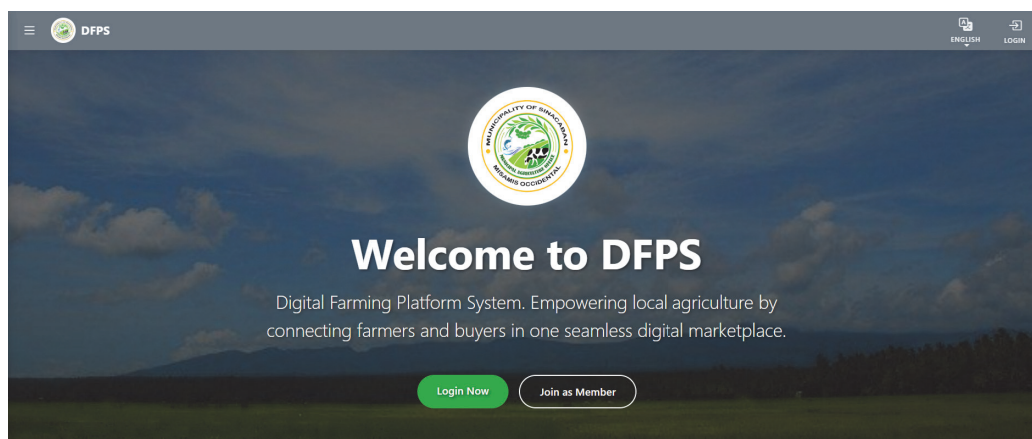
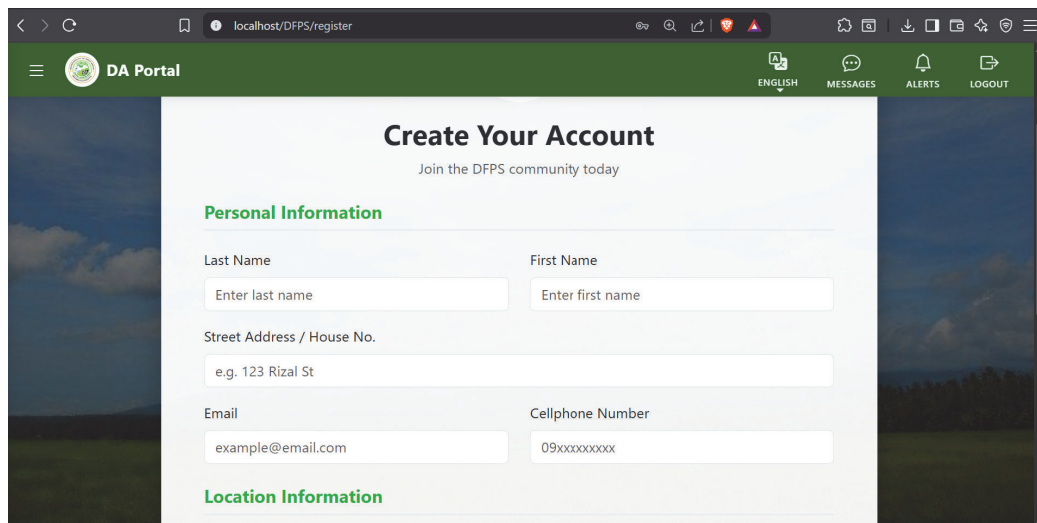


Figure 14. Landing Page

Registration Page



The screenshot shows a web browser window with the address bar displaying 'localhost/DFPS/register'. The page has a green header with the 'DA Portal' logo and navigation links for 'ENGLISH', 'MESSAGES', 'ALERTS', and 'LOGOUT'. The main content area is titled 'Create Your Account' with the subtitle 'Join the DFPS community today'. It features two sections: 'Personal Information' and 'Location Information'. The 'Personal Information' section includes input fields for 'Last Name' (placeholder: 'Enter last name'), 'First Name' (placeholder: 'Enter first name'), 'Street Address / House No.' (placeholder: 'e.g. 123 Rizal St'), 'Email' (placeholder: 'example@email.com'), and 'Cellphone Number' (placeholder: '09xxxxxxxx'). The 'Location Information' section is partially visible below.

Figure 15. Registration Page

Figure 15 following steps describe the account registration and login process of the system:

1. Open a web browser and access the registration page (`register.php`).
2. Fill in all required registration fields with the necessary user information.
3. Select the appropriate user role based on the type of account being created.
4. Create a strong and secure password for account protection.
5. Click the **Register** button to submit the registration form.
6. After successful registration, log in using the registered email address and password.

Login Page

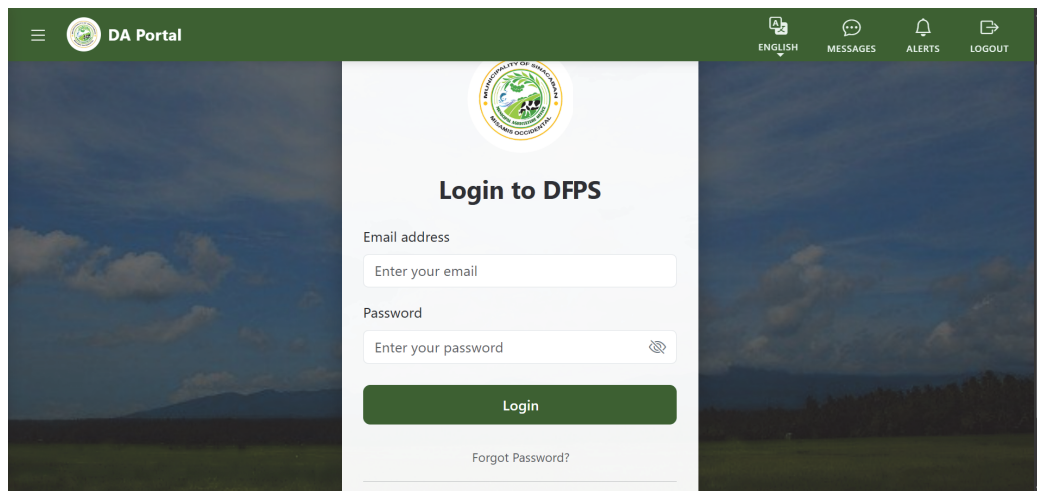


Figure 16. Login Page

Figure 16 illustrates the following to describe the user login procedure of the system:

1. Open a web browser and navigate to the login page (`login.php`).
2. Enter the registered email address and password in the appropriate input fields.
3. Click the **Login** button to access the system.
4. After successful authentication, the user will be redirected to the corresponding dashboard based on the assigned role.

Password Recovery Page

Figure 17 the system provides a password recovery mechanism for users who forget their account password. This feature allows users to securely reset their password through their registered email address.

Steps in Password Recovery

1. Open the *Forgot Password* page of the system.

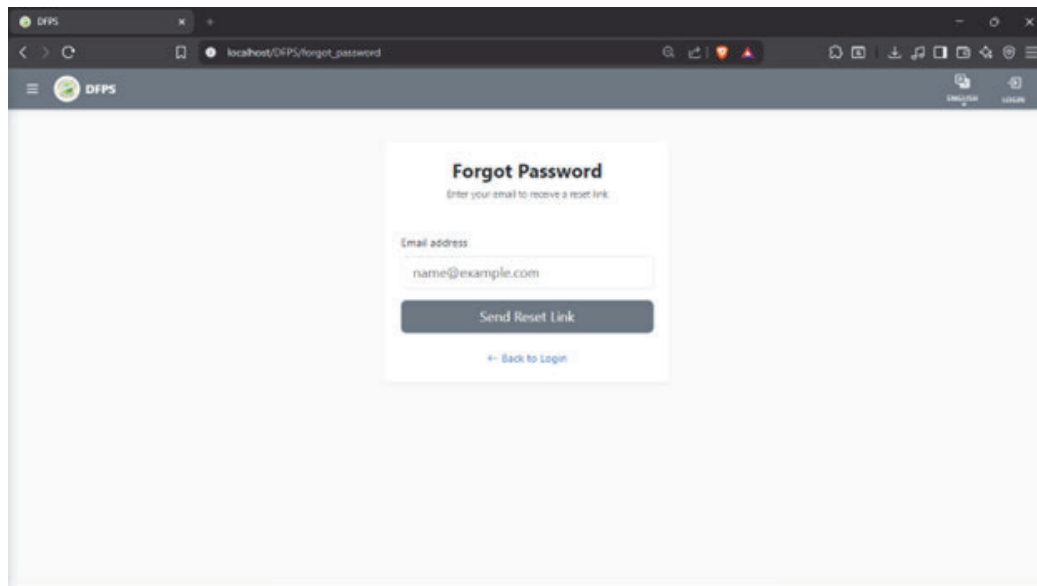


Figure 17. Password Recovery

2. Enter the registered email address associated with the account.
3. Submit the password recovery request.
4. Access the password reset link sent to the registered email address.
5. Enter a new password in the provided field.
6. Confirm the new password for verification.
7. Submit the password reset form to complete the recovery process.

Profile Management Page

Figure 18 shows how users can enter and amend information about themselves on the system. This module allows users to control the information and security of their account.

The following profile management functions are available:

- Change contact information.
- Change, or add a profile picture.

The screenshot shows a web browser window with the URL 'localhost/DFPS/profile/'. The page has a green header with the 'DFPS Farmer' logo. The main content area is divided into two columns. The left column, titled 'My Profile Settings', contains a profile picture upload area, fields for 'First Name' (filled with 'Eryan') and 'Last Name' (filled with 'Majano'), 'Email Address' (filled with 'id@gmail.com'), 'Phone Number' (filled with '+639171234567'), 'Street Address / House No.' (filled with 'Pobongal, Misamis Occidental'), and 'Bio / Short Description'. Below these is an 'Additional Details' section with a text area. A green 'Save Profile Changes' button is at the bottom. The right column, titled 'Security Settings', has a 'UPDATE PASSWORD' section with 'Current Password', 'New Password', and 'Confirm New Password' fields, and a red 'Change Password' button. Below this is an 'ACCOUNT STATUS' section with a blue 'FARMER' status and 'Verified Participant' text.

Figure 18. Profile Management

- Set, or reset the account password.

Farmer Dashboard Page

The screenshot shows the 'Farmer Dashboard' page. The header is green with the 'DFPS' logo and navigation links for 'ENGLISH', 'MESSAGES', 'ALERTS', and 'LOGOUT'. The main content area is divided into three sections. On the left is the 'Farmer Updates' section with sub-sections for 'Announcements', 'Subsidy', 'Ayuda', and 'Abono'. In the center is the 'My Product Listings' section, which shows three listings: 'Organic Coffee', 'Fresh Dried Coffee', and 'Rice'. Each listing includes a price per kg and a stock quantity. On the right is a search bar labeled 'Search my posts...'. The 'Organic Coffee' listing shows a price of ₱ 75.00 / kg and a stock of 100.00 kg. The 'Fresh Dried Coffee' listing shows a price of ₱ 70.00 / kg and a stock of 20.00 kg. The 'Rice' listing shows a price of ₱ 25.00 / kg and a stock of 100.00 kg.

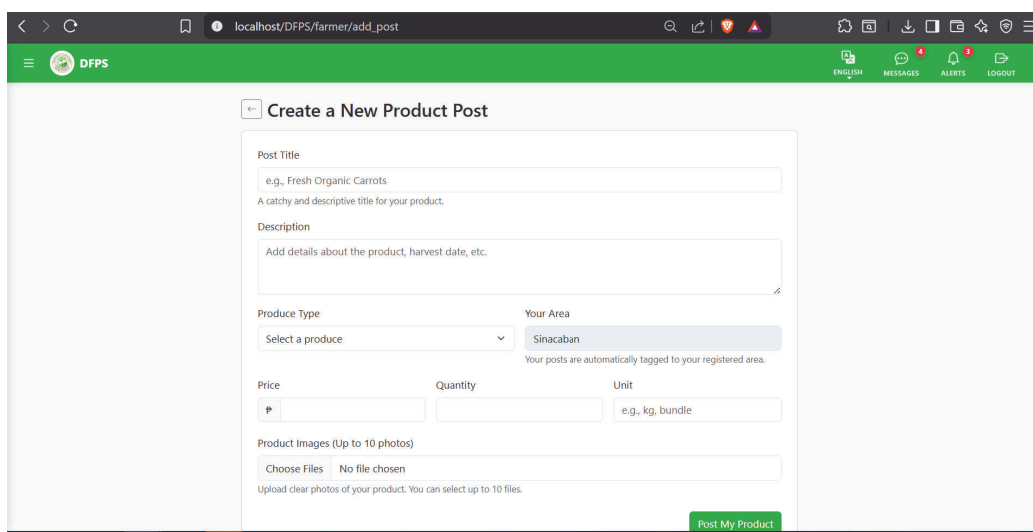
Figure 19. Farmer Dashboard

Figure 19 shows the farmer dashboard page of the system as the main page, from which the farmer gets all the features and system updates and notifications relevant to the farmer's activities.

The dashboard contains the following:

- **Announcements Panel** panel showing updates, notes, and announcements from the Department of Agriculture (DA).
- **Quick Links** access most used pages and to use the product management, messaging, notifications, and resource request features.
- **Notifications** showing the system notes and the status of requests with messages that were sent to the farmer.

Managing Produce Listings Page



The screenshot shows a web browser window with the URL `localhost/DFPS/farmer/add_post`. The page has a green header with the DFPS logo and navigation links for ENGLISH, MESSAGES, ALERTS, and LOGOUT. The main content area is titled 'Create a New Product Post' and contains a form with the following fields:

- Post Title:** A text input field with a placeholder 'e.g., Fresh Organic Carrots' and a note 'A catchy and descriptive title for your product.'
- Description:** A text area with a placeholder 'Add details about the product, harvest date, etc.'
- Produce Type:** A dropdown menu with the option 'Select a produce'.
- Your Area:** A dropdown menu with the option 'Sinacaban' and a note 'Your posts are automatically tagged to your registered area.'
- Price:** A text input field with a placeholder 'P'.
- Quantity:** A text input field.
- Unit:** A text input field with a placeholder 'e.g., kg, bundle'.
- Product Images (Up to 10 photos):** A file upload section with a 'Choose Files' button and a note 'No file chosen'. Below it, a note says 'Upload clear photos of your product. You can select up to 10 files.'

A green 'Post My Product' button is located at the bottom right of the form.

Figure 20. Managing Produce Listings

Figure 20 shows the system produce management listings page and allows the farmer to make listings of the products available for other users of the system to see and for potential buyers.

The page has the following:

- **Add Post Button** An add post button to create a new produce listing with the relevant product information.

- **Produce Details Form** A produce details form for the farmer to specify the product name, quantity, price, description, and the available stock.
- **Suggested Retail Price (SRP) Review** Helps farmers determine reasonable and competitive pricing for their products.
- **Submit Button** Posts the finished produce listing to the system after reviewing all the listed information and saves the listing.

To add a new produce listing, the farmer should follow these steps:

1. Click the **Add Post** button.
2. Fill in the required produce details.
3. Review the displayed Suggested Retail Price (SRP).
4. Click the **Submit** button to publish the listing.

My Listings Page

The screenshot shows the 'Edit Product Post' form in the DPFS system. The form is titled 'Edit Product Post' and includes the following fields and options:

- Current Images (1/10)**: A thumbnail image of coffee beans.
- Post Title**: A text input field containing 'Organic Coffee'.
- Description**: A text input field containing 'Next sunday'.
- Produce Type**: A dropdown menu with 'Coffee (Coffee Beans Dried)' selected.
- Price**: A text input field containing 'P 75.00'.
- Quantity**: A text input field containing '100.00'.
- Unit**: A text input field containing 'kg'.
- Status**: A dropdown menu with options: Active, Sold, Hidden, Archived, and Active. The 'Hidden' option is currently selected.
- SRP**: A text input field containing 'P70 / kg'.

Figure 21. My Listings Page

Figure 21 illustrates the My Listings page of the system, which allows farmers to view all produce listings they have made accessible to the public.

The page contains the following features:

- **Listings Table** Displays all active and completed produce listings made public by the farmer. Listings include product details, quantity, unit price, and the status of the listing.
- **Edit Button** Updates the information of a produce listing.
- **Delete Button** Enables the removal of listings that were made public by the farmer by mistake or are no longer necessary.
- **Mark as Sold Option** Updates the status of a listing after the transaction is complete.
- **Search and Filter Tools** Used by farmers to quickly locate a listing by the product name and/or by the product category or status.

This page helps farmers efficiently organize and monitor their produce listings while ensuring that product information remains accurate and updated within the system.

Interacting with Buyers

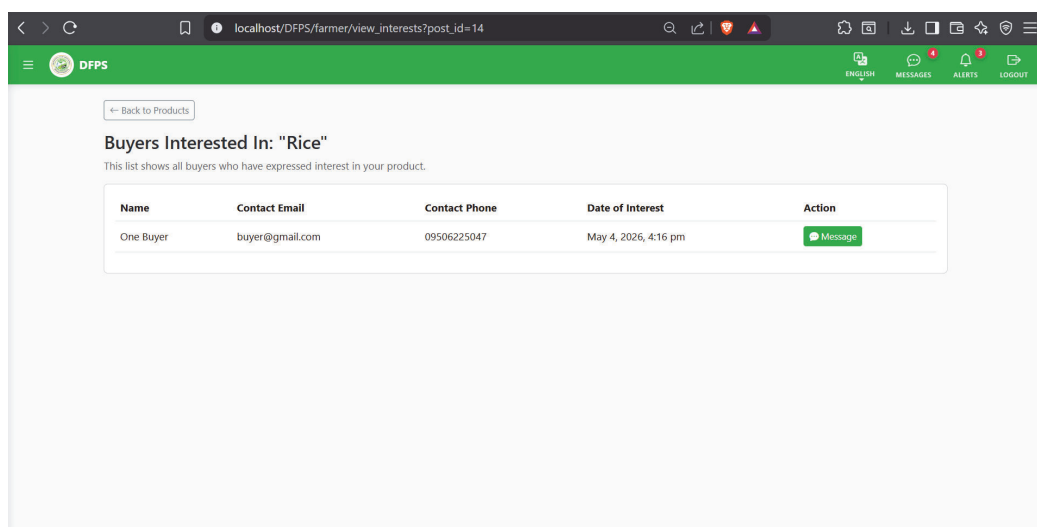


Figure 22. Interacting with Buyers

Figure 22 shows the system messaging interface used for interacting with buyers. This allows the farmer to directly contact the buyers that are interested in the listings and read more about the transaction.

The page provides the following functions:

- Farmers can directly communicate with the buyers via the messaging module.
- Buyers can message the seller about the listings to ask questions about the product's availability, price, quality, and how the product will be delivered to them.
- Farmers can respond to messages in a timely manner to complete the transaction by negotiating the terms of the sale.
- The messaging is the preferred method of communication which allows farmers to effectively communicate with buyers.

Marketplace Browsing Page

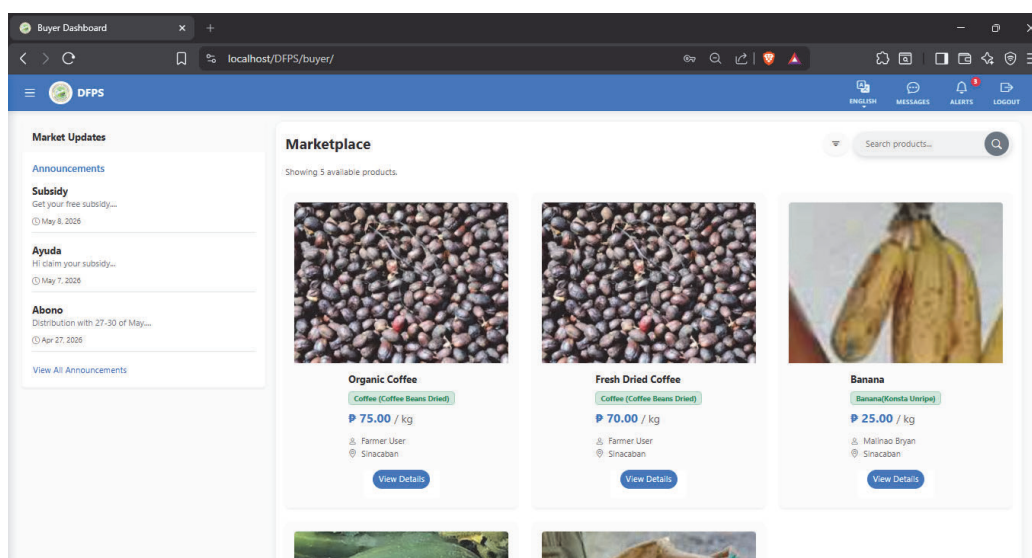


Figure 23. Marketplace Browsing

Figure 23 shows the marketplace browsing page of the system. This page allows users to explore available agricultural products posted by farmers within the platform.

The page contains the following features:

- **Search Bar** search by keywords to find specific agricultural products
- **Filter Options** search results depending on the product availability, sale price, product, category, or location of the seller
- **Produce Listings** of products including important details such as the product name and quantity, pricing, and seller info
- **Produce Details View** Allows users are given the option to view further product description, listing details, and images, as well as give them a chance to inquire and purchase the listed product.

Users can now search products listed in agricultural marketplaces.

Expressing Interest and Communication

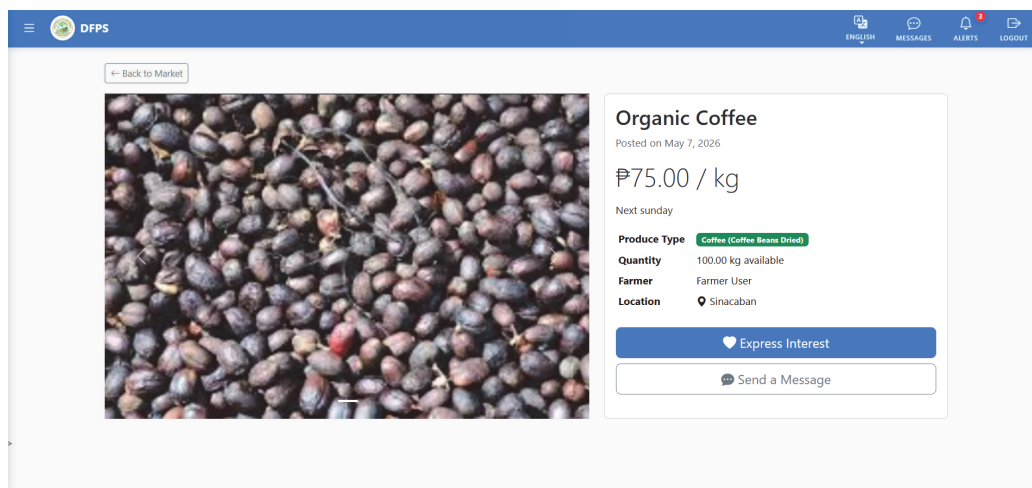


Figure 24. Expressing Interest and Communication

Figure 24 shows the communication interface used by buyers to express interest in agricultural products listed within the marketplace. This feature allows buyers and farmers to coordinate transactions directly through the system.

The following steps are involved in expressing interest and communication:

1. Click the **Express Interest** option on the chosen produce listing.
2. Use the built-in messaging system to contact the producer to ask questions about the product, its availability, and delivery.
3. Set the price, quantity, payment, and delivery preferences for the transaction.

This system works to improve the interaction of users and producers, making marketplace transactions work better.

Department of Agriculture Monitoring and Management Page

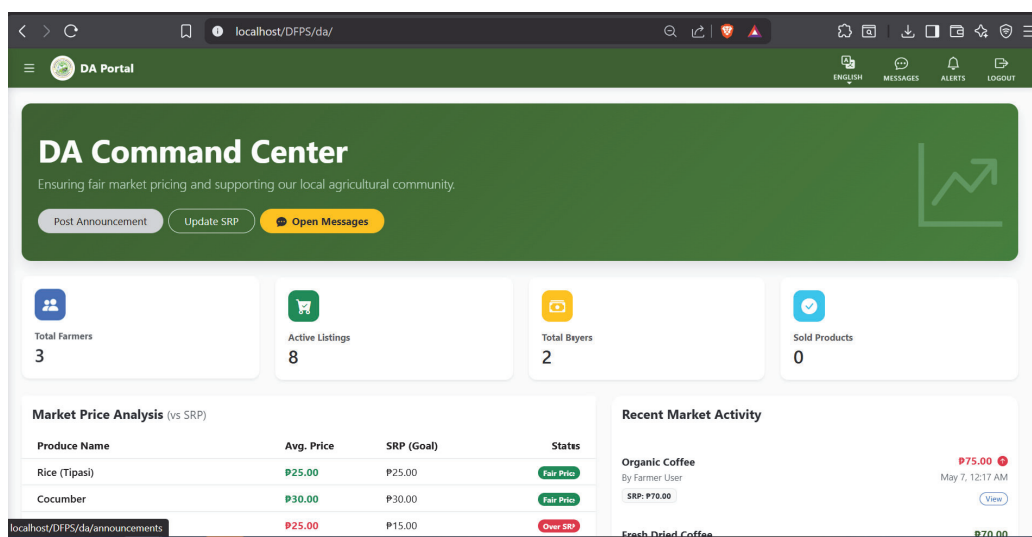


Figure 25. Monitoring and Management

Figure 25 shows the Monitoring and Management Page for Department of Agriculture (DA) Officials. This page gives selected staff the chance to watch how the system works, the ability to work with agricultural listings, and the opportunity to keep the proper and correct prices in the system.

The page provides the following functions:

- **Verify Accounts** This option allows DA officials to check buyer and producer Accounts to confirm that the users on the system are registered and are real.

- **Manage Produce Lists** This option allows officials to monitor, accept, modify, or delete produce listings.
- **Update Suggested Retail Prices (SRPs)** This permits officials to change the SRP to the prices that are correct and just for the products that are offered in the system.

The feature helps DA officials effectively monitor marketplace activities and maintain transparency, reliability, and fair pricing within the system.

Announcements and SMS Broadcasts

The screenshot shows a web browser window with the URL `localhost/DFPS/da/send_notification`. The page is titled "DA Portal" and has a navigation bar with links for "ENGLISH", "MESSAGES", "ALERTS", and "LOGOUT". The main content area is titled "Dispatch Communication" and contains a form for sending a "System Alert". The form has two tabs: "System Alert" (selected) and "SMS Notification". The form fields include:

- Target Role:** A dropdown menu with "All Farmers" selected.
- Target Area:** A dropdown menu with "All Locations (Global)" selected.
- Alert Title:** A text input field containing "Urgent System Alert".
- Alert Message:** A large text area containing "Details for the communication...".

Below the text area, there is a note: "Users will see this as a high-priority system notification." and a character count "0 characters". At the bottom of the form is a green button labeled "Broadcast Alert".

Figure 26. Announcements and SMS Broadcasts

Figure 26 shows the messages and SMS broadcast options for DA officials of the Department of Agriculture. This option allows DA officials to send important and urgent messages to the producers and other users of the system.

The page provides the following functions:

- **Create Announcements** This function enables designated Agriculture Department (DA) officials to post notices, announcements, plans, and other pertinent information on the system's dashboard.
- **Send Urgent SMS Alerts** This function allows officials to send time-sensitive

and/or emergency information to registered users of the system by means of short messaging service (SMS) text messages.

Through this function, the Department of Agriculture (DOA) and users of the system are better able to communicate as time-sensitive and emergency information are delivered to users of the system in a timely manner.

System Reports Page

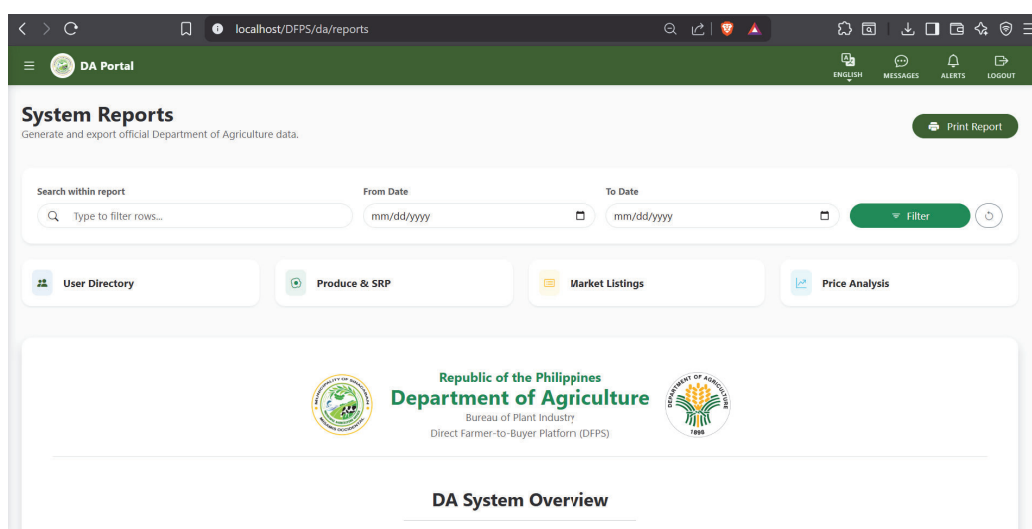


Figure 27. System Reports

Figure 27 shows the system reports page used by Department of Agriculture (DA) officials. This page provides functions to generate and export reports concerning activities related to the marketplace, agricultural products, and transactions related to the system.

The page contains the following features:

- **Generate Market Reports** This function allows DA officials to generate reports concerning the listing of produce and prices, as well as the activities of farmers and transactions in the marketplace.
- **Export Reports** This function allows the users of the system to export the reports that have been generated to a CSV or PDF format for their documentation, analysis, and record maintenance.

This function allows DA officials to keep track of activities in the marketplace, perform an analysis of the data pertaining to agriculture, and keep the records of the system in an orderly manner for the purpose of making decisions and reports.

Super Admin System Maintenance

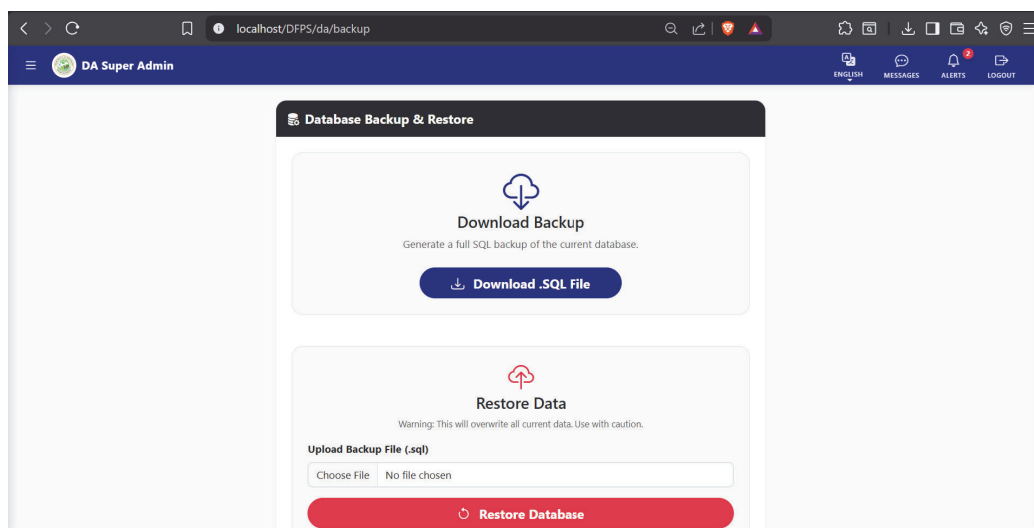


Figure 28. System Maintenance

Figure 28 shows the system maintenance page used by the Super Admin, which provides management tools for maintaining the system's database, managing the recovery of the system, and configuring the geographical information that is used within the system.

The page provides the following functions:

- **Create Database Backups** This function allows the Super Admin to generate copies of the system's database as a backup to ensure that the data is protected and that the recovery of the system is made ready.
- **Restore Backups** This feature allows previously created backups of the database to be restored after a system crash, data corruption, or for some other reason a database backup needs to be restored.
- **Manage Geographic Areas** This feature allows the Super Admin to set up and

administer the geographic areas (regions, provinces, municipalities, and barangays) that are employed by the system.

This feature promotes system reliability, data security, and the management of geographic data.

Manage DA Personnel

The screenshot shows a web browser window with the URL `localhost/DFPS/da/create_da`. The page title is "DA Super Admin". The main content area displays a form titled "Create Department of Agriculture Account". The form includes the following fields:

- First Name** and **Last Name**: Text input fields.
- Username**: Text input field.
- Email Address** and **Phone Number**: Text input fields.
- Assigned Area**: A dropdown menu with "Select Area" as the current selection.
- DA Role Level**: A dropdown menu with "Standard DA Staff" as the current selection.
- Temporary Password**: Text input field.

Below the password field, a note states: "User should change this after first login." At the bottom of the form is a blue button labeled "Register DA Account".

Figure 29. Manage DA Personnel

Figure 29 shows the page that the Super Admin utilizes to set up and manage Department of Agriculture (DA) personnel accounts. This feature allows the Super Admin to set up registered DA staff members who will control and oversee the operations of the system.

The page contains the following components:

- **Personnel Information Fields** This feature gives the Super Admin the ability to enter the first name, last name, username, email address, and mobile number.
- **Assigned Area Selection** This feature allows the Super Admin to assign an operational area to the DA personnel.
- **DA Role Level** This feature enables the Super Admin to set the authority and determine the level of the personnel role within the system.

- **Temporary Password Field** This feature allows the Super Admin to set or provide the personnel a password that will be used for their first login.
- **Register DA Account Button** Saves and creates a DA personnel account in the system.

This function also enables the proper administrative management of the platform and regulates access to the authorized Department of Agriculture personnel.

Insights and Lessons Learned

While carrying out the project multiple insights were made. Understanding the practices of farmers, buyers and agricultural officers is the first step to developing a localized agricultural platform. The system covers more than the buying and selling operations, it is also about the coordination, monitoring, and communication among stakeholders.

The second identified insight is that for the system to be fully accepted and adopted, user simplicity must be incorporated in the design. Since some of the respondents reported to having little to no experience on both smartphones and web applications, the design called for clear labels, a defined step-by-step workflow, and responsive mobile design. Positive ease-of-use ratings showed users perceived an intuitive workflow and barrierless adoption interface.

The third identified insight of this project was that market linkage is a two-way street. Buyers actively seeking out the system will result in more value to farmers, whereas a more active role in the selling and posting by the farmers will add greater value to the buyers. It is, therefore, important for the local agriculture office to support and onboard users, as well as advocate and sustain the quality of data on the system.

Support to municipal level agricultural coordination is also possible as the system ensures DA/MAO staff have better visibility of what is being requested and who the farmers are. This provides better support for planning and monitoring and facilitates the distribution of resources and subsidies.

Challenges Encountered

While carrying out the project, a couple of challenges were also identified. One of the challenges identified was designing a system that accommodates the various levels of digital and tech literacy among farmers, buyers, and DA/MAO staff. Considering the different tech literacy levels and stakeholders' expectations of the system, it was essential for the system to have a balanced interface that was simple and responsive.

Ensuring the system would function effectively on mobile devices was another challenge. Because most users are expected to use the system via smartphones, a responsive design was necessary. This required adjusting the layout to guarantee that buttons, forms, product listings, and messages would be readable and maintain functionality on smaller displays.

Another challenge was ensuring data accuracy. The system's functionality depends on the accuracy of product listings, quantities, prices, and harvest schedules provided by users. Thus, user training and agricultural office staff verifications should be incorporated when the system is deployed again.

Limited connectivity was a concern given that some of the users from the rural areas experience intermittent poor-quality internet. The system should continue to enhance its functionality in low-connectivity environments. The implementation of SMS notifications and the use of simplified pages provides partial solutions, and further enhancements are likely required.

Implications for Agricultural Coordination

There are three implications for agricultural coordination in Sinacaban. First, localized digital agricultural systems will be embraced by rural users when systems are designed with identifiable tasks, ease of navigation, and a mobile-first approach. Second, market linkage goes beyond farmer and buyer connections; it is also about institutional engagement. In this respect, DA/MAO staff are provided with organized data for their planning and resource allocation, and monitoring. Lastly, the system's effectiveness will

be dependent on its users. The system will achieve its purpose when farmers frequent the system to upload the latest details on the produce, and buyers actively browse to look for the available produce on offer.

Limitations of the Evaluation

Multiple aspects of this evaluation were limited. The pilot study had a small sample, and participants were chosen from local users rather than a random community sample. Consequently, the results should be considered preliminary. The survey results were summarized through descriptive statistics of means and standard deviations, which restrain advanced reliability and inferential statistics to be conducted.

During the short testing phase, quantitative economic impacts were not considered, such as post-harvest losses or farmer income. Raw survey data, a longer field trial, follow-up transaction surveys, and formal security testing should be incorporated into future evaluations.

Discussion Summary

The Digital Farmers' Produce System was positively received by the projected users of the system. The system was rated highly for its usefulness, ease of use, attitude towards use, behavioral intention to use, system functionality, and overall satisfaction with the system. Overall, the system has a solid base to become a commitment tool that district local support to the Municipality of Sinacaban.

The results of the pilot study indicate that the system begins to fill gaps in agricultural coordination, specifically addressable produce visibility, farmer to buyer linkage, and controlled monitoring of the agriculture office. Using the system will require training, technical assistance, support, and system enhancements to meet the needs of users in the field.

SUMMARY AND CONCLUSION

This project established a framework for the Digital Farmers' Produce System that developed a cloud-based application that facilitates the management of crops and market linkages for farmers in the Municipality of Sinacaban, Misamis Occidental. The project responds to certain constraints that are faced by the local farmers. These include limited access to price information, scant availability of stable buyers, cumbersome transaction processes, and the absence of structured crop visibility at the barangay level. These constraints may be of a local concern, but they are also of a national concern as they are examples of postharvest losses, information imbalance, and lack of digital equity in the agriculture sector.

The project employed a Rapid Application Development (RAD) approach to address the requirements of the local farmers, buyers and the DA/MAO staff and of the Administrators, by creating a role-based web application. Farmers can list and manage their produce and can also make a request for agricultural inputs. Buyers are able to list, browse, and contact farmers for the produce. The DA/MAO staff are able to manage the requests, monitor the listings, and make a report by exporting the data. The system was built with a PHP-MySQL stack, the Flight microframework, Bootstrap for a responsive design, and shared cloud hosting. For security and reliability, the project employed the use of HTTPS, role-based access control, password hashing, input validation, prepared statements, and security feedback in the design along with scheduled security tests.

Acceptance testing showed positive results across farmers, buyers and DA/MAO officers. They all rated the system within the Strongly Agree range for perceived usefulness, perceived ease of use, attitude toward using, behavioral intention to use, system functionality, and overall satisfaction. Buyers reported the highest ratings. DA/MAO officer and farmer ratings followed, with farmers reporting the most positive ratings of all. However, training, consultation and sustained buyer activity are needed to ensure sustained system usage and transform acceptance into system usage. With sustained buyer activity farmer acceptance will be transformed into actual usage.

The project shows that a localized user centered agriculture platform has the potential to link farmers and buyers with the local agriculture office. The system has value beyond simply showing produce for sale. It has the potential to show agricultural activities, enable support planning, display activities, and system usage. The system may be a coordination support planning tool for municipalities.

The Digital Farmers' Produce System has successfully achieved the primary objectives of the initial project development and pilot range evaluation. It provides a viable, low-cost, and easily adaptable solution to the digital agriculture coordination needs of Sinacaban. The results of the Pilot encourage the immediate deployment and continued integration of the system.

FUTURE WORK

This project establishes the foundation for a localized *Digital Farmers' Produce System*; however, several improvements and extensions may still be explored to further support farmers, buyers, and the Municipal Agriculture Office.

Predicted updates to this system involve adding additional transaction management features, such as order management, reservation management, delivery scheduling, and additional integration with nearby delivery services. Further updates may include an online payment system. Since most farmers prefer cash management and cash negotiations, these features would be embedded to accustom users to the features of cashless transactions. Considering that most of the rural population is still connected to the internet sporadically, most of the subsequent updates will focus on offline capabilities. These will include postponed caching of SMS messages, and simple web pages which will consume less data. These updates will include the addition of USSD and/or SMS workflows to assist users with basic mobile phones.

Improvements in measuring usability, functionality, and intent to use the system, as well as greater validation, may be possible through larger and longer system evaluations, additional participants, and repeated reliability testing. Implementation of a longitudinal study with a measurement framework aimed at documenting the time it takes for posts to be made, users to be contacted, and requests to be processed would provide critical insights. The dashboard may be enhanced by including automated alerts and prediction tools in order to improve user decision making.

The system's modular construction allows for easier implementation in nearby localities. It also allows us to integrate existing barangay agriculture records and reporting systems in future interoperability assessments with other provincial or national Department of Agriculture systems. Full-time, ongoing, and inclusive training is a key factor in successful system adoption. To improve users' confidence in the system and the data collected, data governance frameworks should define user roles, control data quality, and oversight mechanisms. This includes listing verification, report access, and

correction.

Better privacy and access control testing should be part of an organized system protection approach, while strong CSRF protections, security headers, and incident-response frameworks should be included. Longitudinal studies and postharvest loss measurement coupled with the request and fulfillment system transparency will allow for a more evidence-based approach to system efficiency and sustainability. An improved request and fulfillment system will increase farmer's income.

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Appendices A: INFORMED CONSENT FORM



University of the Philippines Open University INSTITUTIONAL RESEARCH ETHICS COMMITTEE

UPOU IREC FORM: INFORMED CONSENT FORM
TEMPLATE FOR SURVEYS, INTERVIEWS, AND FOCUS GROUP DISCUSSIONS | Page 1

INFORMED CONSENT FORM TEMPLATE FOR SURVEYS, INTERVIEWS, AND FOCUS GROUP DISCUSSIONS

(This template is for research interventions that use questionnaires, in-depth interviews or focus group discussions.)

Informed Consent Form for [Identity of the particular group of individuals (e.g., clients, patients, community leaders, service providers) in the project for whom this consent is intended]

Informed Consent Form for	Farmers, buyers, and Municipal Agriculture Office / DA staff who will participate in interviews, surveys, and/or system testing
Principal Investigator / Researcher	Bryan N. Malinao
Organization	University of the Philippines Open University, Master of Information Systems / Faculty of Information and Communication Studies
Sponsor	Not applicable / academic project
Project and Version	Digital Farmers' Produce System (DFPS), Version 1.2

PART I: INFORMATION SHEET

INTRODUCTION

You are invited to participate in a study conducted by Bryan N. Malinao, a Master of Information Systems student of the University of the Philippines Open University. Please take time to read this information sheet and decide whether you would like to participate. You may ask questions at any time if there are words, procedures, or parts of the study that are unclear.

This consent form explains the purpose of the study, what you will be asked to do, the possible risks and benefits, and how your information will be protected.

PURPOSE OF THE RESEARCH

The purpose of this study is to develop and evaluate the Digital Farmers' Produce System (DFPS), a cloud-based web application intended to help farmers manage seasonal crop listings, connect with potential buyers, and submit resource requests to the local agriculture office. The study also aims to determine whether the system is functional, usable, and acceptable to its intended users: farmers, buyers, and Municipal Agriculture Office / DA staff.

TYPE OF RESEARCH INTERVENTION

This research involves hands-on user testing of the web application, a questionnaire survey, and, when needed, short interviews or clarifying questions about the participant's experience using the system. The study does not involve medical procedures, experimental drugs, vaccines, or physical interventions.



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PARTICIPANT SELECTION

You are being invited because you belong to one of the target user groups of the DFPS: farmer, buyer, or Municipal Agriculture Office / DA staff. Your experience and feedback are important in determining whether the system is useful, easy to use, and appropriate for the local agricultural community.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. You may choose to participate or not. You may also withdraw at any time without penalty and without any effect on your academic standing, employment, access to services, or relationship with the University, the Municipal Agriculture Office, or the researcher. If you decide to withdraw after answering the survey or interview, you may request that your responses not be used in the study, provided that the data can still be identified and removed.

PROCEDURES

If you agree to participate, you may be asked to complete the following activities depending on your role:

- Attend a brief orientation about the purpose of the DFPS and how to use the assigned features.
- Use the staging or test version of the system with sample or test data.
- Perform role-based tasks such as logging in, posting or editing a product listing, searching for products, sending a message, submitting or reviewing a resource request, viewing dashboards, or exporting reports.
- Answer a short questionnaire using a 5-point Likert scale about usefulness, ease of use, attitude toward using the system, and intention to use it.
- Participate in a short interview or provide comments about what worked well, what was confusing, and what can be improved.

You may skip any question that you do not wish to answer. If the questionnaire is difficult to read or complete, a member of the research team may read the questions aloud and record your answers, but only with your permission. No one outside the authorized research team will have access to your individual responses.

RESEARCH USING ARTIFICIAL INTELLIGENCE (AI)

The DFPS itself is not an artificial intelligence system and will not make automated decisions about participants. No AI tool will be used to determine whether a participant is accepted, rejected, or evaluated. If the researcher uses generative AI tools for writing assistance, formatting, or summarizing non-identifiable notes, no names, contact details, or directly identifying participant information will be entered into such tools. All final analysis, interpretation, and reporting will remain under human oversight and accountability of the researcher and adviser.

Participants understand that appropriate safeguards will be used to reduce risks of bias, unfair outcomes, or disclosure of personal information. Any AI-assisted work, if used, will be limited to responsible academic writing support and will not replace the researcher's judgment.



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(** References

Ethics and AI Guidelines

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4. OECD. (2019). *OECD Principles on Artificial Intelligence*.
5. IEEE. (2020). *Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems*.
6. U.S. Department of Health & Human Services (HHS) Office for Human Research Protections. (2020). *Considerations for AI in Human Subjects Research*.

DURATION

Your participation is expected to take approximately 30 to 60 minutes for hands-on system testing, plus about 10 to 15 minutes to answer the questionnaire. If an interview is conducted, it may take an additional 15 to 30 minutes. There will be no long-term follow-up unless you agree to be contacted for clarification or a later testing round.

RISKS

This study involves minimal risk. Possible risks include mild inconvenience, tiredness, or discomfort when answering questions or using the system. There is also a small risk that personal information or comments may be unintentionally disclosed; however, the researcher will use confidentiality safeguards to minimize this risk. You may refuse to answer any question or stop participating at any time. **BENEFITS**

Benefits may be divided into benefits to the individual, benefits to the community in which the individual resides, and benefits to society as a whole as a result of finding an answer to the research question. Mention only those activities that will be actual benefits and not those to which they are entitled regardless of participation.

REIMBURSEMENTS

There will be no salary, honorarium, or payment for participation unless separately approved and communicated. If any reimbursement for reasonable participation-related expenses is provided, it will be limited to actual expenses and will not be a form of payment to influence participation.

CONFIDENTIALITY

The researcher will protect the confidentiality of your information. Survey forms and interview notes will use codes instead of names whenever possible. Individual answers will not be reported in a way that directly identifies you. Only the researcher, adviser, and authorized review or ethics personnel, when necessary, will have access to the study data.

Information may be summarized in the final manuscript, presentations, or reports, but names, phone numbers, exact addresses, and other direct identifiers will not be included. Confidentiality may have limits if required by law, institutional policy, or research ethics review.



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SHARING THE RESULTS

The results of the study may be included in the researcher's academic manuscript, oral defense, presentations, or related publications. Findings will be presented in summary form. A summary of results may be shared with the University, the Municipal Agriculture Office, and other relevant stakeholders for academic and community improvement purposes.

RIGHT TO REFUSE OR WITHDRAW

Your participation is voluntary. You may refuse to participate, refuse to answer any question, or withdraw from the study at any time. If you participated in an interview, you may request that specific statements or all of your responses be removed from the study data, as long as the data can still be identified before final analysis and reporting.

DATA MANAGEMENT

All completed questionnaires, interview notes, digital files, and system testing records will be stored securely in password-protected files or locked storage accessible only to the researcher and authorized academic or ethics personnel. Digital data will be backed up securely and handled in accordance with the Data Privacy Act of 2012 and applicable University policies.

Anonymized data may be retained for up to five (5) years after completion or publication of the study for academic verification and possible future research, after which it will be permanently anonymized or securely destroyed. Paper records, if any, will be shredded or disposed of securely. All records of ethical decisions, revisions, and approvals related to this study will be securely stored in the UPOU-IREC digital tracking system to promote transparency, accountability, and institutional learning.

DATA GOVERNANCE AND QUALITY ASSURANCE

State:

1. The researcher has explained how my data will be collected, stored, and protected in accordance with the Data Privacy Act of 2012 and relevant international data protection standards (e.g., GDPR).
2. I understand who will have access to my data and under what conditions it may be shared or used for academic purposes.
3. I agree that my anonymized data may be securely stored for up to five (5) years following the publication of the research, after which it will be permanently anonymized or destroyed.
4. I understand that all data collected in this study will be managed according to a formal Data Management Plan (DMP) to ensure accuracy, transparency, and accountability throughout the research process.
5. I consent to the responsible sharing of anonymized data for future research or inclusion in open access repositories, consistent with the ethical and privacy safeguards explained to me.
6. I understand that all data governance processes related to this study are overseen by the UPOU Data Privacy Office (Secure Ethics DPO Clearance Form 1) to ensure compliance with AI and digital ethics standards.



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ACCOUNTABILITY

All researchers, advisers, and review bodies involved in this study share collective responsibility for maintaining ethical compliance throughout every stage of the research process—from design to dissemination.

WHO TO CONTACT

Principal Investigator / Researcher	Bryan N. Malinao Email: _____ Mobile No.: _____
Adviser	Katrina Joy M. Abriol-Santos Faculty of Information and Communication Studies, UPOU Email: _____
Review / Ethics Committee	UPOU Institutional Research Ethics Committee (UPOU IREC) Email / Contact No.: _____
Data Privacy Concern	UPOU Data Privacy Office or designated Data Protection Officer Email / Contact No.: _____

PART II: CERTIFICATE OF CONSENT

This section must be written in the first person. It should include a few brief statements about the research and be followed by a statement similar to the one in bold below. If the participant is illiterate but gives oral consent, a witness must sign. A researcher or the person going over the informed consent must sign each consent.

This section is mandatory

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Print Name of Participant: RENE B. ACOSTA

Signature of Participant: [Signature]

Date: [MM/DD/YYYY]

If Illiterate

A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent

Appendices B: User Acceptance Questionnaire

①

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☒ Buyer ☒ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☒ 26-35 ☐ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:
☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.				✓	
2	The system makes it easier to connect with buyers and/or farmers.			✓		
3	The system improves my productivity in managing transactions.				✓	
4	The system provides useful information for decision-making.				✓	

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.				✓	
2	The system interface is clear and understandable.				✓	
3	It is easy to find the features I need (e.g., search, messaging).				✓	
4	I can use the system without assistance.				✓	

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.				✓	

(a) User Acceptance Questionnaire 1 - Page 1

①

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.				✓	
2	Using this system is a good idea for the community.				✓	
4	I feel comfortable using the system.				✓	

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.				✓	
3	The messaging feature between users is reliable.				✓	
4	The notification features (including SMS) are helpful.				✓	
5	The system responds quickly when performing actions.				✓	

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.				✓	
2	The system meets my needs as a user.				✓	

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?
Users are able to access the market for their products outside the municipality.

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?
I suggest to make an application so that farmers can easily access the system rather than the internet and use the laptop.

(b) User Acceptance Questionnaire 1 - Page 2

②

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☐ Buyer ☒ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:
☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(c) User Acceptance Questionnaire 2 - Page 1

2

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.				✓	
3	The messaging feature between users is reliable.				✓	
4	The notification features (including SMS) are helpful.				✓	
5	The system responds quickly when performing actions.				✓	

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(d) User Acceptance Questionnaire 2 - Page 2

Figure 30. User Acceptance Survey Questionnaires 1 and 2

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☐ Farmer ☐ Buyer ☒ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☒ 26-35 ☐ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:

☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					/
2	The system makes it easier to connect with buyers and/or farmers.					/
3	The system improves my productivity in managing transactions.					/
4	The system provides useful information for decision-making.					/

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					/
2	The system interface is clear and understandable.					/
3	It is easy to find the features I need (e.g., search, messaging).					/
4	I can use the system without assistance.					/

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					/

(a) User Acceptance Questionnaire 3 - Page 1

2	Using this system is a good idea for the community.					/
3	I feel comfortable using the system.					/

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					/
2	Using this system is a good idea for the community.					/
4	I feel comfortable using the system.					/

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					/
2	The search and filtering features are effective.					/
3	The messaging features between users is reliable.					/
4	The notification features (including SMS) are helpful.					/
5	The system responds quickly when performing actions.					/

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					/
2	The system meets my needs as a user.					/

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(b) User Acceptance Questionnaire 3 - Page 2

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☐ Farmer ☒ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☐ 26-35 ☒ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:

☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					/
2	The system makes it easier to connect with buyers and/or farmers.					/
3	The system improves my productivity in managing transactions.					/
4	The system provides useful information for decision-making.					/

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					/
2	The system interface is clear and understandable.					/
3	It is easy to find the features I need (e.g., search, messaging).					/
4	I can use the system without assistance.					/

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					/

(c) User Acceptance Questionnaire 4 - Page 1

2	Using this system is a good idea for the community.					/
3	I feel comfortable using the system.					/

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					/
2	Using this system is a good idea for the community.					/
4	I feel comfortable using the system.					/

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					/
2	The search and filtering features are effective.					/
3	The messaging features between users is reliable.					/
4	The notification features (including SMS) are helpful.					/
5	The system responds quickly when performing actions.					/

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					/
2	The system meets my needs as a user.					/

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(d) User Acceptance Questionnaire 4 - Page 2

Figure 31. User Acceptance Survey Questionnaires 3 and 4

5

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.
Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☒ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☐ 26-35 ☒ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:
☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.				✓	
3	The system improves my productivity in managing transactions.				✓	
4	The system provides useful information for decision-making.				✓	

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.				✓	
3	It is easy to find the features I need (e.g., search, messaging).				✓	
4	I can use the system without assistance.				✓	

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(a) User Acceptance Questionnaire 5 - Page 1

5

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging feature between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(b) User Acceptance Questionnaire 5 - Page 2

6

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.
Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☒ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☒ 26-35 ☐ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:
☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(c) User Acceptance Questionnaire 6 - Page 1

6

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging feature between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(d) User Acceptance Questionnaire 6 - Page 2

Figure 32. User Acceptance Survey Questionnaires 5 and 6

7

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☒ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:
☐ Beginner ☒ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(a) User Acceptance Questionnaire 7 - Page 1

7

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No. (B)	BEHAVIORAL INTENTION TO USE	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging features between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(b) User Acceptance Questionnaire 7 - Page 2

8

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions
Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:
☐ Farmer ☐ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:
☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:
☒ Beginner ☐ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:
☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(c) User Acceptance Questionnaire 8 - Page 1

8

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No. (B)	BEHAVIORAL INTENTION TO USE	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/editing products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging features between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(d) User Acceptance Questionnaire 8 - Page 2

Figure 33. User Acceptance Survey Questionnaires 7 and 8

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☒ Farmer ☐ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☐ 26-35 ☒ 36-45 ☐ 46 and above

3. Experience in Using Smartphones/Web Applications:

☒ Beginner ☐ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(a) User Acceptance Questionnaire 9 - Page 1

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/selling products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging feature between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(b) User Acceptance Questionnaire 9 - Page 2

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree
1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☒ Farmer ☐ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:

☒ Beginner ☐ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/selling products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging feature between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART IX: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(c) User Acceptance Questionnaire 10 - Page 1

(d) User Acceptance Questionnaire 10 - Page 2

Figure 34. User Acceptance Survey Questionnaires 9 and 10

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree

1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☒ Farmer ☐ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:

☒ Beginner ☐ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(a) User Acceptance Questionnaire 11 - Page 1

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/selling products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging features between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART III: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(b) User Acceptance Questionnaire 11 - Page 2

USER ACCEPTANCE SURVEY QUESTIONNAIRE

Instructions

Please read each statement carefully and indicate your answer by checking (✓) the box that best represents your level of agreement.

Strongly Disagree Disagree Neutral Agree Strongly Agree

1 2 3 4 5

PART I: RESPONDENT PROFILE

1. Role:

☒ Farmer ☐ Buyer ☐ Department of Agriculture (DA) Officer

2. Age Group:

☐ 18-25 ☐ 26-35 ☐ 36-45 ☒ 46 and above

3. Experience in Using Smartphones/Web Applications:

☒ Beginner ☐ Intermediate ☐ Advanced

PART II: SYSTEM USAGE

4. Frequency of System Use:

☐ Daily ☐ Weekly ☐ Occasionally ☒ First-time user

No.	PERCEIVED USEFULNESS (PU)	1	2	3	4	5
1	The system helps me manage agricultural products efficiently.					✓
2	The system makes it easier to connect with buyers and/or farmers.					✓
3	The system improves my productivity in managing transactions.					✓
4	The system provides useful information for decision-making.					✓

No.	PERCEIVED EASE OF USE (PEOU)	1	2	3	4	5
1	Learning to use the system is easy for me.					✓
2	The system interface is clear and understandable.					✓
3	It is easy to find the features I need (e.g., search, messaging).					✓
4	I can use the system without assistance.					✓

No.	ATTITUDE TOWARD USING (ATU)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓

(c) User Acceptance Questionnaire 12 - Page 1

2	Using this system is a good idea for the community.					✓
3	I feel comfortable using the system.					✓

No.	BEHAVIORAL INTENTION TO USE (BI)	1	2	3	4	5
1	I find the system useful for my daily activities.					✓
2	Using this system is a good idea for the community.					✓
4	I feel comfortable using the system.					✓

No.	SYSTEM FUNCTIONALITY EVALUATION	1	2	3	4	5
1	The product listing features (adding/selling products) function properly.					✓
2	The search and filtering features are effective.					✓
3	The messaging features between users is reliable.					✓
4	The notification features (including SMS) are helpful.					✓
5	The system responds quickly when performing actions.					✓

No.	OVERALL SATISFACTION	1	2	3	4	5
1	Overall, I am satisfied with the system.					✓
2	The system meets my needs as a user.					✓

PART III: OPEN-ENDED QUESTIONS

1. What do you like most about the system?

2. What problems or difficulties did you encounter while using the system?

3. What improvements would you suggest for the system?

(d) User Acceptance Questionnaire 12 - Page 2

Figure 35. User Acceptance Survey Questionnaires 11 and 12

Appendices C: Pictures Showcasing Data Gathering



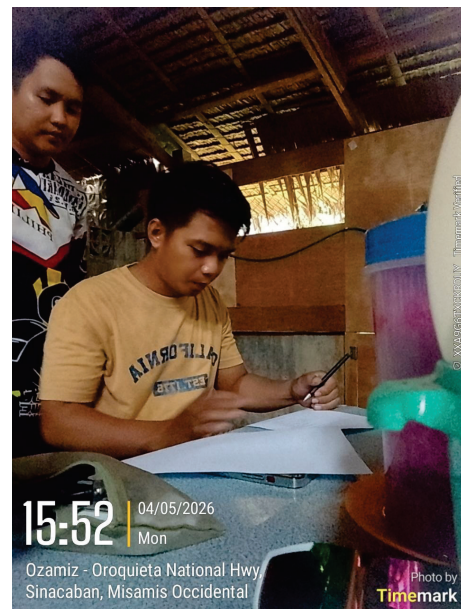
(a) Data Gathering - Picture 1



(b) Data Gathering - Picture 2



(c) Data Gathering - Picture 3

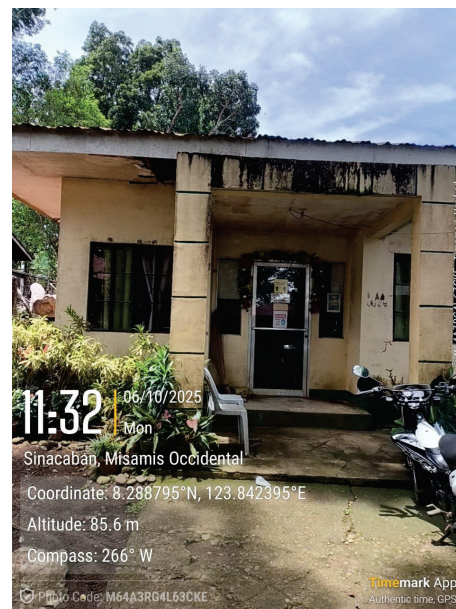


(d) Data Gathering - Picture 4

Figure 36. Photographs Showcasing the Data Gathering Process (Part 1)



(a) Data Gathering - Picture 5



(b) Data Gathering - Picture 6



(c) Data Gathering - Picture 7

Figure 37. Photographs Showcasing the Data Gathering Process (Part 2)

Appendices D: Curriculum Vitae



BRYAN NARANJO MALINAO

Email Address: bryannmalinao@gmail.com

Contact Number: 09506225047

PERSONAL DATA

Date of Birth:	November 07, 2000
Place of Birth:	Oroquieta City
Home Address:	Purok Doña Luz, Señor, Sinacaban, Misamis Occidental
Sex:	Male
Civil Status:	Single
Citizenship:	Filipino
Religion:	Iglesia Ni Cristo
Height:	5'7"
Weight:	58 kg
Parents:	Fortunato G. Malinao Liza N. Malinao

EDUCATIONAL ATTAINMENT

Level	School	Years
Graduate	University of the Philippines Open University (UPOU) Master of Information Systems	2024 – Ongoing
Tertiary	Jose Rizal Memorial State University (JRMSU) Main Campus	2019 – 2023
Secondary	Clarin National High School	2018 – 2019
Primary	Sinacaban Central School	2007 – 2013

WORK EXPERIENCE

- **Visiting Lecturer (VL)** **2025 – Ongoing**
Jose Rizal Memorial State University (JRMSU) Main Campus
- **IT Encoder** **2024 – 2025**
Millennium Distribution System Inc.