

# Mutyaba Edwin Muwanguzi

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**MAKERERE UNIVERSITY BUSINESS SCHOOL**

**PROGRAM: BACHELOR OF BUSINESS COMPUTING**

**COURSE UNIT: IT PROJECT DEVELOPMENT (ITPD).**

**DEVELOPING OF A DIGITAL AGRO-MARKETING MOBILE APPLICATION FOR FARMERS IN UGANDA.**

**By.**

<b>NAME</b>	<b>REGISTRATION NUMBER</b>	<b>PHONE NUMBER</b>
MUTYABA EDWIN MUWANGUZI	23/U/0908	+256-743857633
NANSAMBA ANGEL	23/U/15185/PS	+256-760250750
KAKOOZA PETER	23/U/0481	+256-767467466
NYAGOMA ERETH	23/U/16374/EVE	+256-763867115
KALYANGO SSEKIDDE SHAFIK	23/U/08818/EVE	+256-706333004

**Supervised by**

**Lecturer Engotoit Bernard**

**Department of information systems**

A project submitted to the faculty of computing & informatics of Makerere University Business School in Partial fulfillment for the award of the degree of Bachelors of Business Computing of Makerere University.

October, 2025

## DECLARATION

We, the undersigned, declare that to the best of our knowledge, this proposal is our original piece of work, and has never been published or submitted for any award in any other university or higher institution of learning.

NAME	REGISTRATION NUMBER	SIGNATURE
MUTYABA EDWIN MUWANGUZI	23/U/0908	
NANSAMBA ANGEL	23/U/15185/PS	
KAKOOZA PETER	23/U/0481	
NYAGOMA ERETH	23/U/16374/EVE	
KALYANGO SSEKIDDE SHAFIK	23/U/08818/EVE	

Date.....

### APPROVAL

This project proposal has been submitted with my approval as supervisor and my signature is here appended:

Signed .....

Date.....

Makerere University Business School.

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## SECTION ONE

### 1.0 THE INTRODUCTION

#### 1.1. Background of the study

Agriculture constitutes the backbone of the Ugandan economy, employing more than 70% of the working population and accounting for about 24% of national Gross Domestic Product (GDP) according to World Bank figures. In the sector, smallholder farmers account for over 90% of total holdings of agriculture and production of food stocks and cash crops is most heavily concentrated. These are the farmers that ensure food security nationally as well as the livelihoods in rural areas and work towards reducing poverty. Major outputs are coffee, maize, beans, bananas and horticultural consumables, which have domestic and regional demand. For all its relative relevance, the Uganda agriculture sector is marred by several challenges, slowing its development and limiting farmers' ability to thrive. Marketing and the distribution of agricultural produce is a major bottleneck. Historically, the supply chain has been very fragmented, ineffective, and has primarily focused on conventional, informal markets. Farmers sell their farm produce through itinerant middlemen or at local farm gates, and immediately after harvesting for example when prices are at their lowest because of glut and the absence of storage facilities (Muto & Yamano, 2009). Such a system is marred by a crucial information asymmetry. Farmers have almost no real-time information about market prices in various parts along with consumer demand trends or potential purchasers apart from their immediate market. This information gap depletes their bargaining power considerably, resulting in exploitative prices and significant post-harvest losses, in some cases estimated at 30-40% for perishable crops (Food and Agriculture Organization [FAO], 2019). Digital transformation can provide transformation opportunities to solve these deeply embedded market inefficiency problems. Uganda has seen rapid mobile phone penetration with more than 26 million subscriptions (over 100%) a sign of nationwide access to the technology, especially in the rural areas (Uganda Communications Commission [UCC], 2023). At the same time, internet access is increasing with more and more people having access to the network and inexpensive smartphones. This digital infrastructure provides an unparalleled level of capability to escape conventional entry barriers to market. Digital agro-marketing — a process that is often promoted via mobile applications (apps) — is emerging worldwide. These platforms enable producers to easily engage with consumers, retailers and exporters, thereby bypassing the many middlemen who gobble up a disproportionate piece of the spoils. Other areas—particularly Esoko in Ghana and We Farm in Kenya— illustrate the potential of mobile services to give farmers information and link them to purchasers as well as provide advice (Foster & Heeks 2013). These applications have the potential to make farmers



informed when, where, and at what price to sell their produce, thus increasing income and resilience. A number of initiatives have been developed in Uganda acknowledging this potential. However, platforms such as Ensibuuko, EzyAgric and Crop Safe have also started to provide digital solutions that mainly include agricultural extension services, financial inclusion (such as mobile money and savings loans) as well as farm management tools (Gebreyesus & Kaguongo, 2022). While these are indeed very valuable inputs, they tend to be limited to the marketing and other transactional aspects of the agricultural value chain and may thus be an additional piece of a puzzle or not thoroughly developed enough. Many current solutions are one-way information (e.g., SMS price reminders) and there is no active marketplace (marketplace functionality) which allows one to purchase instantly in a market and manage the whole logistics chain. Moreover, the use and successful application of these digital methods are stymied by the specific contextual requirements of Uganda. These shortcomings involve a poor digital literacy among the elderly farmer population, high data and smartphone prices, unrelenting Internet connectivity barriers in remote rural areas, and a fundamental trust issue in digital transactions especially when interacting with unknown parties on a digital platform (Baumüller, 2018). A robust application will therefore need to be built on those user-centered strengths; simple user experience offline, icon-based navigation, and working with respected systems like mobile money (i.e., MTN Mobile Money, Airtel Money) already in place for financial transactions. Hence, there is an established need for a specific, user-centered, and comprehensive digital agro-marketing application. Such an application would involve not only spreading information but also making a virtual marketplace. You could integrate core features like real-time price discovery, buyer-seller matching, display of produce for sale, quality validation protocols, and integration of payment and transportation coordination. Using these capabilities as a single platform and a user-friendly platform in Ugandan terms, a tool could greatly increase market access, improve price transparency and small-holder incomes to enable direct impact on Sustainable Development Goals (SDGs) 1 (No Poverty) and 2 (Zero Hunger). Sources of agro-marketing in Africa versus developed countries. the differences (market structure, infrastructure, information & finance, losses. Agro-marketing in much of Africa is more fragmented, depends on informal traders, suffers higher post-harvest losses and weaker cold-chains, and has lower formal finance and contract farming than in developed countries — but digital platforms and startups are beginning to close some gaps. a) Market structure and buyers

Africa: Many small farmers sell through many middlemen, local brokers, and open markets. This fragmentation makes prices unstable for farmers and raises costs for consumers.

Example: informal markets are common across East and West Africa. Developed countries: Markets are more formal and concentrated (supermarkets, processors, exporters). Farmers

often sell under contracts, use cooperatives, and have reliable buyer relationships (better price stability and standards compliance). Example: In Kenya, Twig Foods built a B2B platform that links thousands of small farmers directly to urban vendors and pays farmers faster and more fairly — showing how organized digital buying can replace parts of the informal chain. b) Infrastructure (roads, storage, cold chain)

Africa: Roads, storage warehouses, and refrigerated logistics are limited and uneven between countries. This raises transport time and spoilage. A World Bank analysis found large food losses in transit (for some reports the loss in transit is very high — e.g., a World Bank press note

Developed countries: Strong road networks, big cold-storage capacity, and efficient logistics keep food fresh and lower losses. The Global Cold Chain Alliance (2020) reports North America and large economies have most of the world's refrigerated warehouse space (example: U.S. had ~156 million m<sup>3</sup> in 2020). Africa's cold-chain capacity per person is much lower and concentrated in a few countries (South Africa more mature; many other countries have tiny capacity). Global Cold Chain Alliance

Numbers to keep in mind: global/regional studies show post-harvest (farm-to-market) losses are substantially higher in Africa than in developed regions — FAO / Our World in Data provide region comparisons of food lost in post-harvest processes. c) Post-harvest losses and impact

Africa: Post-harvest loss rates (farm-to-market) are high for many crops. Estimates vary by crop and country, but FAO/Our World in Data show the share of food lost in post-harvest stages is higher in Africa than in high-income regions. High losses reduce farmer income and national food availability. Developed countries: Losses are much smaller before retail thanks to better storage, processing and logistics; food safety and quality standards are enforced. d) Information, price discovery and digital tools

Africa: Many farmers lack reliable price information and sell to the nearest buyer. Mobile services and platforms (M-Farm, Twig, Tula, We farm and others) have improved price info, market links, and payments for thousands of farmers — but coverage is partial and impact varies. For example, M-Farm in Kenya served tens of thousands and helped with price info; Twig reported paying farmers 20–40% more than brokers for some produce and has linked many small retailers and farmers. Emerging Markets Program

Developed countries: Farmers use market reports, futures markets, electronic trading, and integrated supply-chain IT (very widespread), which lowers uncertainty and allows forward contracting.

## Problem Statement

Ugandan smallholder farmers—the backbone of Uganda’s agriculture market—are stuck in a vicious cycle of poverty and low productivity, largely owing to poor access to profitable and reliable markets. The prevailing conventional marketing mechanism is ineffective and opaque — they’ve only been able to sell their produce immediately after harvest, to a small group of local middlemen on exploitative price levels. As such, there is a high dependency on wholesale vendors for food, which is prone to a vicious cycle. The lack of timely and accurate market intelligence on price, demand and prospective buyers in other regions is a direct cause, not the least of which are post-harvest losses and storage options deficit (FAO, 2019; Muto & Yamane, 2009). Mobile technology penetration has emerged as a potential solution to this information asymmetry, however Uganda’s existing digital agricultural platforms have not successfully addressed the underlying marketing challenge. Contemporary solutions often center on rural management (such as agricultural management), information resources (such as financial inclusion), agricultural advisory, etc., but fail to develop the solution into an integrated/transactional market, connecting farmers to the real market. Moreover, their design often overlooks the severe barriers of low digital literacy, unstable internet connectivity and trust problems that are characteristic of the targeted rural population. Therefore, there is an urgent need to design and develop an integrated mobile agro marketing application that is uniquely designed to combat these challenges. This research project aims to design and create an intuitive and detailed mobile application that will serve as a direct interface between Ugandan farmers and markets. The application’s goal is to empower farmers by offering real-time market information, a demonstration and sale platform for what they produce, along with integrated platforms for transactions and logistics - thereby providing farmers with direct answers to a problem that is market access and inefficiency – one that hinders both agricultural development and farmers’ livelihoods – in Uganda.

#### 1.4.0 Project Scope Summary

The time, space and conceptual emphasis of the project are presented in this portion.

1.4.1. Time frame: The project will be administered over the course of 8 months, first semester of the academic year 2024/2025. This also encompasses problem analysis, literature review, system design, prototype development and preliminary testing phases.

1.4.2 Location scope: The research and project design will deal primarily with the challenges of smallholder farming in the Central Region of Uganda (Kampala). But the app is scalable for the future, it will be designed to eventually cater to other regions.

#### 1.4.3 Concept Scope:

The project will only include developing a marketing + transaction platform. It will include modules to user registration, list produce, find prices in real-time, match up buyers with sellers to purchase produce, and integrate mobile money payment with the products. You're restricted to facilitating connections and coordination rather than detailed farm management tools, agricultural extension services, and physical logistics execution.

#### 1.5.0 Potential Project Significance.

One such initiative to transform Ugandan smallholder farmers is the Digital Agro-Marketing Application. In giving us access to our markets, the application is going to:

- a) Increase Income and Profitability: Give farmers instant price information and access to a greater number of sellers and buyers, improving their bargaining power and ultimately allowing them to sell their produce at more competitive prices and thus to improve their income opportunities.
- b) Lead To Decrease Post-Harvest Loss: This will help in an overall faster and more reasonable matching of supply to demand that allow the farmers to sell from their produce at a time before it goes bad, thereby reducing the estimated current losses of farmers 30-40%.
- c) Market Efficiency Enhancement: Break the chain of a sea of middlemen, generating fairer market that compensates farmers.
- d) Increase Food Security: The project directly supports improved household and national food security through stabilizing farmers incomes and mitigating farm losses.

### 1.5.2 The Developers/Students:

This capstone project is an essential experiential learning platform for the student team and holds an important role in terms of:

**Relevance in Practice:** Offering practical experience for the skills to be used in a business context, thus bringing the theoretical learning such as programming, database, systems analysis and design, software engineering and UI/UX design into practice.

a) **Project Management Experience:** Hands-on experience dealing with a complex IT project from conception to prototype, including teamwork, time management, budgeting and problem-solving under constraints.

b) **Research and Analytical Skills:** Developing the skills to do deep research, analyze user needs, and design a customized technical solution for an urgent socio-economic issue.

c) **Professional Portfolio Building:** Producing a working prototype and holistic project report that will be a tangible resource for academic work in the tech industry and future job opportunities.

### 1.5.3 Contributions to Knowledge and Academia:

The project will make inroads onto the academic and professional literature on a number of fronts:

a) **Bridging the gap on context:** It will make a point of using each case and presenting an appropriate structure to create digital agro-marketing solutions adapted to Ugandan challenges – the specific emphasis would be given on low digital literacy and unreliable connectivity.

b) **Advancing Design Science Research:** The project will provide real-world artefacts for those adopting the Design Science Research method, on the development of IT systems which effectively create and evaluate systems to meet the needs of real world development problems.

c) **Implications for Policy and Future Initiatives:** The results and the produced prototype can be used as a reference for policymakers, NGOs, and stakeholders in establishing sustainable

digital technology tools to facilitate agricultural conversion in Uganda and similar emerging economies.

## SECTION TWO

### 2.0. LITERATURE REVIEW.

#### 2. 1. SECTION INTRODUCTION

This literature review investigates current knowledge concerning digital agro-marketing platforms, looking at their applicability to smallholder farmers like Uganda. The review is organized to review the existing frameworks in practice, to specify farmer needs, concerns and problems, and to conclude which are the key needs if a new, better functioning digital agro-marketing application is to develop. The objective is to introduce the theoretical and practical framework for the construction of the system design and development.

Current digital agro-marketing systems and their limitations

A number of digital platforms have been developed and implemented in Uganda and throughout East Africa in response to agro-problems. Although they provide useful services, the functionality of each has been reviewed and obvious areas of opportunity are found to lead to a major gap in tackling the main marketing demand.

EzyAgric: A large and reputable platform for agricultural extension services, access to inputs and finance network in Uganda primarily focused on agricultural extension service (Gebreyesus & Kaguongo, 2022).

Strength: Its holistic approach to farm and financing management is laudable.

Weakness: Though this platform has a marketplace functionality, it doesn't feature any other significant features as marketplace is often a utility and is not used to make sure a user experience; instead, it is an add-on solution, not a live, dynamic trading platform. It does not provide strong price discovery, buyer-seller negotiation, direct buyer-seller features that are a prerequisite to break through to markets.

Ensibuuko: It provides digital record-keeping and administrative tools for Savings and Credit Cooperative Organizations (SACCOs).

Strength: It leans on trustworthy community structures (SACCOs) to contribute to financial inclusion.

Weakness: Focus on internal group management and financial services, not open marketplaces enabling direct linkage of farmers to the external buyers (Ensibuuko, 2023). It does not touch on the demand for price transparency and linking to the market.

Esoko (Ghana): A reputable platform that gives price alerts and supply information through SMS and web.

Strength: It can spread information to farmers using basic mobile phones.

Weakness: The model is mainly communication. It tells farmers prices, but does not offer the farm how to make the transaction, or how to pay, so the farmer is left with all of this complexity in the selling process (Foster & Heeks, 2013).

CrowdyFarm (Uganda): This platform aims to connect farmers with markets.

Strength: It has a clearer focus on market linkages than some other platforms.

Weakness: User adoption is often low, scalability is limited, and when integrated payment is not deeply integrated with logistics it presents a more complicated user experience.

Many current systems inherently lack a holistic transactional marketplace that links the entire process from the listing of produce through to the payment and logistics process, that has proven to be an ongoing issue across the existing and future markets.

The needs of farmers + persistent challenges

A new system needs to begin with the end-users -- the farmers -- and must be designed on this premise. Literature defines those functional requirements, but also the challenges.

Farmer Requirements:

Real-Time Market Intelligence: The availability of updated prices for commodities sold in specific regions and countries (Baumüller, 2018).

Direct Buyer Connections: A platform for producers to promote their produce and make direct contact directly with other retailers, wholesalers and exporters.

Transaction Facilitation: Integrated and trusted payment systems, chiefly mobile money, to create a secure and convenient financial transaction.

Logistics Coordination: Services to coordinate or facilitate transportation of sold products and goods.

Accessibility and Simplicity: An icon-centric interface; accessible in local languages, and effective for affordable smartphones with lesser data usage.

Low Digital Literacy: The older group of farmers struggles with app and smartphone navigation when using the app (Baumüller, 2018).

Technology cost: The cost of smartphones and the constant costs for mobile data are still large restrictions.

Poor-Speed Connectivity: If you live in rural areas, the network fails and it makes a place for cloud only apps (UCC, 2023).

Trust Deficit: Farmers fear that not being paid may have them playing their truth game with unknown purchasers at all (Muto & Yamano, 2009).

Expected Needs for the New System

Expected Requirements: Based on the gaps in the current systems and the articulated needs of the farmers, the future requirements will be as follows for the Digital Agro-Marketing Application.

## 2.5. Functional Requirements

These are how the system ought to work.

User Management: The system must enable the user to register and profile farmers and buyers.



**Produce Listing:** The farmers will be able to list their produce at a price for a specific type, quantity, quality & location.

**Search and Discovery:** Buyers will search for produce by type, location and price range.

**Price Board:** The interface shall display a dynamic price board of up-to-date market price as per the real time availability of each of this market.

**Communication Module:** The system shall provide an integrated chat/messaging system which buyers and farmers can use to communicate or negotiate.

**Intertwining Transaction And Payment Integration:** The platform will connect to mobile money APIs (MTN Mobile Money, Airtel Money and others) for secure payments in the application.

**Logistics Coordination Interface:** System must support for user facilities for organizing or connecting to transport services.

### Non-functional requirements

These specify how the system is intended to behave.

**Usability:** Interface should be simple, intuitive and icon-based, needing low literacy to navigate.

**Offline capabilities:** The app should include essential functionalities like listing, message management, which are available offline and synched when a connection is restored.

**Performance:** The app must have short load times and have optimisation for low-to-mid-range Android devices.

**Security – Data:** Financial and personal user data must be encrypted or stored securely.

### Conclusion

The research literature review demonstrates a clear gap in Ugandan digital agriculture that must be addressed. While present platforms give valuable pieces of the puzzle, none offers an integrated, farmers'-specific solution which fully encapsulates the whole marketing solution for the entire process—from price discovery to secure payment. So the design of Digital Agro-Marketing Application needs to have dedicated marketplace. Its success is going to depend on its integration of core transactional functionalities, and on it being designed to scale up to the very real barriers of digital literacy, connectivity, and trust in the system that its potential consumers face. This project helps fill this gap by creating a custom artifact that fits these derived needs.

## SECTION THREE

### RESEARCH METHODOLOGY

#### 3.0 INTRODUCTION

This section will explain the methods and steps that will be followed to collect information, design, build, and test the Digital Agro-Marketing Application. It will show how the research team will ensure that the process is well-organized, accurate, and focused on solving farmers' marketing challenges.

DSR Stage	Research Objective Addressed	Proposed Methods & Activities	Expected Output/Deliverable
1. Problem Identification & Motivation	a) To analyze the current agricultural produce marketing channels and challenges.	Conduct literature review, interviews and Focus Group Discussions (FGDs) with farmers in the <i>Central Region</i> , and survey with agricultural extension officers.	A detailed report summarizing the existing marketing system's inefficiencies and a validated problem statement.
2. Definition of Objectives for a Solution	b) To identify the functional and technical requirements.	Analyze data from Stage 1. Use brainstorming and participatory design sessions with farmers to define solution features	A comprehensive Software Requirements Specification (SRS) document, including functional and non-functional requirements.
3. Artifact Design & Development	c) To design and develop a prototype.	Design: Create system architecture, database schemas (ER Diagrams), and UI/UX wireframes. Development: Use a suitable tech stack (e.g., Flutter for frontend, Node.js/Python for	A working prototype of the application with core features: user profiles, produce listing, search, price board, and integrated mobile money payment.

		backend, MySQL/PostgreSQL for database) to build the working prototype.	
4. Demonstration	d) To test and evaluate the usability and functionality.	Deploy the prototype to a limited test environment. Conduct usability testing sessions with a select group of farmers and buyers, collecting feedback via surveys and direct observation.	A test report detailing bugs, user feedback, and usability scores. A refined prototype based on the feedback.
5. Evaluation	d) To test and evaluate the usability and functionality.	Analyze feedback and performance data from the demonstration phase against the initial objectives. Assess how well the artifact solves the identified problem.	An evaluation report concluding on the artifact's effectiveness, efficiency, and user satisfaction.
6. Communication	All Objectives	Compile the final project report, prepare a presentation, and create a video demonstration of the prototype.	The complete project report, presentation slides, and a demonstration video for submission and defense.

### 3.1 Research Design

**Design Science Research (DSR) will be used for the study. Using this approach, we will ascertain a real problem and subsequently develop a working technology aimed at solving it. The research will involve: defining a problem (limited access to markets for smallholder farmers), setting objectives and system requirements, designing and developing the application, testing and evaluating the system and implementing improvements as per user feedback. A prototype model will be employed as well. The app will start off as a workable**

version, incrementally built and verified by users by design and then improved. This should help ensure that the final application will address what customers require.

### **3.2 Study Area**

The study will be conducted in the Central Region of Uganda, comprising Kampala districts and Luweero District. The areas will be selected as for many smallholder farmers in these districts are limited in marketing, have fairly mobile phone and smartphone coverage and representation of rural as well as semi-urban communities and thus are suitable for app testing.

### **3.3 Target Population**

The population will be as follows:

Farmers for sale at a small scale. Produce buyer and vendor-wholesalers, retailers and exporters. Agricultural officers and IT specialists to assist in professional and technical issues.

### **3.4 Sample Size and Sampling Procedure**

Forty respondents will be invited to participate in the study as follows: 20 smallholder farmers from Luweero District, 10 produce purchasers at Kampala markets, e.g. Nakasero and Kalerwe, and 10 Agricultural officers and ICT experts. Purposive sampling will be used because it allows us to select people whom we know have useful experience in agro and technology.

### **3.5 Data Collection Methods**

There will be various methods for the collection of data, so that data captured is correct and comprehensive:

- a). **Questionnaires:** Farmers and buyers will complete questionnaires about the market challenges, smartphone usage, and willingness from them to use a digital application.
- b). **Interviews:** Agricultural officers will be interviewed to get a detailed impression of digital agriculture and marketing systems, while IT specialists will be further prepared to deal with all aspects from top-to-bottom.
- c). **Observation:** The researchers are to observe the present way for farmers of produce to sell and to deal with middlemen.

**d). Document Review:** The researchers will read through reports and statistics from such leading organizations as FAO, the World Bank and MAAIF in order to really see where agriculture stands in Uganda today.

### **3.6 System Analysis and Design**

**This phase is very important when translating user needs to a tech-lead Technical blueprint for the Digital Agro-Marketing Application. It is divided into System Analysis (recognizing the problem and requirements) and System Design (engineering the problem solve).**

#### **3.6.1 System Analysis Methods, Procedures, and Techniques**

**System analysis is the analysis of the current environment and processes to get the problem statement.**

##### **A. Methodologies for Analyzing of Systems**

**There are many, but the two most traditional approaches are:**

**Structured Analysis:** The typical, process approach which emphasizes dataflow and process flow in a system. It considers a system as a chain of procedures which process input data into the output. Highly systematic and use Diagrams such as data flow diagrams (DFDs).

**Object-Oriented Analysis (OOA):** The OOA paradigm describes the system as a bundle of interacting objects. An object contains both an information, or its attributes, and the way (methods) that can react to that information. This is mostly better for the system driven by events and diagrams like Use Case Diagrams and Class Diagrams.

##### **B. Chosen Approach and Justification**

**The main reason to choose this approach as a method is the fundamentally process and data flow problem, the inefficient flow of information between farmers and buyers. It demonstrates the efficiency that a successful farm will take if it works its communication mechanism and the resilience of those systems, in the face of possible risks. Structured Analysis is useful in modelling these data processes in a clear, graphical manner that is easier to validate with non-Technical stakeholders such as farmers and agricultural officials. This emphasis on logical processes before physical implementation matches the early stages of the Design Science Research cycle beautifully.**

### C. System Analysis Procedure

This process will run in the following way:

#### Sources of the project Data

The project will employ both primary and secondary data:

**Primary Data:** Collection from Target Stakeholders Directly. These include qualitative (interviews and FGDs with farmers), quantitative (surveys).

**Secondary Data:** Information will be obtained from existing secondary sources like the academic journals, World Bank and FAO records (also reports), data of agencies such as the Uganda Communications Commission, and also old research on digital agriculture in Uganda.

#### Data Analysis and Modeling

Data will analyze qualitative and quantitative data and develop logical models of a model of the current and a model of the proposed system. The key techniques include:

**Data Flow Diagrams (DFDs):** To visualize how information flows through the existing marketing system and the intended application. A Level 0 (Context Diagram) and Level 1 DFD will represent the major processing steps (e.g., “List Produce,” “Search for Produce,” “Process Payment”).

**Entity-Relationship Diagrams (ERDs):** This will be used to model the data that stores in the system. It will define the entities (e.g., Farmer, Buyer, Product, Order, Transaction), their attributes, and the relationships between them (e.g., Farmer lists many Products).

#### 3.6.2 System Design and Development Life Cycle Approach

System design, in this way, describes the architecture, components, and interfaces of a new system to meet requirements seen during analysis. **A. System Design Techniques**

This will be followed by a series of design artifacts generated based on the models produced as part of the analysis:

**Entity-Relationship Diagram (ERD):** A conceptual ERD generated by the analysis phase will be converted to a physical database schema that specifies tables, primary keys and foreign keys required for implementation in MySQL/PostgreSQL.

**Data Flow Diagrams (DFDs):** The logical DFDs will be sharpened to demonstrate the system physical action as it is implemented with specific software modules and data stores.

**Mockups for the User Interface (UI):** We will create detailed, pixel-perfect mockups of all application screens using Figma. These principles will be based on the wireframes and are consistent with the usability and accessibility of the target users.

**1. What approaches exists? Multiple SDLC models can form including the:**

**Waterfall model:** A sequential process where each phase must be finished thoroughly before the next is initiated. This is brittle and harder to change. **Agile Model:** A method which consists of an iterative and incremental approach the project is split up into periodic small sprints. It focuses on fast deliverability, customer collaboration, and flexibility in obtaining working software in an agile manner. **Prototyping Model:** A modeling scheme whereby an early, incomplete version of the system (a prototype) is rapidly built and then iteratively improved (again and again) through cycles of feedback. 3.6.4.2 Which method will the project implement and what why? Reasoning for the project will be prototyping approach;

**To ease uncertainty:** The user need for a farmer focused app is not completely defined from a user-end point of view initially. This means prototyping will create a working user-centered model for people to play with; users will receive more reliable feedback they can use to create the next model. **For user-centredity and acceptability:** It is more helpful for farmers to have a working prototype – however rudimentary – than it is for the abstract descriptions. It is the trust builders that assures that it addresses the pragmatic needs they have and raises the chances for adoption. **Flexibility and adaptability:** This will allow the project to be divided into 2-week sprints (e.g., sprint 1: User authentication, sprint 2: produce listing). The working feature is tested at the end of each sprint, and feedback with how the plan to be adopted at the next sprint will enable the finished product to be in harmony with user needs. 3.7 System testing. System testing is an integral part to establish if the built application satisfies specific requirements and is defectless. Multi-level testers will be used;

### 3.7.1 Unit testing;

Particles of source code (e.g., a function that determines the total price of a product); the code will be isolated and independently tested by developers. 3.7.2 Integration testing;

The interface/integration of integrated units/modules (e.g., ensuring that a list produce module saves the data into the product table in the database) will be attempted and interfaces will be tested for bugs. 3.7.3 System Testing

System testing is an essential step to ensure the developed application comply with the defined requirements and is free of defects. 3.7.4 User Acceptance Testing (UAT)

This is the most important test for the duration of this project. A small subset of target users (e.g., farmers and buyers) will be given a final prototype. The app will work under controlled conditions for them in an actual application. Their feedback on how the apps are used and are very satisfied will be our final check-point before releasing them to the community or outside the platform. 3.8 Ethical Considerations

Ethical considerations will be observed in all studies. Participants will be informed about the aim of the study and will provide consent. Participating will be a voluntary process. All personally identifiable information will be stored confidentially. The app and information derived will only be used for academic use. 3.9 Limitations of the Study

The research might encounter some limitations including no internet access to remote places, low literacy levels in some farmers who need additional guidance, financial and time

restrictions which would affect the testing scale and difficulty in deploying true mobile-money functionality that is due to restricted API access. In light of these challenges, however, the project team is also going to limit that impact, so that the study can be completed successfully. **3.10 Timeline and milestones**

### Text Summary of Activities

**I. Month 1-2: Problem analysis and requirement gathering**

**II. Month 3: Literature Review and SRS documentation**

**III. Month 4–5: System design (DFDs, ERDs, and wireframes)**

**IV. Month 6-7: Prototyping development (Flutter front end Firebase Backend)**

**V. Month 8: Testing, evaluation, report writing and submission**

### Gantt chart

Activity	August	September	October	November	Decemcer	January	February	March
Problem analysis & requirements								
Literature review & SRS								
System design								
Prototype development								
Testing & evaluation								
Report writing & submission								

### 3.11 Conclusion

This research will follow a clear and practical process — from identifying the problem, collecting data, designing and testing the app, to evaluating the final system. By using Design Science Research and prototype development, the project will create a Digital Agro-Marketing Application that is suitable for Ugandan farmers and will help improve their market access, income, and productivity.



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## APPENDICIES

### I: Proposed Project Budget

Item	Quantity	Unit Cost (UGX)	Total Cost (UGX)	Notes
Smartphones for testing	2	800,000	1,600,000	Mid-range Android devices
Internet bundles	8 months	100,000	800,000	For research, testing, deployment
Hosting & domain	1 year	350,000	350,000	Cloud hosting and domain name
Stationery & printing	Lump sum	—	200,000	Questionnaires, reports
Transport (field visits)	10 trips	50,000	500,000	Kampala & Luweero
Refreshments for FGDs	4	100,000	400,000	Farmer focus groups
Contingency (10%)	—	—	385,000	Buffer for unexpected costs
<b>Total</b>			<b>4,235,000</b>	—

### II: Data Collection Tools

#### A) Sample Questionnaire (for farmers)

##### Section i: Demographics

- i. Age.....
- ii. Gender.....
- iii. District.....
- iv. Type of crops grown.....

##### Section ii: Current Marketing Practices

- v. How do you currently sell your products?
  - a) Local market
  - b) Middlemen
  - c) Cooperatives
  - d) Other(specify)
- vi. How often do you face challenges in accessing fair prices?
  - a) Always
  - b) Often
  - c) Sometimes
  - d) Rarely
  - e) Never
- vii. What is your main source of market information?
  - a) Word of mouth
  - b) Radio

- c) Mobile phone
- d) Other(specify)

### Section iii: Technology Use.

viii. Do you have smart phone?

- a) Yes
- b) No

ix. If yes, what do you mainly use it for?

- a) Calls/SMS
- b) Mobile money
- c) Social media
- d) Other(specify)

x. Have ever used a digital platform to sell produce?

- a) Yes
- b) No

### Section iv: Expectations

xi. What feature would you find most useful in a digital agro-marketing app?

- a) Real time prices
- b) Direct buyers contacts
- c) Mobile money payments
- d) Transport
- e) Coordination
- f) Other (specify)

xii. What challenges do you anticipate in using such an app?

B) For buyers and agricultural officers

xiii. What challenges do you face when sourcing produce from farmers?

xiv. How do you currently obtain market price information?

xv. What are your views on using mobile applications for a grow marketing?

xvi. What features would you make such an application to buyers?

xvii. What concerns do you have regarding trust, payments, or logistics in digital platforms?

xviii. How do you think farmers could be supported to adopt such technology?

### III: Schedule of Activities / Gantt chart

a) Text Summary of the activities

- I. Month 1-2: Problem analysis and requirement gathering
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- IV. Month 6-7: Prototyping development (Flutter front end Firebase Backend)
- V. Month 8: Testing, evaluation, report writing and submission

b) **Gantt chart**

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