BUSITEMA UNIVERSITY
Pursuing Excellence

P.O. Box 236, Tororo, Uganda
Gen: +256 - 45 444 8838
Fax: +256 - 45 4436517
Email: info@adm.busitema.ac.ug
www.busitema.ac.ug

COFFEE INFORMATION MANAGEMENT SYSTEM (CIMS)

CASE STUDY: SMALL HOLDER FARMERS IN KAPCHORWA

BY

CHEPTORIS WINNIE

BU/UP/2023/1647

+256752796789

Cheptoris69@gmail.com

A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF COMPUTER STUDIES FOR PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE IN SCIENCE EDUCATION

AT BUSITEMA UNIVERSITY

SUPERVISORS

DR. ANGOLE RICHARD & MR. MUSANA EDDIE

AUGUST, 2026

DECLARATION

DECLARATION

I CHEPTORIS WINNIE, Registration No: BU/UP/2023/1647, humbly hereby declare that this final year project report is the outcome of information concerning my own work.

Signature.....

Date.....31st August 2026.....

APPROVAL

APPROVAL

This Project Report has been submitted with the approval of my supervisors.

Sign.....

Date.....

Dr. Angole Richard Okello.

Department of computer studies - Faculty of Science and Education, Busitema University

Sign.....

Date.....

Mr. Musana Eddie

Department of computer studies - Faculty of Science and Education, Busitema University

DEDICATION

I dedicate this research project to the Almighty GOD, whose guidance and provision have enabled me to complete it with good health and a sound mind. To my mother, **Ms Cheptoek Ruth**, I express my heartfelt gratitude for your unwavering financial support and encouragement. To my siblings for your love and support throughout this journey. I extend my sincere appreciation to my supervisors, **Dr. Angole Richard** and **Mr. Musana Eddie**, for their expert guidance and mentorship. To my lecturers, who instilled in me the fundamentals of research, and my course mates, especially **Kibet Levi** and **Chemutai Sarah**, who supported me throughout this journey, I say thank you. To everyone who contributed to my success, I am grateful for your efforts and pray that the Almighty GOD blesses you abundantly.

ACKNOWLEDGEMENT

I give glory and thanks to the Almighty God for granting me life, good health, knowledge, wisdom, understanding, and strength throughout my academic journey. I believe that my achievements have been made possible through His grace and guidance. I sincerely appreciate my parent, Ms. Cheptoek Ruth, for her unconditional love, encouragement, financial support, and sponsorship, which enabled me to meet my tuition and complete my studies. May God bless you abundantly. I thank my lecturers for their guidance and support throughout my studies. Special appreciation goes to my project supervisor, Dr. Angole Richard and Mr. Musana Eddie for his valuable guidance and advice from the beginning to the completion of this research project. His support helped me select an appropriate research topic and successfully conduct the study. I extend my appreciation to the Chairperson of Smallholder Farmers, Chema Sub-County, Mr. Chelangat Patrick, for granting me permission and providing a conducive environment to conduct my research. Finally, I thank my friends, relatives, and the Nagongera community for their encouragement and support. Special thanks go to my sister, Cherotich Victoria; my course mate, Alajo Melane, Arapmwotile Levi, Chemutai Sarah and all my colleagues for their support throughout my studies. May the Almighty God bless you all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACROMYMS

CIMS-Coffee Information Management System

CSS-Cascading Style Sheets

DBMS-Database Management System

DFD-Data Flow Diagram

ERD-Entity Relationship Diagram

HTML-HyperText Markup Language

ICT-Information and Communication Technology

MD5-Message-Digest Algorithm 5

MySQL-My Structured Query Language

PHP-PHP: Hypertext Preprocessor

RAD-Rapid Application Development

RAM-Random Access Memory

SADAM-Structured Analysis and Design Methodology

SDLC-System Development Life Cycle

SSADM-Structured Systems Analysis and Design Method

SSD-Solid State Drive

UNIX-Unix operating system

UPS-Uninterruptible Power Supply

XAMPP-Cross-Platform, Apache, MySQL, PHP and Perl

ABSTRACT

Coffee is an important cash crop and a major source of livelihood for smallholder farmers in Uganda. However, smallholder coffee farmers in Kapchorwa face challenges in post-harvest handling, drying, storage, and marketing. Poor harvesting practices, inadequate drying and storage conditions, limited documentation, and weak traceability can contribute to coffee quality deterioration, reduced market access, and lower returns to farmers. The study therefore aimed to design, develop, implement, and test a Coffee Information Management System (CIMS) to improve coffee post-harvest handling, storage, and marketing among smallholder farmers.

The study adopted an applied research approach and used the SADAM methodology within the System Development Life Cycle (SDLC), incorporating Rapid Application Development (RAD) principles. Data were collected through interviews, observation, and document review involving smallholder farmers, coffee buyers, and selected agricultural extension officers. The collected information was analyzed to identify functional and non-functional system requirements. The system was developed as a web-based application using HTML, CSS, Bootstrap, JavaScript, PHP, and MySQL, with XAMPP used for local deployment and testing.

The developed CIMS provides functionality for user registration and login, farmer management, harvest recording, drying and storage records, coffee availability, buyer transactions, and purchase history. The system also supports centralized data storage and improves the organization, retrieval, and traceability of coffee information from harvest to sale. Unit testing, integration testing, and user validation were conducted to assess the functionality and usability of the system.

The study concludes that CIMS provides a practical digital approach to replacing fragmented manual record-keeping and improving the management of coffee post-harvest and marketing information. The study recommends adoption of the system by coffee organizations and smallholder farmers, together with continuous system maintenance, improvement, and development of additional modules to enhance its functionality

CHAPTER ONE: INTRODUCTION

1.1 Background

Coffee remained one of Uganda's most important cash crops, contributing significantly to rural livelihoods, export earnings, and agricultural employment (Mwesigye, Francis, and Hanh Nguyen, 2020.). In regions such as **Kacphorwa**, smallholder farmers predominantly cultivated Arabica and Robusta coffee under low-input, labour-intensive systems. Despite favourabled agro-ecological conditions and strong cultural engagement with coffee production, farmers in Kacphorwa have faced persistent challenges that undermined quality and income, (Kambuche and Maria Mghulo, 2025.) particularly during the **post-harvest handling, drying, storage, and marketing stages** of the coffee value chain.

Post-harvest handling practices among many smallholder farmers in Kacphorwa are largely informal and characterised by inconsistent harvesting techniques, limited access to appropriate drying infrastructure, and weak documentation of quality parameters. Often, coffee cherries are harvested indiscriminately, mixed with underripe or overripe fruit, and subjected to uncontrolled drying conditions, leading to quality defects such as fermentation, mould growth, and uneven moisture content. (Moon, Sai Aung, 2024.). These defects have directly affected the grade and flavour profile of coffee—critical determinants of market pricing on both local and international markets.

Storage practices furthered compound the problem such as Inadequate facilities, exposure to humid environments, poor pest control, and lack of standardized monitoring result in re-absorption of moisture, bean discoloration, and loss of quality over time. Without systematic documentation or traceability of handling and storage conditions, farmers in Kacphorwa are often unable to demonstrate quality consistency to buyers, limiting their ability to access premium markets or negotiate higher prices. This situation exacerbated due limited access to market information, weak linkages between producers and buyers, and opaque pricing mechanisms, which collectively perpetuated low returns to farmers despite high production costs.

Underlying these technical and market challenges was an **information management gap**. Many farmers lacked tools for capturing, storing, and analysing critical data related to harvesting dates,

drying progress, moisture levels, storage conditions, and market prices. Existing data, when recorded, is often fragmented, paper-based, or inaccessible to stakeholders who could use it to improve decision-making, access quality premiums, or demonstrate compliance with buyer and certification standards.

Given these challenges, there was a clear need for an **information management system** that can support comprehensive tracking and coordination of coffee post-harvest practices, ensure consistency in quality documentation, enabled traceability from field to market, and enhanced farmers' capacity to engage effectively with buyers. Such a system had the potential to improve not only coffee quality outcomes but also market access and pricing returns for smallholder farmers in Kacphorwa, which contributed to poverty reduction and agricultural competitiveness.

1.2 Problem statement

The inappropriate handling of coffee during the **harvest, drying, and storage stages** is a major factor which contributed to reduced coffee quality and, consequently, lower market prices. At the harvest stage, practices such as picking unripe or overripe cherries, stripping branches instead of selective picking, and delayed processing after harvesting can introduce defects that negatively affect cup quality. These defects reduced the consistency and grade of the coffee, which directly influenced how buyers price the product.

During the drying stage, improper drying techniques—such as uneven sun-drying, drying coffee directly on bare ground, exposure to rain, or insufficient control of moisture levels—can lead to mold growth, fermentation defects, and discoloration. Coffee that is over-dried or under-dried fails to meet quality standards required by specialty and export markets, resulting in price penalties or rejection.

Storage practices further compound these problems. Storing coffee in poorly ventilated, humid, or contaminated environments can cause moisture reabsorption, pest infestation, and odor absorption. The use of inappropriate storage materials and prolonged storage without proper monitoring often leads to deterioration in bean quality. As a result, buyers downgrade the coffee, offering lower prices regardless of production costs incurred by farmers.

Overall, inappropriate handling across these post-harvest stages undermines coffee quality, limits access to premium markets, and reduces farmer income. Improving handling practices through training, quality standards enforcement, and better infrastructure is therefore critical to enhancing coffee value, market competitiveness, and pricing outcomes.

1.3 Research Gap

Existing studies on coffee production and value chains in **Uganda** have extensively documented agronomic practices, productivity challenges, and market constraints faced by smallholder farmers. In addition, research on post-harvest coffee handling has highlighted the effects of poor harvesting, drying, and storage practices on coffee quality and pricing. However, much of this work has focused on **technical or behavioral interventions**, such as farmer training, infrastructure improvement, or quality standards enforcement, with limited attention to the role of **information management systems** in addressing these challenges.

Although information systems have been widely applied in agriculture for farm management, traceability, and market information dissemination, there is **limited empirical research** on the design and application of **integrated information management systems** that specifically support coffee post-harvest handling, storage, and marketing as a continuous, connected process. Existing digital solutions often address isolated functions—such as price information or certification tracking—without systematically linking quality data from post-harvest stages to storage conditions and marketing decisions.

Furthermore, there is a notable lack of **context-specific studies** that examine how smallholder coffee farmers in localized settings, such as **Kacphorwa**, can practically adopt and benefit from information management systems. Many proposed digital solutions are developed for large-scale producers or export-oriented actors, making them less suitable for smallholder farmers who face constraints related to digital literacy, infrastructure, and access to technology.

Most importantly, the existing literature does not sufficiently explore how an information management system can be **designed, developed, tested, and implemented** to directly improve post-harvest handling practices, preserve coffee quality during storage, and enhance transparency and coordination in marketing at the smallholder level. This creates a gap between recognized

post-harvest challenges and actionable, system-based solutions that integrate quality monitoring, documentation, and traceability across the coffee value chain.

This study seeks to address this gap by designing and implementing a **Coffee Information Management System (CIMS)** tailored to the needs and realities of smallholder farmers in Kacphorwa, Uganda, thereby contributing both practical and context-specific insights into the use of information systems for improving coffee post-harvest handling, storage, and marketing.

1.4 Main Objective

To design, implement, test, and develop a Coffee Information Management System (CIMS) that improves coffee post-harvest handling, storage, and marketing among smallholder farmers.

1.4.1. Specific Objectives

- To determine requirements for the design of the Coffee Information Management System (CIMS) for improved post-harvest handling, storage and marketing.
- To develop the Coffee Information Management System (CIMS) for improved post-harvest handling, storage and marketing.
- To Test and validate the developed Coffee Information Management System (CIMS).

1.4.2 Research questions

1) What are the requirements for designing CIMS?
2) How can CIMS be developed to support the farmers' activities?
3) How can the implemented CIMS track the farmers' activities?

1.5 Significance

This study was significant at multiple levels, including smallholder farmers, practitioners, policymakers, and the academic community.

For **smallholder coffee farmers in Kapchorwa, Uganda**, the study provided a practical solution to persistent challenges related to poor post-harvest handling, inadequate storage practices, and limited access to reliable market information. By implementing a Coffee Information Management

System (CIMS), farmers are empowered to systematically monitor, document, and trace coffee quality across post-harvest stages, enabling better decision-making and reducing quality losses that negatively affect coffee pricing and income.

1.6 Scope of the Study

The scope of this study was defined along three dimensions: content, geographical, and time.

1.6.1 Content Scope

The study focused on the development of coffee information management system (CIMS) to improve post-harvest handling, storage and marketing among smallholder coffee farmers in Kapchorwa. The scope is limited to the post-harvest phase of the coffee value chain including handling practices, storage management, quality records and market transactions. It assessed the systems usability and its impact on reducing post- harvest losses, improve coffee quality and ensures market access.

1.6.2 Geographical Scope

The study was limited to smallholder coffee farmers operations within the Sebei region, specifically covering the farmers and administrative activities under the cooperative's jurisdiction.

1.6.3 Time Scope

The research and system development was conducted within a period of 1 to 4 months, covering system analysis, design, implementation, and testing phases.

1.7 Significance of the Study

The development of the Coffee Information Management System (CIMS) was significant to all stakeholders within smallholder farmers. For admins/ staff, the system would simplify daily operations by automating farmer registration, delivery tracking, and payment processing, thereby reducing manual errors and improving efficiency. For farmers, the system would provide transparency in how their coffee deliveries are recorded, how payments are calculated, and how sales are conducted, which would build trust and encourage active participation in cooperative activities. For management, the system will offer real-time, accurate reports that enhance

oversight, accountability, and strategic decision-making. For researchers and future developers, the system will serve as a reference model for designing agricultural management solutions, supporting future studies, innovation, and development within the coffee sector.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed the literature relevant to the design and implementation of a Coffee Information Management System (CIMS) aimed at improving post-harvest handling, storage, and marketing among smallholder coffee farmers in Kapchorwa, Uganda. The review is structured to examine theoretical foundations of systems and management systems, digital and web-based information systems in agriculture, post-harvest coffee handling practices, and existing coffee information management systems globally and regionally.

The chapter further analyzed related systems, identified gaps in literature and practice, and established the need for a context-specific, integrated Coffee Information Management System tailored to smallholder farmers in Kapchorwa.

2.2 The Concept of a System

A system is defined as a set of interrelated and interdependent components that work together to achieve a common objective. Systems operated through structured processes involving inputs, processing mechanisms, outputs, and feedback loops.

In the context of agricultural information management, a system captured data (inputs), processed it through defined procedures, and produced meaningful outputs such as reports, alerts, or analytics that supported decision-making.

For smallholder coffee farmers in Kapchorwa, post-harvest activities such as harvesting, drying, grading, storage, and marketing can be viewed as interconnected components of a larger system. However, in many rural settings, these activities are poorly coordinated and lack structured documentation. The absence of an integrated system resulted in inconsistencies in quality monitoring, limited traceability, and weak market positioning.

Understanding coffee post-harvest operations as a system provides the conceptual foundation for designing a Coffee Information Management System that integrates data capture, quality monitoring, storage tracking, and market information into a unified framework.

2.3 The Concept of a Management System

A management system provides a structured framework for planning, organizing, monitoring, and controlling operations in order to achieve efficiency, consistency, and accountability. In organizational settings, management systems enhance coordination among different activities, reduce duplication of tasks, and improve transparency in decision-making processes. By establishing clear procedures and documentation mechanisms, management systems ensure that operations follow defined standards and objectives.

In the field of information technology, management systems automate record-keeping, streamline workflows, and enable real-time data processing and reporting. These systems reduce dependence on manual procedures, minimize human error, and improve the speed and accuracy of information retrieval. As a result, management systems have been widely adopted in sectors such as education, healthcare, banking, and increasingly in agriculture, where accurate data management is critical for operational success and strategic planning.

For smallholder coffee farmers in Kacphorwa, a management system is particularly important in organizing and documenting post-harvest activities. Such a system facilitates the systematic recording of harvesting dates, monitoring of drying progress and moisture levels, tracking of storage conditions, documentation of quality grades, and recording of sales transactions and pricing information. Without a structured management system, farmers often rely on fragmented, paper-based records that are susceptible to loss, inaccuracies, and inconsistencies. This lack of organized documentation limits traceability, weakens quality control, and reduces farmers' ability to negotiate better market prices. A Coffee Information Management System (CIMS) therefore provides an integrated digital framework that coordinates post-harvest handling, storage, and marketing processes, enhancing efficiency, transparency, and overall decision-making.

2.4 Web-Based Management Systems in Agriculture

A web-based management system is an online platform that users access through internet browsers or local networks. It enables centralized data storage, multi-user access, and real-time updates, ensuring that information entered by one user is immediately available to others. This centralized structure improves data consistency, security, and accessibility across different operational levels.

In agricultural contexts, web-based systems enhance efficiency by providing secure data storage, real-time access to information, improved collaboration among stakeholders, automated report generation, and reduced reliance on paperwork. They are commonly applied in farm management, traceability systems, supply chain monitoring, and dissemination of market price information. However, many of these systems are designed for large-scale producers and export-oriented companies, making them less suitable for smallholder farmers who face constraints such as limited digital literacy and infrastructure.

For smallholder coffee farmers in Kacphorwa, a simplified and user-friendly web-based Coffee Information Management System (CIMS) can provide structured data capture, improved traceability, and better coordination of post-harvest and marketing activities while remaining affordable and practical for rural use.

2.5 Coffee Post-Harvest Handling and Quality Management

Post-harvest handling significantly determines coffee quality and market value. Literature highlights that improper harvesting, drying, and storage practices result in defects that reduce cup quality and market grades.

2.5.1 Harvesting Practices

Selective harvesting of ripe cherries improves uniformity and cup quality. Conversely, mixing underripe and overripe cherries introduces defects that affect grading and pricing. Delayed processing after harvesting may lead to unwanted fermentation.

2.5.2 Drying Practices

Proper drying reduces moisture content to recommended levels. Uneven drying, exposure to rain, and drying on bare ground increase risks of mold growth, contamination, and discoloration. Moisture monitoring is critical but often poorly documented among smallholders.

2.5.3 Storage Management

Effective storage requires controlled humidity, pest prevention, appropriate packaging materials, and regular monitoring. Poor storage leads to moisture reabsorption and quality deterioration.(

Mabbett, Terry. "Quality control for stored coffee and cocoa." *International Pest Control Magasine* 2 (2013): 55.)

Despite recognition of these technical factors, literature often emphasizes training and infrastructure but gives limited attention to structured digital documentation and traceability systems that support quality consistency.

2.6 Coffee Information Management Systems (CIMS)

A Coffee Information Management System (CIMS) is a digital platform designed to integrate and manage data related to coffee production and post-harvest processes. Such a system captures and organizes information on farmer identification, harvest records, drying progress and moisture tracking, storage conditions, quality grading results, and market prices and transactions. By consolidating these components into a single platform, CIMS enables structured documentation, improved traceability, and better coordination across the coffee value chain.

Globally, digital coffee management platforms have been adopted to enhance traceability and ensure compliance with certification and quality standards. These systems connect production data with market requirements, thereby promoting transparency, accountability, and improved market access. Through digital documentation, stakeholders can monitor quality consistency, track product movement, and demonstrate compliance to buyers.

However, many existing CIMS models are primarily designed for large exporters and commercial processors. They are often technically complex, expensive to implement and maintain, and dependent on high levels of digital literacy and reliable infrastructure. As a result, they are not easily adaptable to smallholder farming contexts. There remains limited research on simplified, affordable, and context-specific Coffee Information Management Systems tailored to smallholder farmers operating under resource and technological constraints, particularly in rural settings such as Kacphorwa.

2.7 Review of Related Systems

2.7.1 Manual Record Systems

Manual record systems rely on notebooks, registers, and handwritten logs to capture and store operational data. These systems are commonly used in rural agricultural settings because they are inexpensive and do not require technical skills or infrastructure. However, manual methods are highly prone to human error, duplication of entries, and loss or physical damage of records. Retrieving information can be slow and inefficient, especially during peak harvest periods when large volumes of data must be managed. As a result, manual systems often limit traceability, transparency, and timely decision-making.

2.7.2 Spreadsheet-Based Systems

Spreadsheet-based systems, such as those developed using basic computer applications, offer an improvement over purely manual methods by allowing structured data entry and simple calculations. They enable users to organize records, generate summaries, and perform basic analysis. Despite these advantages, spreadsheets lack secure multi-user access controls, real-time synchronization, automated traceability functions, and integrated modules for comprehensive quality tracking. When multiple users maintain separate files, inconsistencies and version conflicts may arise, reducing data reliability and accountability.

2.7.3 Existing Digital Agricultural Systems

Existing digital agricultural systems provide more advanced features such as product traceability, certification compliance monitoring, and payment tracking. These platforms demonstrate the potential of digital technology in enhancing transparency and efficiency within agricultural value chains. However, many of these systems are designed for large-scale producers, exporters, or well-resourced organizations. They often involve high implementation and maintenance costs, require reliable internet and technological infrastructure, and demand advanced technical skills to operate effectively. In addition, they may offer limited customization for localized rural contexts. These limitations highlight the need for a simplified, affordable, and integrated Coffee Information Management System tailored specifically to the realities of smallholder farmers in Kacphorwa.

2.8 Gap in the Literature

Although previous studies have examined post-harvest coffee handling practices and the application of digital systems in agriculture, significant gaps remain in the literature. Existing research often treats post-harvest handling, storage, and marketing as separate components rather than integrating them into a unified information management framework. There is also insufficient focus on smallholder farmer contexts in localized rural settings, where infrastructure limitations, resource constraints, and varying levels of digital literacy affect technology adoption.

Furthermore, there is a lack of empirical studies that explore the full process of designing, developing, testing, and implementing a Coffee Information Management System specifically aimed at improving post-harvest quality management. Limited attention has been given to how structured digital documentation can enhance traceability, strengthen quality consistency, and positively influence pricing outcomes for smallholder farmers. Most interventions continue to emphasize training and infrastructure improvements rather than the development of integrated information systems. This creates a disconnect between the well-documented post-harvest challenges and the availability of practical, system-based digital solutions tailored to smallholder environments such as Kacphorwa.

2.9 Summary of Literature Review

This chapter has examined theoretical foundations of systems and management systems, the role of web-based information systems in agriculture, post-harvest coffee quality management practices, and existing coffee information management systems. The review highlights that while technical challenges affecting coffee quality during harvesting, drying, and storage are widely recognized, there is limited emphasis on integrated, smallholder-oriented information management systems that link post-harvest handling, storage monitoring, and marketing processes within a single framework.

The identified gaps in literature provide a strong justification for the design, development, testing, and implementation of a context-specific Coffee Information Management System (CIMS) for smallholder farmers in Kacphorwa, Uganda. The proposed system seeks to enhance traceability,

improve quality documentation, strengthen market transparency, and ultimately contribute to increased income and competitiveness for smallholder coffee farmers.

CHAPTER THREE METHODOLOGY

3.1 Introduction

This chapter presents the methodology that will used to design, develop, test, and implement the Coffee Information Management System (CIMS) for improving coffee post-harvest handling, storage, and marketing among smallholder farmers in Kacphorwa, Uganda. The chapter describes the research approach, study area, population and sampling procedures, data collection and analysis methods, system development methodology, tools and technologies, system design models, implementation strategy, and testing procedures. The purpose of this methodology was to ensure that the proposed system is developed in a structured, systematic, and user-centered manner that directly addresses the post-harvest and marketing challenges identified in Chapter One.

3.2 Type of Research and Rationale

This study adopted applied research approach integrated with a practical system development methodology. I used applied research because the main goal of the study is to develop a functional Coffee Information Management System that will solve real challenges faced by smallholder coffee farmers in post-harvest handling, storage monitoring, and marketing coordination.

To guide system development, I adopted the SADAM methodology within the broader System Development Life Cycle (SDLC) framework. I selected the Rapid Application Development approach because of its prioritizes fast development, prototyping, and iterative feedback . The system is developed through repeated cycles of building, testing, and refining based on user feedback.

3.3 Area of Study

I conducted the study in Chema subcounty, located in Kapchorwa District in Eastern Uganda. The area is characterized by smallholder coffee farmers who cultivate both Arabica coffee under low-input systems. Coffee farming is a major source of livelihood in this region, and post-harvest handling, drying, storage, and marketing activities are primarily managed at household level or through informal arrangements. The choice of Kacphorwa is based on the persistent post-harvest challenges and limited digital information management systems available to farmers in the area.

3.4 Population and Sampling Method

The study population consisted of smallholder coffee farmers in Kacphorwa, local coffee buyers, and selected agricultural extension officers operating within the region. These stakeholders were directly involved in harvesting, drying, storage, quality grading, and marketing of coffee.

I used purposive sampling to select participants who are actively engaged in post-harvest handling and marketing activities. I selected a representative group of farmers from different villages within Kacphorwa to ensure diversity in farming practices and production levels. I also included at least one local buyer and one agricultural extension officer to provide insights into quality standards and market requirements. Their input guided system requirement identification, validation of system features, and assessment of usability during testing.

3.5 Data Collection and Analysis

I collected data using interviews, observation, and document review. I conducted semi-structured interviews with selected farmers to understand current post-harvest practices, storage challenges, quality monitoring methods, and marketing constraints.

I also interviewed local buyers and extension officers to identify quality standards, grading requirements, and pricing considerations. (Interviews are a versatile data collection method that can be used in qualitative, quantitative and mixed methods research, **John Creswell** (2009))

Through direct observation, (Goffman 1967) argued that the best way to understand social interaction is to participate in it. I examined how farmers harvest, dry, store, and prepare coffee for sale. I observed how information related to harvest dates, moisture levels, storage duration, and sales transactions is currently recorded and managed. Additionally, I reviewed available records such as notebooks, sales receipts, moisture records, and delivery logs to understand the structure and gaps in existing documentation.

I analyzed the collected data qualitatively to identify functional and non-functional system requirements. The analysis focused on identifying workflow patterns, user expectations, data capture needs, traceability requirements, and security considerations. The findings informed the system design and development process.

3.6 System Development Methodology

I developed the Coffee Information Management System using the SADAM methodology under the System Development Life Cycle framework.

During the requirements gathering phase, I collected detailed information from farmers and stakeholders regarding the data they need to record, monitor, and access. I categorized these requirements into functional requirements, such as farmer registration, harvest recording, moisture tracking, storage monitoring, quality grading documentation, and sales tracking, and non-functional requirements, such as system usability, security, performance, and reliability.

In the system analysis phase, I organized the identified requirements and map the flow of information from harvesting through drying, storage, and marketing. I defined how different users interacted with the system and determined data relationships.

In the system design phase, I created database schemas, use case diagrams, and entity-relationship diagrams to define system structure and interactions. I designed the user interface to be simple, clear, and accessible for smallholder farmers.

During implementation, I developed the backend logic and integrated it with the database. I then connected the backend to the user interface to ensure smooth data entry, retrieval, and reporting.

3.6.1 Tools and Technologies

I developed the system using modern web technologies to ensure reliability and usability. I used HTML, CSS, and Bootstrap to design a responsive and user-friendly interface. I used JavaScript to enhance interactivity and improve user experience. For backend development, I used PHP to handle business logic and process user requests. I used MySQL as the database management system to store farmer profiles, harvest records, post-harvest data, storage information, quality grades, and market transactions.

I used Visual Studio Code as the development environment and deploy the system on an Apache server using XAMPP for local testing before final deployment.

3.7 System Design

System design defined how the components of the Coffee Information Management System interacted to support post-harvest handling, storage, and marketing processes.

3.7.1 Use Case Diagram

I developed a Use Case Diagram to illustrate the interactions between the system and its users. The primary users included farmers and system administrators. Farmers would be able to register, record harvest data, input drying and storage information, view quality grades, and track sales transactions. Administrators would manage user accounts, validate quality records, and generate reports. The diagram clearly showed system boundaries and user roles.

3.7.2 Entity Relationship Diagram

I designed an Entity Relationship Diagram to define the database structure. The main entities included Farmers, Harvest Records, Post-Harvest Handling, Storage, Quality Grades, and Market Transactions. These entities were linked using primary and foreign keys to ensure data integrity and accurate relationships across the system. This design supported traceability from harvest to market.

3.8 Implementation Method

I implemented the Coffee Information Management System by integrating a secure backend with a responsive frontend interface. The backend processed user requests, manage user roles, and handle data related to harvest, storage, quality grading, and sales transactions. It interacted with the MySQL database to ensure accurate and secure data storage.

The frontend provided a clean and mobile-responsive interface suitable for rural users who may access the system via smartphones or computers. The system supported structured data entry, automatic calculations where necessary, and real-time report generation. I ensured that the implementation improves documentation, traceability, and transparency across the coffee post-harvest value chain.

3.9 Testing and validation

Testing Both in unit and integration testing were performed on the equipments records management system to clarify the specifications of the system to reveal possible faults and establish confidence in the system. (Bourne 1982) argued that system testing should be comprehensive and should cover all aspects of the system. He also discussed the importance of using a variety of testing techniques such as black-box testing and white box testing. Unit testing focused on one function at a time in that whenever I designed a function, it would be tested instantly before proceeding to design another function. Integration testing was done after all the different modules had been put together to make a complete system. I aimed at ensuring that all modules of the system work hand in hand and that they could be integrated to form a complete working system. In the end, user testing was also carried out, which involved the potential users of the system to test the system if it met their requirements.

Validity (Bourne 1982) argued that validation should be conducted by the users of the system and should focus on the usability and functionality of the system. Validity in research is the issue of how valid the research is, in other words, how logical, truthful, healthy, reasonable, meaningful and useful the research can be.Validation was done to check whether the system satisfies or fits the intended use ie if the system met the user requirements, not as specification artifacts or as needs of those who would operate the software only, but as the needs of all the stakeholders.

3.10 Ethical considerations

I kept ethical considerations in my mind when I was conducting research for my final year project as explained below; Respect for persons; I respected the autonomy of my research participants and protect them from harm. This included getting their informed consent before I collected any data from them and ensured that they are not exposed to any risks as a result of participating in my study.

Confidentiality and data protection; I also protected the confidentiality of my research participants' data by not sharing their data with anyone without their consent. I took steps to secure their data against unauthorized access.

Conflict of interest; I made sure that I avoid any situation where my personal interests could influence my research thereby disclosing any potential conflicts of interest to my research participants and even my supervisor.

Integrity; lastly but not least, I was honest and accurate in that I didn't do any fabrication or falsification of data and also reported my findings accurately as well as objectively.

CHAPTER FOUR: SYSTEM ANALYSIS AND DESIGN

4.0 Introduction

This chapter describes the study of the current system its strengths and weaknesses, system requirements (functional and non-functional requirements) and system design (system architecture, context diagram, ERD, user case diagram).

4.1 Current system study

The current system used by smallholder coffee farmers in Kacphorwa for managing coffee activities is mainly manual and traditional. Farmers rely on notebooks, memory, and verbal communication to manage information related to harvesting, drying, storage, and sales.

During harvesting, farmers pick coffee cherries but often do not record important details such as quantities, dates, or quality. In the drying stage, coffee is usually dried under the sun without proper monitoring of moisture content or drying duration. This results in inconsistent quality.

Storage is also poorly managed, as coffee is kept in ordinary bags or stores without proper tracking of conditions such as humidity or storage time. When selling coffee, transactions are recorded informally or not recorded at all, making it difficult to track sales history or income.

Overall, the current system lacks a structured and reliable method for storing and managing information across all stages of the coffee value chain.

Strengths of the current system;

- The system does not require computers, software, or internet, making it affordable for all farmers.
- Farmers can easily use the system since it relies on simple methods like writing or memory.
- Farmers do not need training in ICT to operate the system.
- The system works without electricity or internet, which is suitable for rural areas.
- Farmers can manage their activities freely without system restrictions.

Weakness of current system

- The systems Information is not recorded or recorded inconsistently, leading to unreliable data.
- This system is difficult to track coffee from harvest to sale, which affects quality assurance and market trust.
- Farmers lack accurate data to guide decisions on drying, storage, and selling.
- The buyers prefer traceable and high-quality coffee, which the current system cannot guarantee.
- The use of manual recording and retrieval of information takes a lot of time.
- There is limited communication and data sharing between farmers, buyers, and stakeholders.

4.2 System Requirements

Various techniques and tools were used to analyze the data collected from the small holders farmers such as interview, observation among others from which important information was extracted, identifying and listing of the functional and non-functional requirements in an orderly and organized manner.

4.3 Functional requirements:

The functional requirements describe the functionalities or services that the system is going to render to its end users and these include the following;

- The system shall allow users (Admin and Farmers) to register.
- The system shall allow users to log in using a username and password.
- The system shall allow the admin to manage user accounts (add, update, delete).
- The system shall record farmer details (name, contact, location).
- The system shall allow viewing and updating of farmer records.
- The system shall allow farmers to record harvest details such as Harvest date, Quantity harvested, Coffee type
- The system shall store and retrieve harvest information.
- The system shall record storage details such as Storage condition, Storage duration.
- The system shall allow recording of sales details such as Buyer information, Quantity sold, Price, Date of sale.

Non - functional requirements

The non-functional requirements are not directly concerned with specific functions rendered by the system, but increases on the accuracy, reliability, performance, usability of the system among others and they include the following;

- Performance: System performance defines how fast a system can respond to carrying out its intended tasks.

- Reliability: this is the ability of a system to perform its intended function under stated conditions for a specified period of time.

- Flexibility requirement: this is the ability of a system to adapt to changes in its environment or requirements. Each part of the system should be independent so that changing of one does not affect the other part and new parts can be added to increase functionality.

- Accuracy requirement: The system should be more accurate in terms of computing and displaying the different equipments statuses for example, the normal, disposed, scraps in order to sort the ones for borrow.

- Usability: This is the ease of use and learnability of how to use the system.

- Backup recovery. There is a backup of records in case of any disaster.

- Security. The system shall ensure high security to prevent unauthorized users from accessing or corrupting the content of the system and to ensure that customer's accounts are only accessed by an authorized user.

Hardware/ Software requirements

- A Universal hard disk drive or a solid state disk (SSD).
- A hard disk of at least 80GB.
- Random Access Memory (RAM) not less than 2GB/4GB.
- An uninterruptible power supply (UPS).

4.4 Software requirements

- XAMPP (Version3. 2.4) Windows 8pro, 10 or higher version.
- Internet browser such as Mozilla Firefox and Google Chrome.

- The system should have 32/64 bits Operating System.

4.5 System Design:

The design follows system development methods. In this study, Rapid Application Development derived from Structural System Analysis and Design Methods was invoked. The design stages included; system architecture, Context Flow Diagram, Entity Relationship Diagram and System modeling using Use Case Diagrams.

4.6 System Architecture:

CIMS is a web-based architectural system that gives an outlay of how users interact with the system database. Every user will have a unique username and password. The registered user with go to the browser and type CIMS and sees the welcome screen asking him/her to login with the correct credentials, typically username and password. A new farmer has to be registered by the administrator then given a password and from there is when he/she will login into his/her account and edits/changes the account credentials. The admin monitors all the activities in the whole system. The admins table hides the passwords of each member using MD5 tool for security reasons.

The structure of the coffee information management system is divided into components for example:

- coffee information management system(cims) -Acts as the motherboard that connects the different components to perform specific tasks and achieve a common goal. It represented the key features which consisted of administrator and the farmer modules.
- Graphical user interface – which helped one to interact with the system through different displays.
- Xamp Server – acted as the local host for the system given the credentials set.
- Security – This ensures access rights to the information kept in the database. It allows login details to the system for authentication.
- Database/storage service – Covered the rapid and storage of data using relational database management system (MySQL). It housed the data in the system and data about it (Meta data).

- Presentation layer – this represented the various ranges of devices that were used to access the physics equipments records management system via the internet.

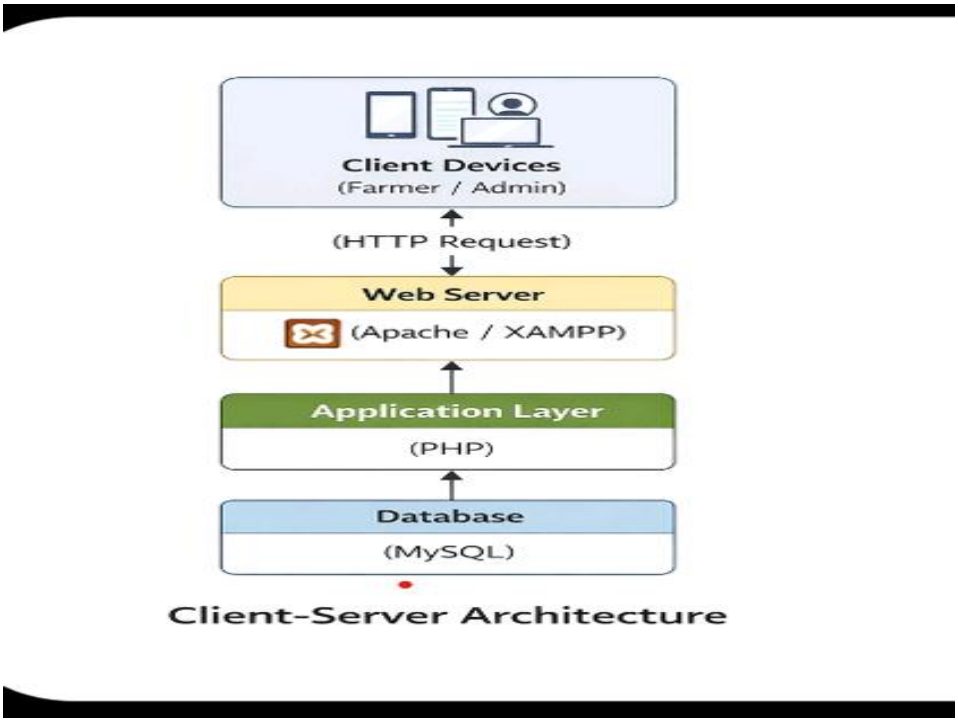


Figure 1: The System architecture

System Context Diagram

This is the high level diagram that shows the relationships between a system and its external entities. It is used to provide a clear understanding of the system and its relationship to other systems or external entities. It is often used in systems engineering, software development and business process modeling to show the boundaries of the system and how it interacts with other actors. The diagram usually includes a box or rectangle representing the system of interest and lines connecting it to other shapes representing the external entities with which it interacts. The purpose of a system context diagram is to give a clear understanding of the system's inputs, outputs and interactions with other systems.

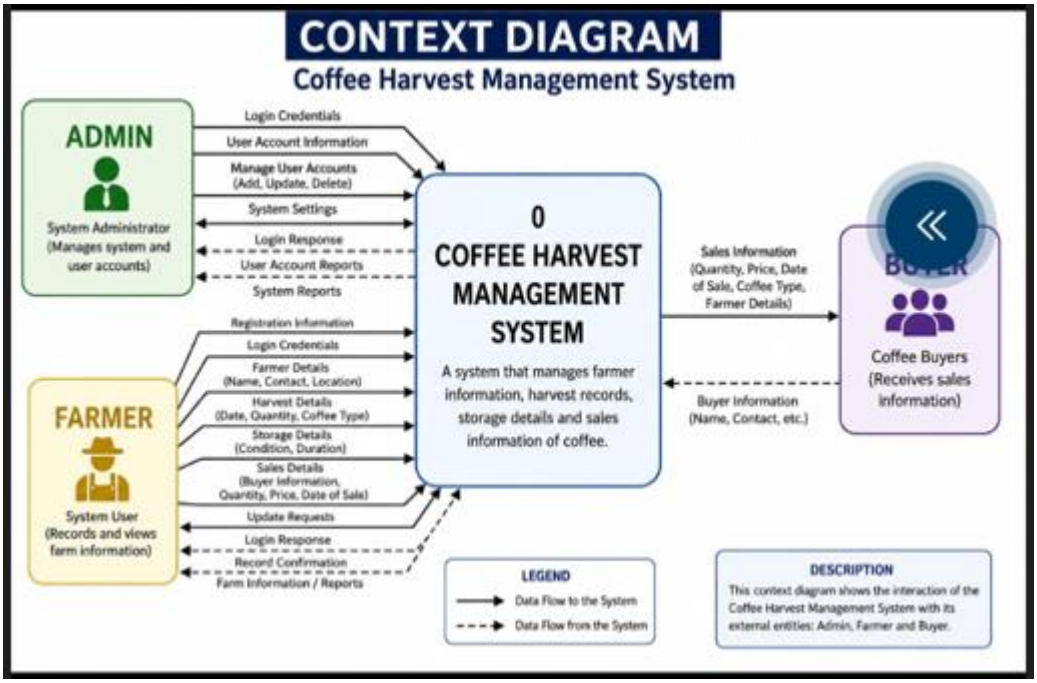


Figure 2: The System Context diagram

The administrator adds new information such as the purchase approvals details as well as new members into the system then he is supposed to notify the member about their new passwords and they are able to login so that they can easily edit their account details, view purchase made. The farmer is able to added new harvest, and also view purchased coffee from the buyer. The buyer is able make purchases from different farmers.

4.7 User case diagram

This is the chart that shows the different activities performed by each entity in the system for example the administrator, farmer and the buyer.

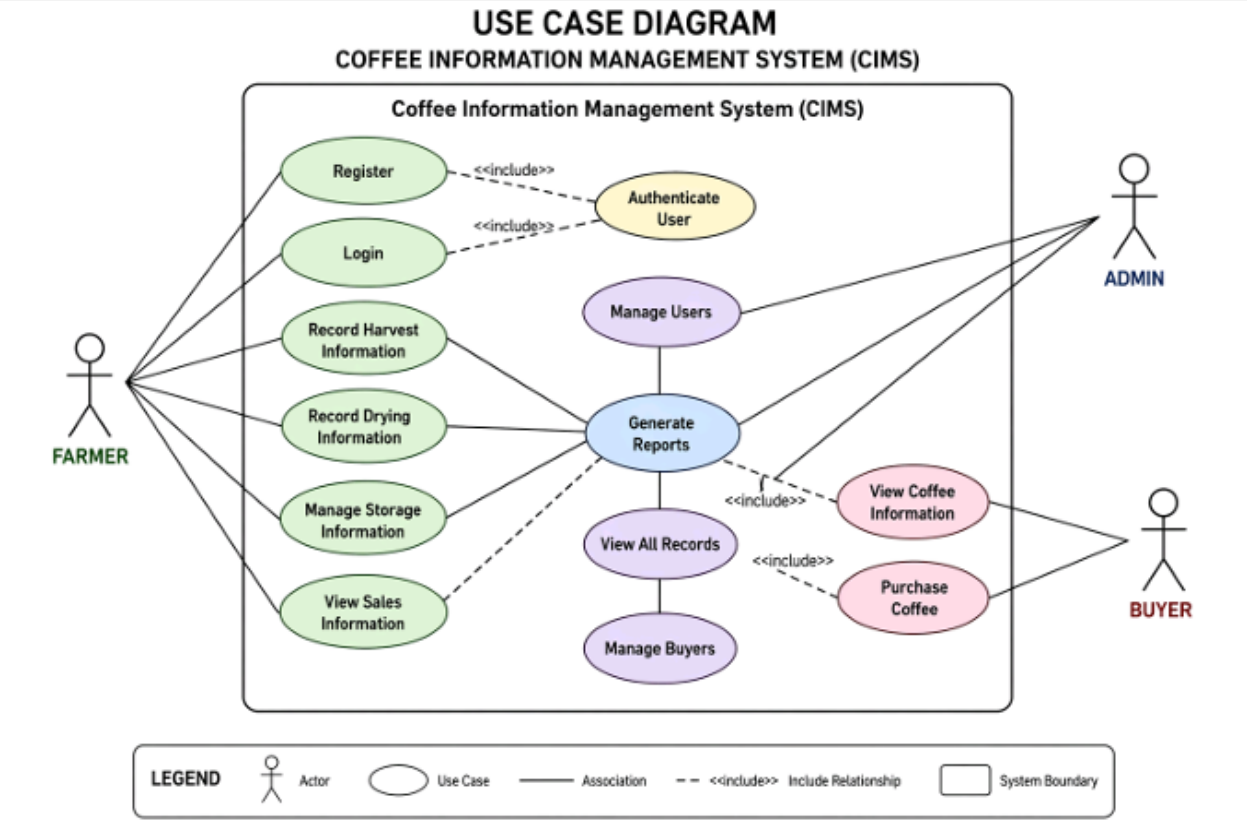


Figure 3: The System use case diagram

System Entity Relationship Diagram (ERD)

The entity relationship diagram is a graphical representation of entities and their relationships to each other. ERDs are used to visually organize and plan the structure of a database, including entities, attributes and relationships. The symbols used in ERDs include; squares for entities, diamonds for relationships, lines for linking the entities, cardinalities for showing number of relationships an entity has towards the other. The entities include; Admin, Farmer and the Buyer.

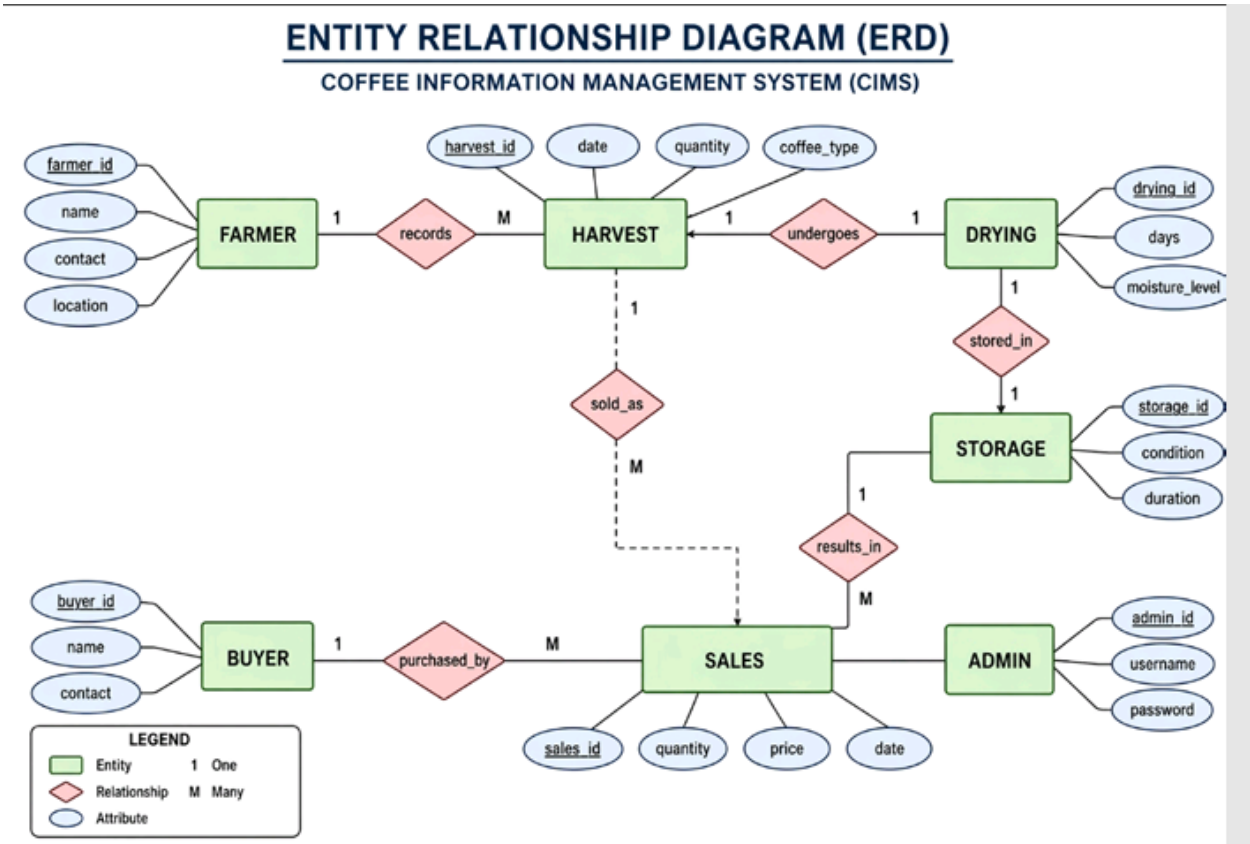


Figure 4: The Entity Relationship Diagram

4.8 Database Design

It consists of tables, which make up the database schema. Primary keys identifying each entry in the table while foreign keys link the tables with each other. Data consistence checks such as data types, illegal or null submissions or duplicate entries are checked at this level. It was designed based on three structures that is the Conceptual database, Logical database and physical database design phase. The database design composed of the following objects: tables, security, indexes, keys, columns.

Table 1: The Administrators' table

Field name	Data type	Constraint
id	Int (11)	Primary key
username	Varchar (60)	
password	Varchar (60)	

Table 2: The buyer table below

Field name	Data type	Constraint
Buyer id	Int (11)	Primary key
Name	Varchar (150)	
Email	Varchar (150)	
password	Varchar (150)	
Created_at	Date	Current-timestamp()

Table 3: The Farmer's table

Field name	Data type	Constraint
farmer id	Int (11)	Primary key
Name	Varchar (150)	
Email	Varchar (150)	
Password	Varchar (150)	
Created_at	Date	Current-timestamp()

Table 4: The drying table

Field name	Data type	Constraint
Dry id	Int (11)	Primary key
Farmer id	Int (11)	Foreign key
Coffee type	Varchar (30)	
quantity	number	
Drying date	Date	
Created_at	Date	Current-timestamp()

Table 5: The storage table

Field name	Data type	Constraint
storage id	Int (11)	Primary key
Farmer id	Int (11)	Foreign key
Coffee type	Varchar (30)	
Quantity	number	
storage date	Date	
Created at	Date	Current-timestamp()

Table 6: The transactions table

Field name	Data type	Constraint
Transaction id	Int (11)	Primary key
Farmer id	Int (11)	Foreign key
Buyer id	Int (11)	Foreign key
Batch source	Varchar (30)	
Batch id	Int (11)	Foreign key

Coffee type	Varchar (60)	
Quantity	number	
Price per unit	number	
Total price	number	
Status	Enum	
Created at	Date	

CHAPTER FIVE: IMPLEMENTATION AND TESTING

5.0 Introduction:

This chapter emphasizes the actual system implementation. The system was transformed from user requirement into a workable project. The purpose of system implementation was to make sure that correct application is delivered to end users. Besides that, this chapter also emphasizes on how the testing is done to confirm whether it meets user requirements.

5.1 System implementation

The system was designed basing on windows environment. Visual studio code was used to design the user interfaces (front end) while PhpMyAdmin as a DBMS was used to design a database for storing data thereafter a logical connection was established.

Welcome screen.

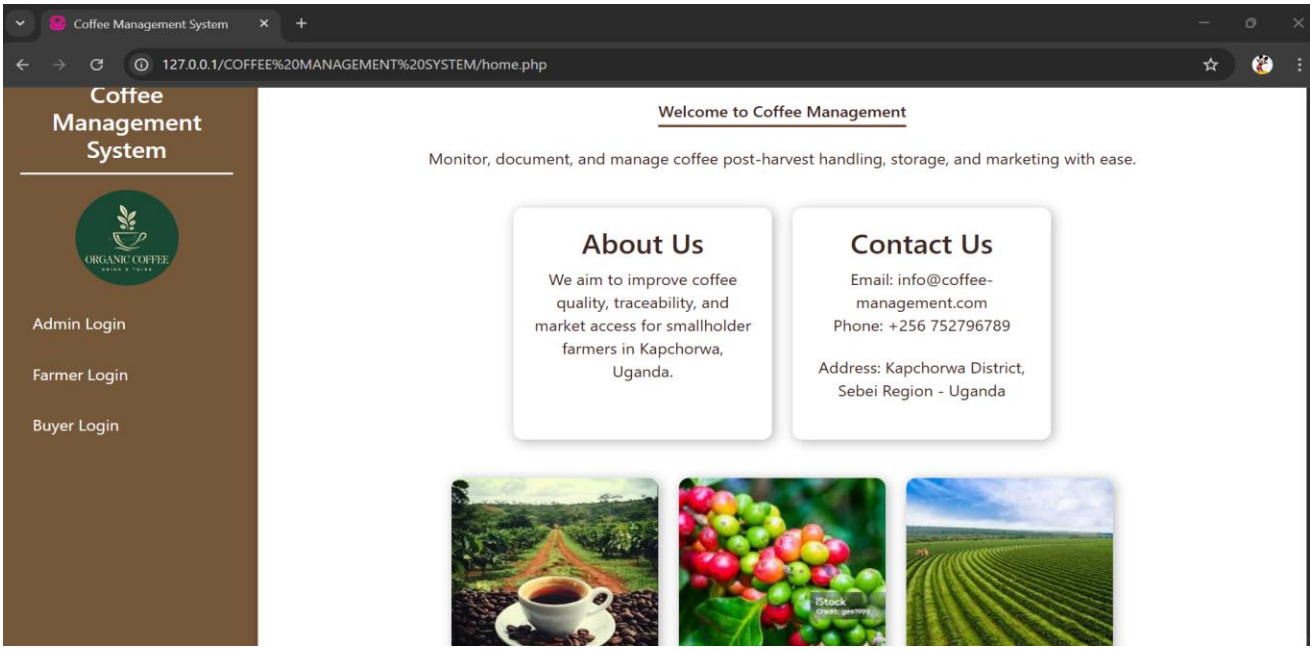


Figure 5: The Welcome screen with Navigation bar

ADMIN'S SIDE;

From the navigation bar, the admin logs in and views the links to all other pages and he is also able to logout from this very page.

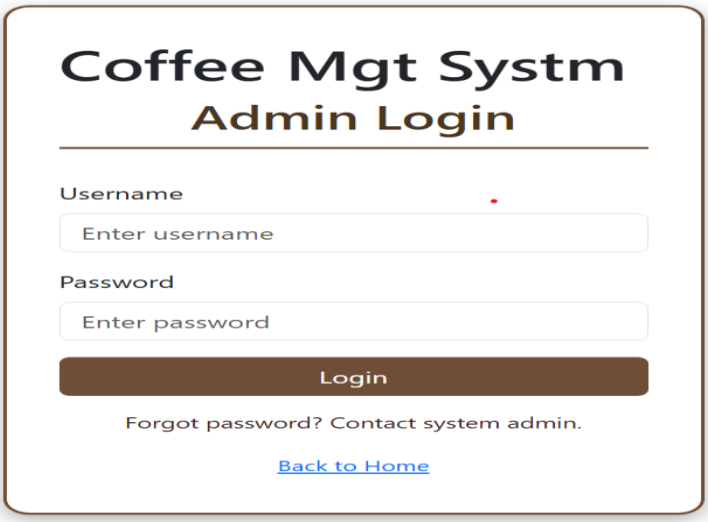


Figure 6: The admin login page

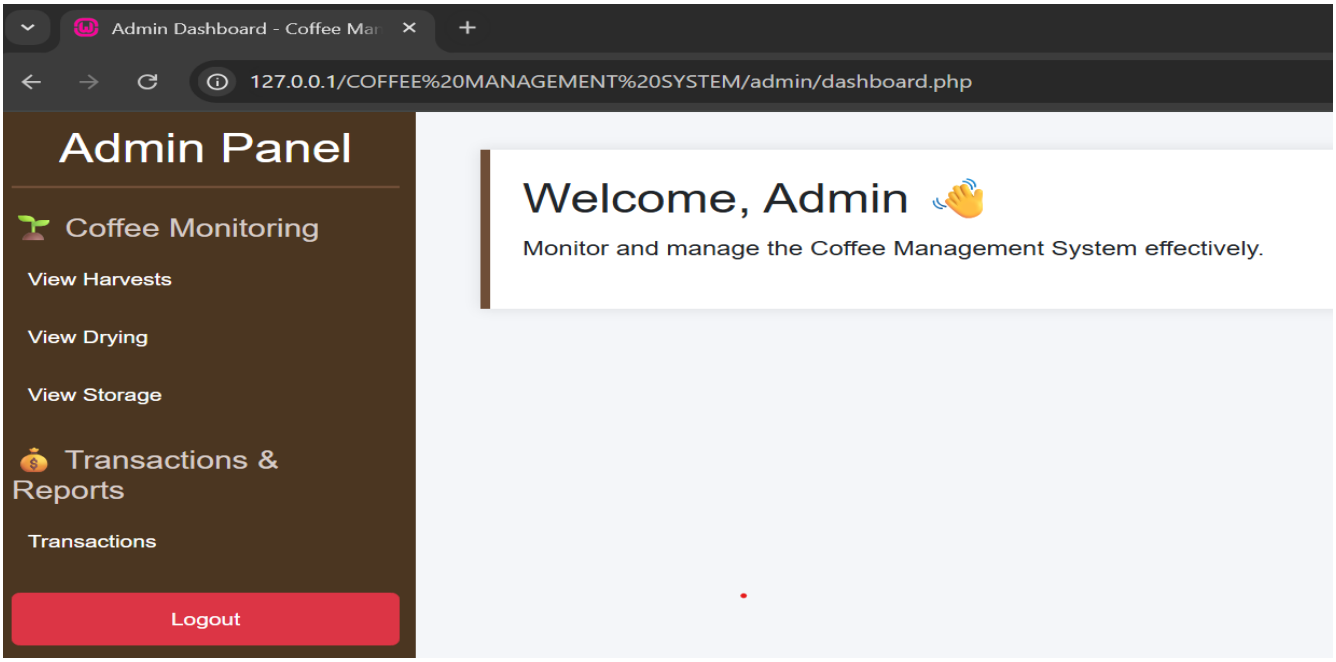
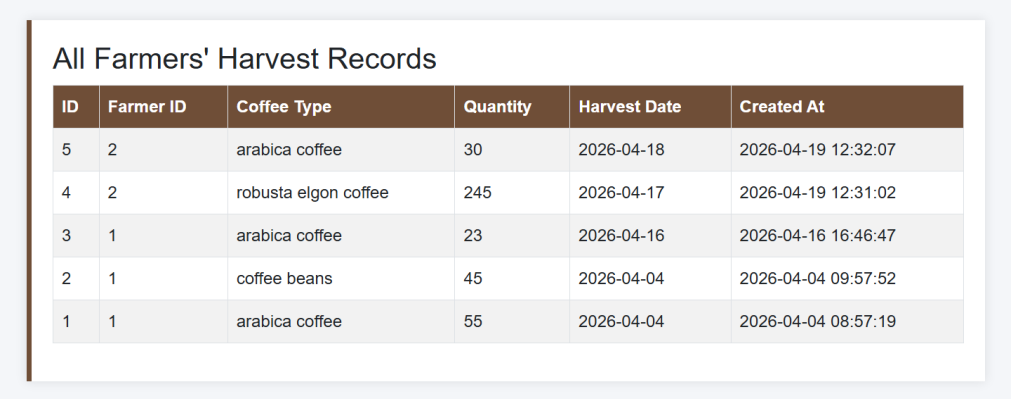


Figure 7: The panel for admin

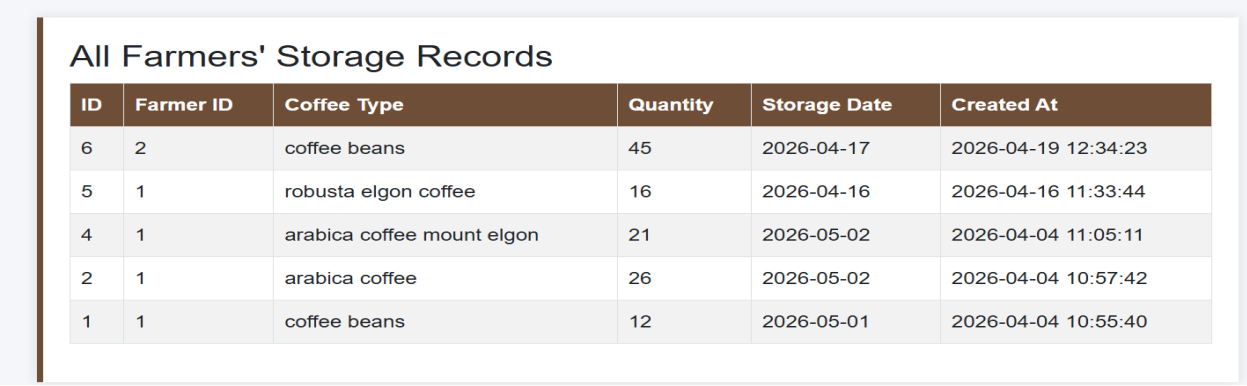
The administrator was able to login and watch or navigate the whole system view harvest ,storage records and privilege to approve sales for transaction between the farmer and buyer.



All Farmers' Harvest Records

ID	Farmer ID	Coffee Type	Quantity	Harvest Date	Created At
5	2	arabica coffee	30	2026-04-18	2026-04-19 12:32:07
4	2	robusta elgon coffee	245	2026-04-17	2026-04-19 12:31:02
3	1	arabica coffee	23	2026-04-16	2026-04-16 16:46:47
2	1	coffee beans	45	2026-04-04	2026-04-04 09:57:52
1	1	arabica coffee	55	2026-04-04	2026-04-04 08:57:19

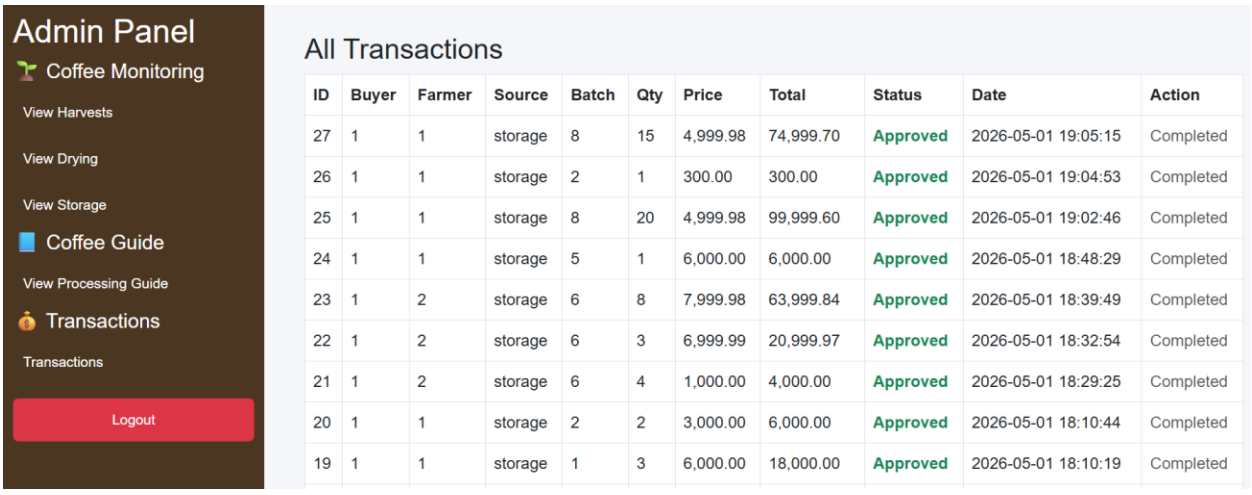
Figure 8: The harvest record



All Farmers' Storage Records

ID	Farmer ID	Coffee Type	Quantity	Storage Date	Created At
6	2	coffee beans	45	2026-04-17	2026-04-19 12:34:23
5	1	robusta elgon coffee	16	2026-04-16	2026-04-16 11:33:44
4	1	arabica coffee mount elgon	21	2026-05-02	2026-04-04 11:05:11
2	1	arabica coffee	26	2026-05-02	2026-04-04 10:57:42
1	1	coffee beans	12	2026-05-01	2026-04-04 10:55:40

Figure 9: The storage records



All Transactions

ID	Buyer	Farmer	Source	Batch	Qty	Price	Total	Status	Date	Action
27	1	1	storage	8	15	4,999.98	74,999.70	Approved	2026-05-01 19:05:15	Completed
26	1	1	storage	2	1	300.00	300.00	Approved	2026-05-01 19:04:53	Completed
25	1	1	storage	8	20	4,999.98	99,999.60	Approved	2026-05-01 19:02:46	Completed
24	1	1	storage	5	1	6,000.00	6,000.00	Approved	2026-05-01 18:48:29	Completed
23	1	2	storage	6	8	7,999.98	63,999.84	Approved	2026-05-01 18:39:49	Completed
22	1	2	storage	6	3	6,999.99	20,999.97	Approved	2026-05-01 18:32:54	Completed
21	1	2	storage	6	4	1,000.00	4,000.00	Approved	2026-05-01 18:29:25	Completed
20	1	1	storage	2	2	3,000.00	6,000.00	Approved	2026-05-01 18:10:44	Completed
19	1	1	storage	1	3	6,000.00	18,000.00	Approved	2026-05-01 18:10:19	Completed

Figure 10: The approved transaction

Farmers Login Page

The farmer is able to login into the system, add and view harvest, add and view storage and finally view sales.

Figure 11: The farmer login interface

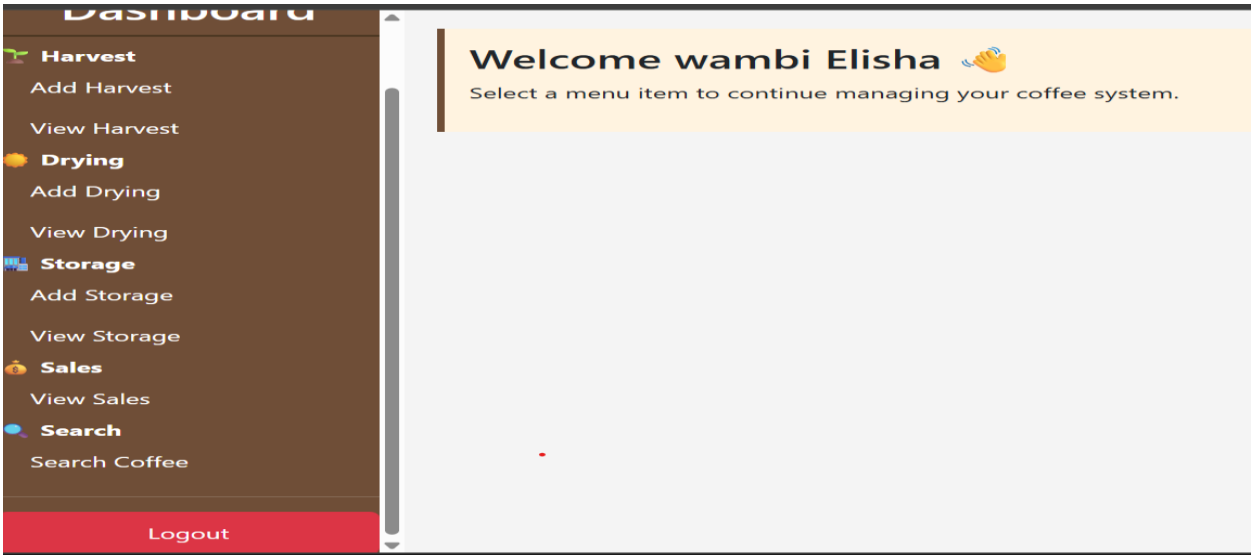


Figure 12: The farmer dashboard

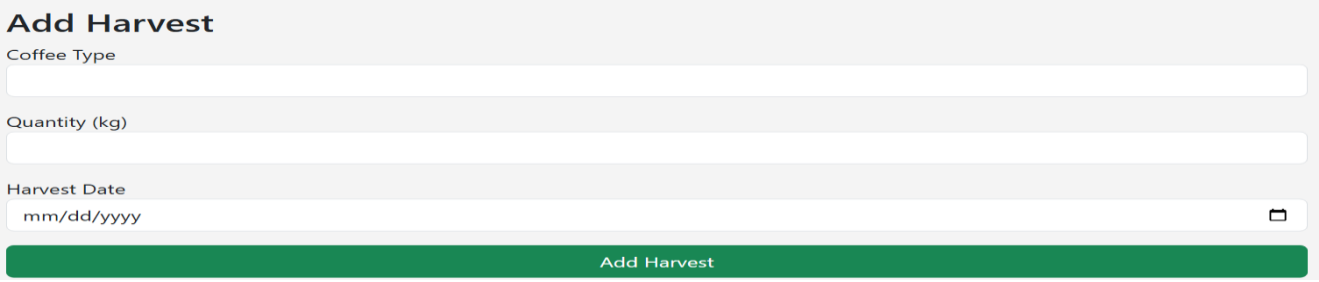


Figure 13: The add harvest page

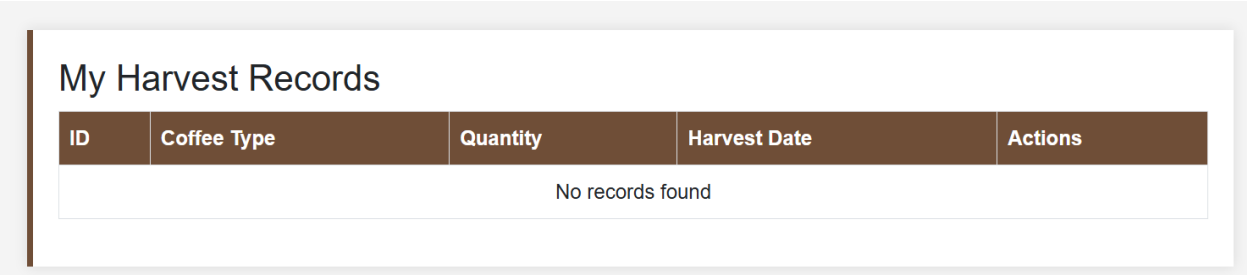


Figure 14: The harvest record

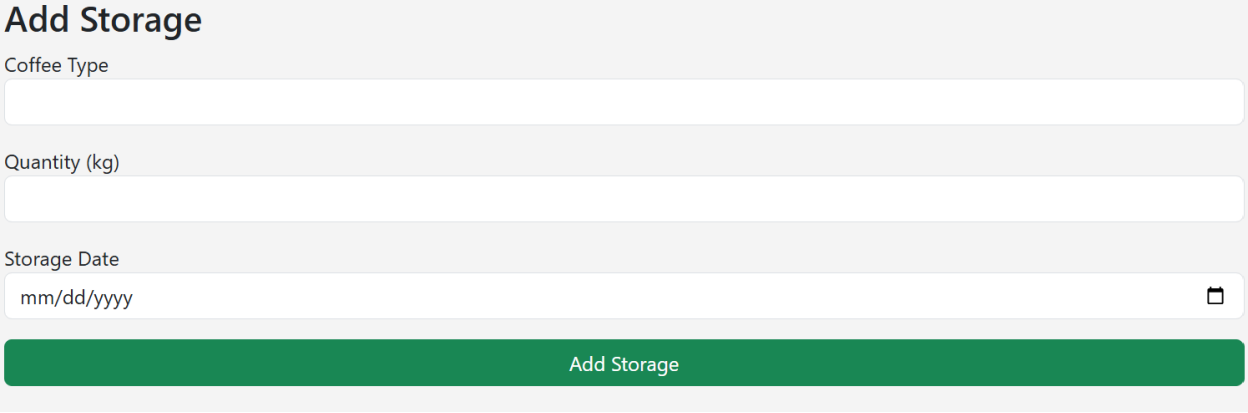


Figure 15: The add storage

My Storage Records

ID	Coffee Type	Quantity	Storage Date
5	robusta elgon coffee	16	2026-04-16
4	arabica coffee mount elgon	21	2026-05-02
2	arabica coffee	26	2026-05-02
1	coffee beans	12	2026-05-01

Figure 16: The storage record

Search Coffee

Search coffee type

Search

Source	Type	Quantity	Date
Harvest	arabica coffee	55	2026-04-04
Harvest	coffee beans	45	2026-04-04
Harvest	arabica coffee	23	2026-04-16
Drying	arabica coffee	11	2026-04-23
Drying	arabica coffee	55	2026-04-23

Figure 17: The search coffee

Buyer Login Page

The buyer is able to login to the system and view available coffee.Buys the coffee batches and the view purchases they make.

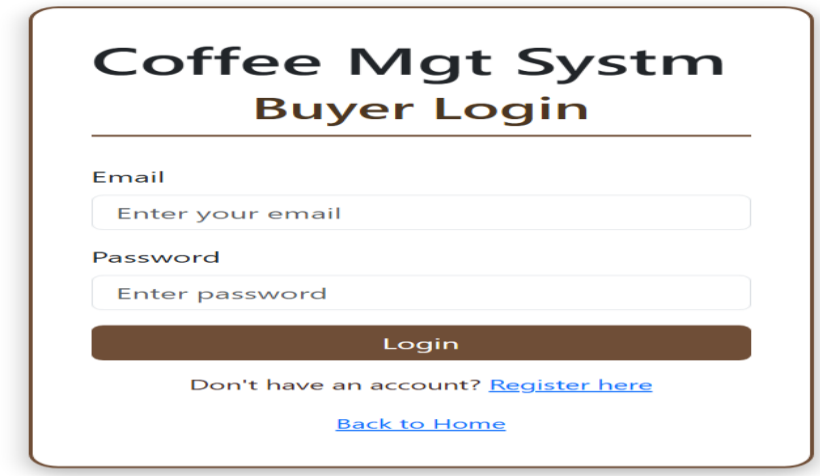


Figure 18: The buyer login page

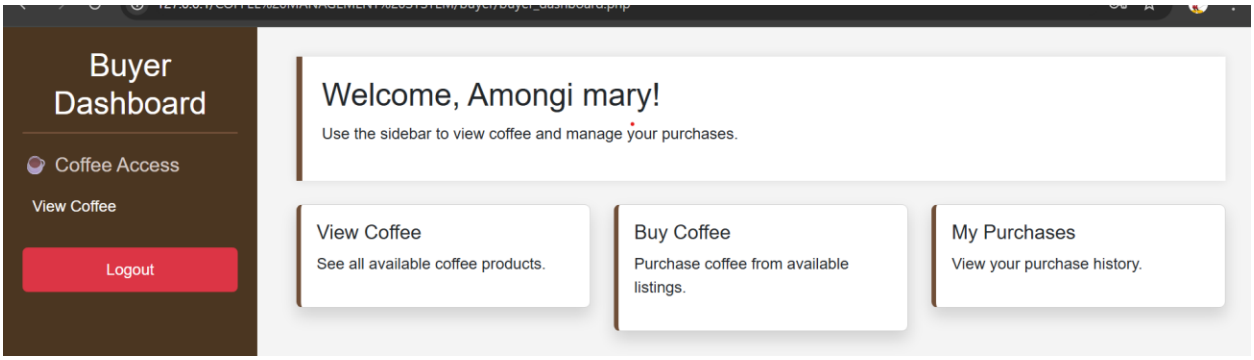


Figure 19: The buyer dashboard

Figure 20: The available coffee

My Purchases

ID	Batch Source	Batch ID	Quantity	Price per Unit (UGX)	Total Price (UGX)	Status	Purchase Date
27	Storage	8	15	4,999.98	74,999.70	Approved	2026-05-01 19:05:15
26	Storage	2	1	300.00	300.00	Approved	2026-05-01 19:04:53
25	Storage	8	20	4,999.98	99,999.60	Approved	2026-05-01 19:02:46
24	Storage	5	1	6,000.00	6,000.00	Approved	2026-05-01 18:48:29
23	Storage	6	8	7,999.98	63,999.84	Approved	2026-05-01 18:39:49
22	Storage	6	3	6,999.99	20,999.97	Approved	2026-05-01 18:32:54
21	Storage	6	4	1,000.00	4,000.00	Approved	2026-05-01 18:29:25
20	Storage	2	2	3,000.00	6,000.00	Approved	2026-05-01 18:10:44

Figure 21: The my purchase table

Data storage

The system automatically stored the admin login details, farmers details, harverts, storage, drying, and transaction into the system database “cims” in tabular form. Some of the database tables include;

Admin-table

+ Options

	id	username	password	created_at
Edit Copy Delete	2	admin	$2y$10$ZlQl8gjh8KSN145gyPHZsOeWw0pI1Mzg7VFff2pl5OU...	2026-04-03 08:35:35

Figure 22: The admin- table

Buyers- table

+ Options

	id	name	email	password	created_at
Edit Copy Delete	1	winnie	winnie@gmail.com	$2y$10$ScODXrrOw/soV3.TJuxI7.B8eZ/OGH2T7F6lz5ZrEyJ...	2026-04-03 10:52:39
Edit Copy Delete	2	musani simon	msani@gmail.com	$2y$10$hk58g8SzXikY70cC6RaDsOYKGZ2qmS0qj8v/1h5Z8ob...	2026-04-04 14:47:57
Edit Copy Delete	3	daniel wek	dan@gmail.com	$2y$10$2/PAoidnst9zaDD/jUlNZ.MWDIJhHwzuOl/RKTzHyom...	2026-04-04 17:58:09
Edit Copy Delete	4	Amongi mary	mary@gmail.com	$2y$10$g1x3lJl0D01sEoTzJWFX/ePkhhDdx3GOUI3MOgfCi32...	2026-04-19 12:37:48

Figure 23: The buyer-tb

Drying-table

+ Options

	id	farmer_id	coffee_type	quantity	drying_date	created_at
Edit Copy Delete	1	1	arabica coffee	11	2026-04-23	2026-04-04 10:08:23
Edit Copy Delete	2	1	arabica coffee	55	2026-04-23	2026-04-04 10:12:25
Edit Copy Delete	8	1	coffee beans	26	2026-04-30	2026-04-04 10:28:24
Edit Copy Delete	4	1	arabica coffee	55	2026-04-23	2026-04-04 10:14:01
Edit Copy Delete	10	2	coffee beans	60	2026-04-18	2026-04-19 12:33:19

Figure 24: The drying-table

Farmers-table below

+ Options

	id	name	email	password	created_at
Edit Copy Delete	1	wambi Elisha	elisha@gmail.com	$2y$10$NoRUhuOfUJLDJtv5XVBVc.tkwovDRSSoMjxlAAapl2J...	2026-04-03 09:49:06
Edit Copy Delete	2	chemutai sarah	chemutai@gmail.com	$2y$10$LcTwR9OFaoq06ler6o1kPeYqalu2KydWPw.VQSFGCHx...	2026-04-19 12:29:51
Edit Copy Delete	3	Mwanga tom	mwanga@gmail.com	$2y$10$xZZU1ZGdxC7AbbHTz1suaOuSO4fYZ5ziNh5YrnSqy.E...	2026-04-19 12:51:37

Figure 25: The Farmers-table

Harvest-table below

	id	farmer_id	coffee_type	quantity	harvest_date	created_at
Edit Copy Delete	1	1	arabica coffee	55	2026-04-04	2026-04-04 08:57:19
Edit Copy Delete	2	1	coffee beans	45	2026-04-04	2026-04-04 09:57:52
Edit Copy Delete	3	1	arabica coffee	23	2026-04-16	2026-04-16 16:46:47
Edit Copy Delete	4	2	robusta elgon coffee	245	2026-04-17	2026-04-19 12:31:02
Edit Copy Delete	5	2	arabica coffee	30	2026-04-18	2026-04-19 12:32:07

Figure 26: The Harvest-table

Storage-table below

	id	farmer_id	coffee_type	quantity	storage_date	created_at
Edit Copy Delete	1	1	coffee beans	12	2026-05-01	2026-04-04 10:55:40
Edit Copy Delete	2	1	arabica coffee	26	2026-05-02	2026-04-04 10:57:42
Edit Copy Delete	4	1	arabica coffee mount elgon	21	2026-05-02	2026-04-04 11:05:11
Edit Copy Delete	5	1	robusta elgon coffee	16	2026-04-16	2026-04-16 11:33:44
Edit Copy Delete	6	2	coffee beans	45	2026-04-17	2026-04-19 12:34:23

Figure 27: The storage-table

Transaction-table below

	id	buyer_id	farmer_id	batch_source	batch_id	quantity	price_per_unit	total_price	price	status	created_at
Edit Copy Delete	2	2	1	storage	2	6	3000.00	18000.00	NULL	approved	2026-04-04 15:17:57
Edit Copy Delete	3	2	1	drying	1	45	3000.00	135000.00	NULL	approved	2026-04-04 17:08:32
Edit Copy Delete	4	3	1	storage	5	4	4000.00	16000.00	NULL	approved	2026-04-16 11:35:40
Edit Copy Delete	5	3	1	harvest	3	100	3000.00	300000.00	NULL	approved	2026-04-16 16:57:04
Edit Copy Delete	7	4	3	drying	11	90	9000.00	810000.00	NULL	approved	2026-04-19 12:55:18

Figure 28: The transaction-table

5.2 System testing

The entire system was tested using codes, class modules and modules. This stage of implementation ensured accuracy and efficiency operation of the system before it was given to the users. It required a series of different tests which varied at different system levels. The system tester assumed that if all parts of the system were correct then the goal would have finally been achieved. Testing the process of executing the program in order to identify errors or bugs. Test shows the software errors. Therefore, testing was done after completion of the system. This was done in two formats including Unit testing and Integration testing.

Unit testing; This was done on individual codes of the system to ensure that they fully yield the functional units and it was done by examining each unit, for example the code for adding new harvest and displaying tables that showed items inserted successfully. This therefore gave me a go ahead for integration testing after all the identified errors were individually worked on.

Integration testing; This was done after all the different modules had been put together to make a complete system. Integration aimed at ensuring that all the modules of the system worked hand in hand and that they could be integrated to form a complete working system.

CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE WORK

In this chapter, we discussed the findings for developing the coffee information management system in relation to the set objectives and methodology. The study found that the University fully relied on the manual system of keeping post-harvest records and tracing transaction . The coffee information management system (cims) that was developed focuses on replacing the manual system for efficient record keeping process and accuracy in data storage. The implementation of the proposed system involved the farmer sacco as the administrator, the farmers.

6.1 Discussion

The discussion of this chapter is based on the theme of objectives stated in chapter one.

- **Determination of the requirements.**

The requirements of the study were got from two sources. These include; Library research and field research. Under Library research, the study was conducted on the previous done projects about the same topic. This guided me on the alignment of my project work. The library research generated requirements that were used in the design of the DFD database design and a few others which led to the fulfillment of functional and non-functional requirement. The field research helped me to get to know how the manual system works, their view and perception towards the web-based coffee information management system (CIMS) which also generated the requirements that were used for designing the interfaces.

- **Designing of the coffee information management system (CIMS).**

The system was designed depending on the requirements followed by the RAD from the SSADM. The stage of design included Architecture, Context Diagrams and DFDs, Usecase diagrams and data base design, which enabled the smooth flow of data. Design and evaluate the effectiveness of CIMS, encouraged the use of the different stages of design.

- **Implementation of the Coffee information management system.**

The implementation of the system design was carried out using the implementation tools which included. Visual studio code, Chrome, MySQL, HTML, Xampp and windows in order to fulfil the implementation where I came up with the interfaces in chapter 5, which interfaces include: “login,

harvests and transaction as well as storage". The system was implemented to run parallel with manual system as the users adopt to it slowly.

- **System testing and validation**

After system implementation, the next step was testing and validating of the system which was done by guiding the users on how to use the system. The study was carried out and it was discovered that most of the users agreed that the system was able to solve the existing problem.

6.3 Conclusion

The system was implemented and tested since the buyer was able to insert his details as well as in carrying out transaction and viewing purchases as a trial test. The system was operated at a high level of efficiency and all the farmers and buyers associated with the system thus understanding its advantage. The system solved the problem that it was intended to solve as to the requirement specification, so I conclude that the system can be used in coffee companies.

6.4 Recommendations

I recommend that my coffee information management system should be adopted by the coffee companies and used by small coffee farmer across the region as well as stores to properly and safely keep records.

In the same spirit, I would wish to recommend the University to fully adopt to students' final year project, if necessary, instead of just fulfilling the sake of student's graduation.

Lastly but not least, the University should give enough time and other resources to students to fully make their projects other than putting abrupt schedules in the due course as well as consulting from them about the system functionalities in future when adopted.

6.5 Limitations

A few challenges like limited funds, limited access to power, limited data for remote project supervision, limited time, poor internet connection (network), limited knowledge about some programming languages and conflicting ideas from different sources. Some processes did not go on perfectly and thus other things were not done.

6.6 Future work

Due to time influence, the researcher was not able to include all the features into the system. Therefore system has few functionalities and one interested should read through and focus on adding on some missing activities and other modules into the system like admin password recovery, among others.System maintenance should done through in order to improve on the system performance. The researcher should also try using other programming languages plus evolving technologies to improve on the system.

References

1. Mwesigye, Francis, and Hanh Nguyen. *Coffee value chain analysis: Opportunities for youth employment in Uganda*. Food & Agriculture Org., 2020.
2. Kambuche, Maria Mghulo. *Effect of Financial Leverage On the Financial Performance of Kenyan Banks*. Diss. KeMU, 2025.
3. Moon, Sai Aung. *Coffee characteristics evaluation from cherries to roasted Beans: A case of Northern Thai arabica coffee*. Diss. Mae Fah Luang University. Learning Resources and Educational Media Centre, 2024.
4. Mabbett, Terry. "Quality control for stored coffee and cocoa." *International Pest Control Magasine* 2 (2013): 55.
5. Interviews are a versatile data collection method that can be used in qualitative, quantitative and mixed methods research, **John Creswell** (2009)
6. (Goffman 1967) argued that the best way to understand social interaction is to participate in it.
7. Bourne, S. R. (1982). The UNIX system. London, Addison-Wesley.

Appendices

Appendix I: Methods Of Data Collection

Data collection was an important stage of the study because it helped the researcher obtain information required for designing and developing the Coffee Information Management System (CIMS). I used different methods to collect information about the existing manual system, the challenges faced by users, and the requirements of the proposed system.

The main methods of data collection used were interviews, observation, and document revive.

Interview Method

I used interviews to obtain detailed information from people involved in coffee production, post-harvest handling, storage and marketing.

The interview method involved asking respondents questions about how coffee information was currently recorded, stored, retrieved and shared. I also asked about challenges experienced with the existing manual system and the features that users expected in the proposed CIMS.

The respondents included:

- Smallholder coffee farmers
- Coffee buyers
- Selected agricultural extension officers
- Other relevant stakeholders involved in coffee information management

Information obtained through interviews included:

1. How farmers record harvest information.
2. How drying and storage information is recorded.
3. How coffee sales and transactions are recorded.
4. Challenges associated with manual record keeping.
5. Information required by farmers and buyers.
6. Suggestions for improving information management.
7. System functionalities required by the users.

Observation Method

Observation was used to enable the researcher to understand the actual activities involved in coffee post-harvest handling and information management.

The researcher observed how farmers handled coffee records and how information relating to harvesting, drying, storage and sales was managed.

Areas observed included:

- Recording of harvested coffee.
- Drying activities.
- Storage of coffee.
- Recording and retrieval of information.
- Interaction between farmers and buyers.
- Recording of coffee sales and transactions.
- Problems associated with manual record keeping.

Document Revival

Document revival was used to obtain information from existing literature and previous studies related to coffee production, post-harvest handling, information management systems and system development.

I reviewed previous projects, books, reports and other relevant academic materials. The information obtained helped the me understand existing approaches and identify requirements for the proposed CIMS.

Data Collection Instruments

The following instruments were used to support data collection:

Table 7:Table showing data collection instruments

Instrument	Purpose
Interview guide	Used to guide questions asked during interviews
Note-taking	Used to record important information obtained from respondents and observations.
Observation checklist	Used to record activities and practices observed

Appendix II: Time Schedule For the Study

The following workplan took four (4) months and presents the activities undertaken during the development of the Coffee Information Management System (CIMS).

Table 8:table showing time schedule for the study

Activity	Duration	Deliverables
Formulation of the title	3rd to 9 April 2026	Project title
Formulation of the problem	10th to 23rd April 2026	Problem statement
Selecting the objectives	24th to 30th April 2026	Compile
Literature review	1st to 7th May 2026	Record
Choosing the methodologies	8th to14th May 2026	Record
Data collection	15th to 28th May 2026	Recording results
Data analysis	29th to 4th June 2026	Analysis
System design and implementation	5th to 25th June 2026	System interfaces
Testing and validation	26th to 2 July 2026	Getting correct results
Report writing	3rd to 16th July 2026	completed
Final correction and submission	17th to 23rd July 2026	Recommendable project

Appendix III: Project Budget

The estimated total cost of conducting the study and developing the coffee information management system (CIMS) is UGX 450000.

The major expenses included transportation during data collection, internet access, stationery, printing and binding, system development, testing, communication and contingency expenses.

God bless you