

**ANALYSIS OF COFFEE VALUE CHAIN UPGRADING OPPORTUNITIES IN
ZOMBO AND NEBBI DISTRICTS, UGANDA**

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DECLARATION

I hereby declare that this research report is my original work and has not been presented for the award of a degree in any other University or any other award.

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DEDICATION

I dedicate this research to my passionate lovely wife Mrs. Ochaya Fortunate and our cherished kids Timothy, Noel and Neo. They sacrificed financial options and allowed me be absent in their lives while studying to become a better providing husband and daddy in the years to come.

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ACRONYMNS

FAO	Food and Agriculture Organization of the United Nations
ICO	International Coffee Organization
USD	United States Dollars
NGO	Non-Governmental Organization
UCDA	Uganda Coffee Development Authority
CWD	Coffee Wilt Disease
IITA	International Institute for Tropical Agriculture
ANOVA	Analysis of Variance
FAO	Food and Agriculture Organization
GVC	Global Value Chain
ICE	International Coffee Exchange
ICO	International Coffee Organization
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
GAP	Good Agronomic Practices
ADB	African Development Bank Group
EAC	East African Community

ABSTRACT

The coffee value chain in the Zombo and Nebbi districts of Uganda faces significant socio-economic challenges that impact the productivity and economic status of smallholder coffee farmers. This study set out to analyze coffee value chain upgrading opportunities in these districts. Specifically, the study characterized smallholder coffee farmers, determined the extent of value chain upgrading, and examined factors affecting upgrading choices. A cross-sectional study design was employed to obtain responses from 288 smallholder coffee farmers. Descriptive statistics was used to characterize smallholder coffee farmers and to determine the extent of value chain upgrading among smallholder coffee farmers and probit regression was used to examine the factors affecting value chain upgrading choice among smallholder coffee farmers. Study findings revealed male dominance in coffee farming, low educational attainment among farmers, and heavy reliance on agriculture for livelihoods. The study also highlights limited access to market information and credit, which impedes farmers' ability to scale operations and invest in necessary inputs. The results indicate that while most farmers are engaged in the initial stages of value chain upgrading, such as producing red cherries and parchment coffee, there is a significant drop in involvement beyond these stages. Factors such as farm size, access to extension services, and market information positively influence upgrading, whereas poverty and high costs pose significant barriers. The study recommends that there is a need for targeted interventions to improve access to affordable credit, extension services, and market information.

Keywords: *Coffee, value chain, upgrading, Probit regression model, Uganda.*

CHAPTER ONE: INTRODUCTION

1.1: Background

Coffee is one of the most traded commodities globally, with millions of smallholder farmers relying on it for their livelihoods. The global coffee market has seen significant growth, with demand for specialty and high-quality coffee rising steadily (ICO, 2023). However, smallholder coffee farmers face challenges such as fluctuating prices, climate change, and limited access to advanced farming techniques and markets (Bracken et al., 2023). The need for value chain upgrading has become critical to ensure these farmers can capture more value from their produce and improve their economic resilience.

Coffee is one of the major cash crops in the world. Brazil is and has been the largest Coffee producer for the last 150 years and is responsible for about a third of all the world's coffee followed by Vietnam, Indonesia, and Colombia (Arslan et al., 2023). There are approximately 70 species of coffee in the world. Among these, two types of coffee species, Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*) are primarily cultivated as commercial crops that account for 99% of global coffee production (Abdulsamad et al., 2015). Coffee is a major cash crop for millions of smallholder agricultural households in developing countries (Arslan et al., 2023).

Africa is one of the major coffee-producing continent, contributing significantly to the global coffee supply. Countries like Ethiopia, Uganda, and Kenya are renowned for their high-quality coffee. Despite this, African coffee farmers often struggle with low productivity, inadequate infrastructure, and limited market access (Boudreau et al., 2023). Value chain upgrading, including better processing, marketing, and adherence to international quality standards, is essential for

African coffee farmers to enhance their competitiveness and profitability (Winarno & Harijani, 2022). Ethiopia is reported to be the largest coffee producer in Africa, and remains one of the chief players in the global market, by exporting exceptionally flavorful gourmet coffees to the world (Babu, 2019).

East Africa, particularly Uganda and Kenya is known for producing some of the world's finest coffee. The region's coffee sector is predominantly composed of smallholder farmers who contribute to the bulk of production. Despite the potential, these farmers face numerous challenges, including low yields, poor post-harvest handling, and limited access to finance (EAC, 2022). Initiatives to upgrade the coffee value chain, such as training on best agricultural practices and improving market linkages, are crucial to unlocking the region's full potential (ADB, 2017).

Uganda ranked eighth worldwide and second in Africa, its coffee production has been a developing process over the last 60 years, with (Bamwesigye et al., 2020). The coffee sector is vital to Uganda's economy, providing income for millions of households. There is a growing recognition of the need to upgrade the coffee value chain to improve the quality and marketability of Ugandan coffee (Elias, 2021).

According to Uganda Coffee Development Authority (UCDA), the government agency responsible for the coffee sector, coffee exports for 12 months (February 2022-January 2023) totaled 5.72 million bags worth US\$ 865.34 million compared to 6.72 million bags worth US\$ 741.03 million the previous year (February 2021-January 2022). This represents a decrease of 15% in quantity but an increase of 17% in value (UCDA, 2023). Coffee is Uganda's major cash crop, both in terms of foreign exchange earnings and employment creation for the different actors along the nodes of coffee value chain. For years now, the demand for Ugandan coffee has steadily

increased where Arabica attracts higher the prices than Robusta (UCDA, 2023). However, Ugandan coffee farmers face significant obstacles, such as inadequate access to modern farming techniques, poor infrastructure, and volatile market prices (UCDA, 2023).

Zombo and Nebbi districts in Uganda are key coffee-producing regions with a large number of smallholder farmers. These districts have the potential to significantly contribute to the national coffee output. However, farmers in these areas face unique challenges, including limited access to credit, insufficient agricultural extension services, and a lack of awareness about coffee quality standards (UCDA, 2023). Addressing these issues through value chain upgrading can enhance productivity, improve coffee quality, and increase farmers' incomes.

1.2: Coffee value chain upgrading approach

The coffee value chain encompasses the entire process from cultivation to the final consumer, including stages such as farming, processing, marketing, and distribution. Upgrading value chain involves improving efficiency, quality, and profitability at each stage. Key strategies include enhancing agricultural practices, adopting advanced processing technologies, improving market access, and fostering stronger linkages between stakeholders (Ponte, 2022). By focusing on these areas, smallholder farmers can increase their productivity and income, contributing to the overall sustainability of the coffee sector. Improving agricultural practices is a fundamental step in value chain upgrading. Training and extension services play a crucial role in disseminating knowledge about these practices to farmers (Winarno & Harijani, 2022). Additionally, promoting sustainable farming methods can help mitigate the impacts of climate change and enhance soil fertility, ensuring long-term productivity (Grabs et al., 2022).

Post-harvest processing is a critical stage where significant value can be added. Upgrading technologies for drying, hulling, and grading can greatly improve the quality of coffee, making it more competitive in international markets. Investments in infrastructure, such as drying stations and processing facilities, are essential for achieving these improvements (Rangsaritvorakarn & Nimsai, 2023). Moreover, certifications and adherence to international quality standards can open up premium markets for coffee producers (Giraldo-Liévano & Quiñones-Ruiz, 2022). Access to markets is a major challenge for smallholder coffee farmers. Upgrading the value chain involves establishing better market linkages and creating direct connections between farmers and buyers. This can be facilitated through cooperatives, farmer organizations, and digital platforms that provide market information and connect farmers with buyers (Ruben, 2024b). By cutting out intermediaries, farmers can achieve better prices for their produce, increasing their overall profitability. Strong linkages between different stakeholders in the coffee value chain, including farmers, processors, traders, and exporters, are vital for successful upgrading. Collaborative approaches, such as public-private partnerships and farmer cooperatives, can help pool resources, share risks, and leverage collective bargaining power (Ruben, 2024a). These linkages also facilitate the flow of information and resources, enabling farmers to adopt best practices and access necessary inputs and services.

1.3: Forms of coffee value chain upgrading

Functional upgrading involves taking on new functions or changing the mix of activities to increase overall value added. For coffee farmers, this could mean moving beyond just growing coffee to also include processing activities like hulling, drying, and roasting. By adopting these additional functions, farmers can capture more value from each stage of the process, improving

their income and economic stability (Ponte, 2022). This form of upgrading also allows farmers to improve the quality of their coffee, meeting higher market standards and potentially accessing premium markets (Giraldo-Liévano & Quiñones-Ruiz, 2022). Product upgrading refers to the improvement of the quality and characteristics of a product to make it more competitive in the market. For coffee, this can involve producing specialty coffee, which requires higher standards in terms of cultivation, harvesting, and processing (Jassogne et al., 2013). Farmers might adopt better agricultural practices, use improved seedlings, and ensure meticulous processing techniques to produce high-grade coffee beans. Certification schemes like Fair Trade or Organic can also be part of product upgrading, as they often lead to higher market prices and improved market access (Ruben, 2024a).

Process upgrading focuses on making production processes more efficient and effective. This can be achieved through the adoption of new technologies, better farming practices, and enhanced management techniques. For example, implementing advanced irrigation systems, using modern farming equipment, or employing integrated pest management can significantly boost productivity and reduce costs (Garner et al., 2020). By optimizing their processes, coffee farmers can increase their yield and quality, making their operations more profitable and sustainable (Rangaritvorakarn & Nimsai, 2023). Chain upgrading involves shifting to a different value chain that offers higher returns or better growth opportunities. For coffee farmers, this could mean diversifying into other high-value crops or products that complement their coffee production. This strategy can reduce dependency on a single commodity, mitigating risks associated with price volatility in the coffee market (Ruben, 2024b). Chain upgrading can also include integrating into value chains that offer better market conditions or consumer bases, thereby enhancing overall economic resilience (Ponte, 2022). Inter-sectoral upgrading refers to leveraging skills and knowledge gained in one sector to

enter and succeed in another sector. Coffee farmers might use their expertise in cultivation and market engagement to venture into related agricultural sectors, such as horticulture or livestock. This approach can help diversify income sources and reduce vulnerabilities associated with reliance on a single crop (Giraldo-Liévano & Quiñones-Ruiz, 2022). The skills and infrastructure developed through coffee farming can thus serve as a foundation for broader economic activities, enhancing the overall economic stability of farming households (Garner et al., 2020).

Value chain upgrading through processing has been a core tenet of value chain interventions focusing on improving smallholder farmer welfare improvements (Kobusinge et al., 2023). Upgrading opportunities enables value addition that facilitates farmers' production efficiency and move to higher-value activities within the same chain (Fromm, 2011). However, the effects of value chain upgrading are largely dependent on existing coffee value chain structures, and prevailing institutional constraints (Kilelu et al., 2017). In Uganda, this paradox holds with 95% of its coffee being exported as raw, green beans predominantly produced by small-holder farms.

While some studies (Abdulsomad, 2020) have been undertaken on smallholder coffee farmers, they do not present sufficient information on value chain upgrading opportunities (Kilelu et al., 2017).

Despite substantial investment by the government (MAAIF) through UCDA, the sector regulator responsible for development, extension services, incentives and promoting value addition in coffee, the smallholder coffee farmers in Zombo and Nebbi districts rarely participate beyond the production level (Bartl, 2024) while other upgrading are taken up by other actors. More specifically, there is limited available research studies undertaken in Zombo and Nebbi districts on smallholder coffee farmer's value chain upgrading opportunities that would enable quick policy

adjustment to support the adoption of available chain upgrading opportunities. This critical knowledge gap unearthed the need to conduct a study to analyze the smallholder coffee value chain upgrading opportunities in Zombo and Nebbi districts, Uganda.

1.4: Problem Statements

Ideally, coffee value chain upgrading should help smallholder farmers in Uganda increase productivity, improve the quality of their coffee, and earn higher incomes. In Zombo and Nebbi districts, farmers grow Arabica coffee at high altitudes of 1,800–2,400 meters above sea level, where fertile volcanic soils and reliable rainfall create perfect conditions for producing premium-quality beans (UCDA, 2023). With proper upgrading, such as improved processing, quality enhancement, and better marketing could fully help farmers to benefit from these natural advantages and contribute significantly to Uganda’s ambition of exporting 20 million 60-kg bags of coffee annually by 2030 (UCDA, 2023).

However, the current situation in Zombo and Nebbi is far from ideal. Although various institutions like MAAIF, UCDA, NGOs, and private actors have promoted upgrading through training, financing, and market support, many smallholder farmers still operate at the lower end of the value chain (Akenroye et al., 2021; Jeff et al., 2021). They mostly sell raw coffee beans with little or no processing, missing out on higher-value opportunities. This is largely due to challenges such as poor access to credit, weak infrastructure, inadequate extension services, and low education levels (Arslan et al., 2023). Consequently, most coffee farmers earn meager returns, often less than USD 2 per day despite producing coffee that has high market potential (Schuit et al., 2021; Pauline Kananu et al., 2023).

The gap between what smallholder farmers could achieve and what they currently experience highlights a pressing problem. While studies have examined coffee value chains in general, little attention has been paid to the specific factors influencing farmers' choices of upgrading strategies in Zombo and Nebbi. Understanding these factors is crucial for designing effective interventions that can enable farmers to capture more value from their coffee, enhance household incomes, and promote sustainable livelihoods in these districts.

1.5.0: Study Objectives

1.5.1 Overall objective

The general objective of the study was to analyze the coffee value chain upgrading opportunities in Zombo and Nebbi Districts.

1.5.2: Specific objectives

- a) To characterize smallholder coffee farmers in Zombo and Nebbi Districts
- b) To determine the extent of upgrading opportunities in the coffee value chain of Zombo and Nebbi
- c) To examine the factors affecting the choice of coffee value chain upgrading opportunities

1.5.3: Research questions

- a) What are the characteristics of the coffee farmers in Zombo and Nebbi districts?
- b) What is the extent of coffee value chain upgrading in Zombo and Nebbi Districts?
- c) What are the factors affecting the choice of coffee value chain upgrading opportunities?

1.6: Scope of the study

The study was conducted in Zombo and Nebbi District in the West Nile region of Uganda. The study focused on analyzing the coffee value chain upgrading opportunities. Specifically, the study characterized the smallholder coffee farmers, determined the extent of coffee value chain upgrading opportunities, and examined the factors affecting the choice of coffee value chain upgrading opportunities. The study was conducted for the period between the periods of three months from January to March 2024.

1.7: Conceptual framework

The conceptual framework for the study on “Analysis of Coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda” is designed to examine the relationships between various factors that influence the upgrading of the coffee value chain. The framework posits that the upgrading opportunities in the coffee value chain are influenced by a combination of farmer characteristics, external support mechanisms, market dynamics, and environmental conditions. At the core, the framework identifies smallholder coffee farmers as the primary actors, whose capacity to upgrade is shaped by their socio-economic characteristics such as education level, gender, farm size, and access to resources (Charlton, 2023). External support mechanisms, including access to credit, extension services, and farmer group memberships, play a crucial role in enabling these farmers to adopt value-adding practices (Kamau et al., 2017; Kumar et al., 2015). Market dynamics, including price information, customer demand, and market availability, are key determinants of the types and extent of value chain upgrading that farmers can engage in (Anh & Bokelmann, 2019; Gereffi, 2019). Environmental conditions such as climate variability and soil fertility also significantly affect productivity and the feasibility of certain upgrading practices (

Charlton, 2023). The framework aims to elucidate how these variables interact to create or hinder opportunities for upgrading within the coffee value chain, ultimately impacting the economic outcomes and livelihood security of smallholder farmers in Zombo and Nebbi districts. As indicated in the figure below

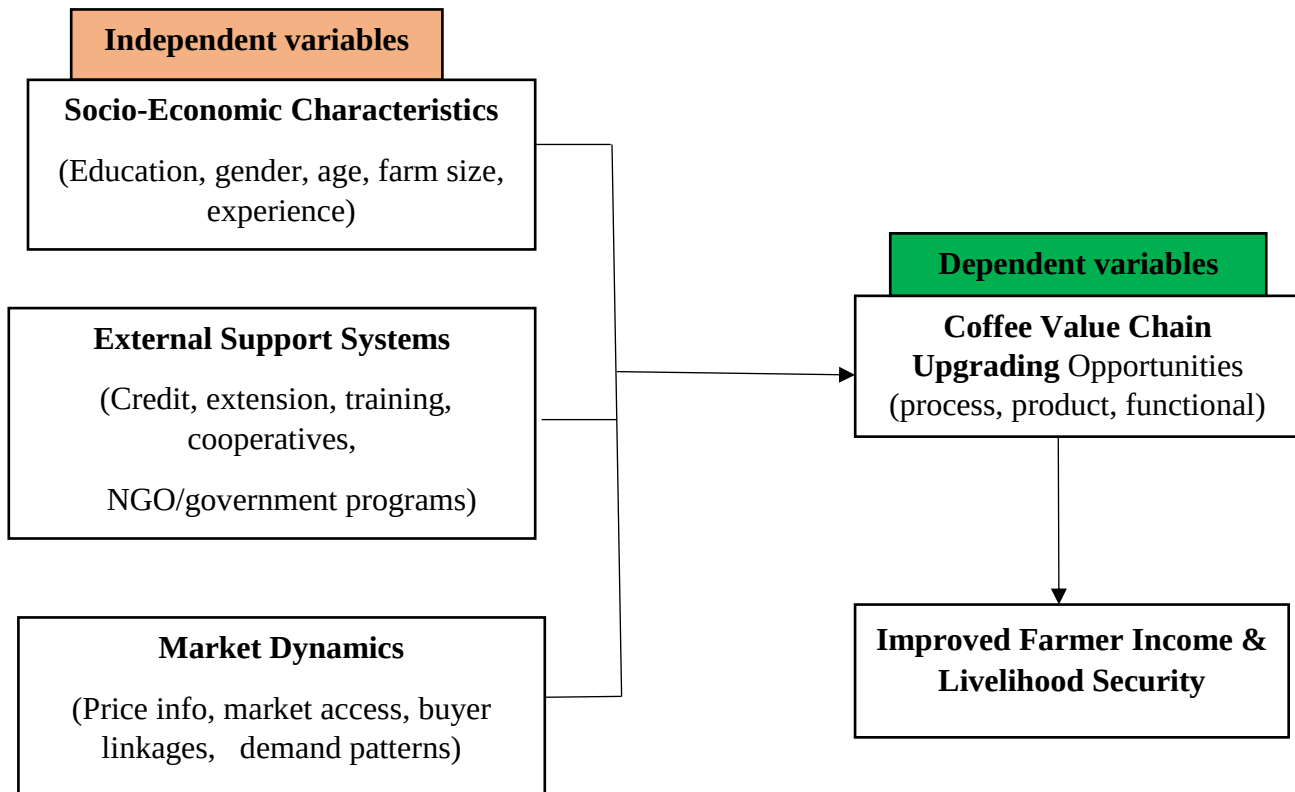


Figure 1: The Conceptual Framework (Authors’ Conceptualization)

1.8: Significance of the study

The study “Analysis of Coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda,” is significant as it aims to provide comprehensive insights into the potential for enhancing the coffee sector's value chain in these regions. For farmers, the study identifies specific strategies for improving productivity and profitability, thereby potentially increasing their

incomes and improving their livelihoods. It highlights the importance of adopting modern farming techniques, better market information, and access to credit, which can help farmers optimize their operations and achieve higher-quality produce. For other value chain actors, such as processors and traders, the study underscores the benefits of forming stronger linkages with smallholder farmers, which can lead to more efficient supply chains and higher-quality products. These improvements can enhance their competitiveness in both local and international markets.

Extension workers and policymakers can use the findings to tailor their support and interventions more effectively. The study provides data-driven recommendations that can inform the design of training programs, extension services, and policy frameworks aimed at promoting sustainable and inclusive value chain development. For researchers, the study contributes to the existing body of knowledge on agricultural value chains, offering new perspectives and identifying gaps that require further exploration. Overall, the study serves as a valuable resource for stakeholders at all levels of the coffee value chain, fostering collaboration and informed decision-making to drive the sector's growth and sustainability in Zombo and Nebbi districts.

1.9: Limitations of the study

The study "Analysis of Coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda," faced several limitations. First, the data collection process was constrained by limited access to remote farming areas, potentially leading to an underrepresentation of certain farmer demographics or geographic regions. This limitation has affected the generalizability of the findings to all smallholder coffee farmers in the districts. Second, the reliability of self-reported data from farmers regarding their farming practices, productivity, and financial information was compromised due to recall bias or reluctance to disclose accurate information. Additionally, the

study's cross-sectional design may not capture the long-term impacts and trends of value chain upgrading initiatives, necessitating follow-up studies for a comprehensive understanding.

CHAPTER TWO: LITERATURE REVIEW

2.1: Overview of coffee production in Uganda

Coffee production is a critical sector in Uganda's economy, serving as the country's leading export commodity and a primary source of income for millions of Ugandans. Uganda is one of Africa's largest coffee producers, with both Robusta and Arabica varieties being cultivated. The country's coffee sector is characterized by a predominance of smallholder farmers who typically own less than 2 hectares of land. These farmers are integral to the production process, contributing approximately 90% of the coffee output. The coffee production system in Uganda is mainly rain-fed, and the agricultural practices vary significantly across different regions, reflecting the diverse agro-ecological zones within the country. Recent years have seen efforts to improve coffee quality and production techniques, driven by both governmental and non-governmental initiatives aimed at boosting yields and enhancing the livelihoods of coffee farmers (ICO, 2023).

In recent years, Uganda has focused on increasing coffee production to meet growing global demand and enhance export revenues. Various initiatives have been introduced to support coffee farmers, including the provision of high-yield coffee varieties, training in sustainable agricultural practices, and improvements in post-harvest processing techniques. The Uganda Coffee Development Authority (UCDA) has been at the forefront of these efforts, working to increase annual coffee exports to 20 million bags by 2025 (UCDA, 2023). Additionally, climate change poses significant challenges to coffee production in Uganda, necessitating adaptive strategies such as the introduction of drought-resistant coffee varieties and agroforestry practices to mitigate adverse environmental impacts (Jassogne et al., 2013). These ongoing efforts highlight the

importance of coffee to Uganda's economy and the need for continuous support and innovation to sustain and grow the sector amidst changing global and local conditions.

2.2: The coffee value chain

While coffee is an important crop to the economy of Uganda it also faces several challenges. Despite the large-scale production of coffee, the vast majority of beans are exported in raw, green bean form with only 51 (60kg) bags of roasted coffee being certified for export in 2018 (Abdulsomad, 2020). Understanding the structure and behaviour of the participants, the activities and processes involved, the transactions, and the integrations and relationships, both vertically and horizontally, among the players are all necessary for a thorough understanding of the Ugandan coffee value chain. The tenth-largest coffee producer in the world in 2007 was Uganda (Jassogne et al., 2013). Yet, according to data from the International Coffee Organisation, by 2021, Uganda has risen to the 7th spot on the list of the top 10 coffee-producing nations worldwide (ICO, 2021). Coffee is Uganda's main cash crop and makes up about 20% to 30% of the country's annual export earnings; it has a total cultivated area of 272,000 ha (UCDA, 2013). About three-quarters of Ugandans' household income comes from the country's coffee sector, which employs more than 3.5 million households (UCDA, 2013).

The majority of Uganda's coffee production, up to 90%, is produced by small-scale farmers with less than 2.5 acres of land (UCDA, 2019). Because it is the primary source of income for households and offers a cash boom once or twice a year, coffee is extremely important to smallholder farmers (Liebig et al., 2016). The two main types of coffee farmed in Uganda are Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*), which account for 30% and 70%, respectively, of the country's total coffee exports (Abdulsomad, 2020). According to the sector

report for June 2021 published by the Uganda Coffee Development Authority (UCDA), a government institution in charge of the industry, there were 52,939 bags of Arabica and 565,449 bags of Robusta, each worth US\$ 8.31 million and US\$ 50,25 million respectively.

Most coffee is grown in mixed farms where it is inter-planted with food crops like bananas and beans to provide the security of food for homes. Also, because it is cultivated in the shadow of trees, coffee is produced sustainably and in an environment that requires little or no agrochemical input, such as fertilizers, pesticides, and fungicides (UCDA, 2019). The availability of inexpensive labor in Uganda expands the huge prospects for investment in the coffee industry. Both Arabica and Robusta coffee in Uganda are harvested mostly throughout two seasons (March-June and September-November). Masaka and the Western areas' primary production season for Robusta runs from May to August, while the Central and Eastern regions' main production season is from November to February. In the case of Arabica, the two primary growing seasons are from October to February in the Eastern and West Nile Regions and from April to June in the Western Region (Jassogne et al., 2013).

Luwero, Mpigi, Mukono, Mityana, Kayunga, Masaka, Rakai, Mubende, and Kiboga are among the Central coffee-growing regions. Western Bushenyi, Ntungamo, Mbarara, Kasese, Ibanda, and Rukungiri. In general, the highest-quality coffee is produced in the west. Buwenge, Jinja, Iganga, and Kamuli are other production hubs. Due to poor post-harvest practices and a predominance of low-quality pre-mature harvests, this region is responsible for the lowest grade coffee produced worldwide. In Uganda, the low input method is mostly used by coffee farmers, and productivity is heavily dependent on family labor (Abdulsomad, 2020). Uganda is a favorable country for the

production of organic coffee due to the minimum usage of agrochemicals (fertilizers, pesticides, and fungicides).

The Sub-Saharan African coffee value chain, which is typical of Uganda, is marked by weak institutions, restrictions on contracts, low-quality goods handled, and little to no value addition to the coffee produced by the farmers (Utrilla-Catalan et al., 2022). According to UCDA, (2013), smallholder farmers produce the majority of the coffee traded along the value chain using inefficient, unsophisticated production and post-harvest handling techniques that typically yield low- and poor-quality output. Traders at the farm gate make numerous small-scale transactions and purchases, which they later combine and resell to processors or wholesalers (Abdulsomad, 2020). It is well recognized that the nature of market transactions can lead to the exploitation of some value chain participants, most notably farmers. According to a study by (Bergquist et al., 2022), farm gate purchasers who agree on the prices given to farmers and/or make use of asymmetric knowledge in the market have a high likelihood of colluding.

To compensate for the significant transaction costs required, such as transportation, sourcing, and the dangers faced, several researches show that village and seasonal traders seek multiple rents instead of acting opportunistically (Dillon & Dambro, 2017). Yet, research on the topic of seeking rents to offset the high transaction costs is still inconclusive, and the assumption that opportunistic behavior is pervasive has led to recommendations to boost competition in these kinds of rural marketplaces to achieve efficiency. Yet, given that local transactions are heavily influenced by social relationships and customized contractual agreements, this advice is blunt and may not have much impact (Utrilla-Catalan et al., 2022). On the other hand, Gelaw et al. (2017) suggested that increasing buyer competition is not necessarily advantageous to consumers or farmers .

2.3: Characterization of Uganda's coffee farmers

The characterization of Uganda's coffee farmers reveals a landscape predominantly composed of smallholder farmers who manage the bulk of the country's coffee production. According to the Uganda Coffee Development Authority (UCDA), approximately 90% of Uganda's coffee is produced by these smallholders, who typically operate on farms of less than two hectares. These farmers are dispersed across various regions, with significant concentrations in the Central, Western, and Eastern parts of the country. The demographic profile shows a majority of male farmers, although women play a critical role in the coffee value chain, particularly in post-harvest processing and marketing. Educational attainment among coffee farmers tends to be low, which can hinder the adoption of improved agricultural practices and access to market information (UCDA, 2023).

The socio-economic conditions of Uganda's coffee farmers are marked by limited access to financial resources and agricultural inputs. A study by Diiro et al., (2023) highlights that many smallholder farmers face challenges such as inadequate access to credit, which restricts their ability to invest in quality inputs like fertilizers and improved seedlings. Additionally, access to extension services is uneven, with a significant number of farmers lacking the necessary technical support to improve their farming practices. Despite these challenges, there is a growing awareness among farmers of the importance of producing high-quality coffee, driven by both market demands and government initiatives. Membership in farmer groups and cooperatives is also increasingly common, providing farmers with better bargaining power and access to collective resources (Diiro et al., 2023)

2.4: Value chain upgrading opportunities available for smallholder farmers

Value chain techniques are being promoted more and more as comprehensive intervention frameworks for inclusive smallholder development in Sub-Saharan Africa's expanding agri-food markets. The varied actors involved in various production-to-consumption activities are referred to as the "value chain," and their dynamic relationships are what create value and link markets (Franzin et al., 2022). The transformation of agri-food systems associated with trends like changing demographics, rising incomes, altering dietary habits, and shifting consumer preferences is one aspect of this value chain evolution that presents opportunities as well as risks for the integration of smallholders into lucrative local, regional, and international markets (Jezeer et al., 2019).

The claim is that production-oriented farm-level interventions with a narrow focus on market integration and no consideration of the larger value chain in which smallholders are integrated or excluded result in smallholders receiving the smallest benefits (Bro et al., 2020). Value chain techniques are thus viewed as a chance to promote inclusive smallholder innovation and enterprise development as well as to contribute to broader development outcomes like food, nutrition, and income security (Macchiavello & Morjaria, 2022). Studies on the involvement of smallholders and other actors with limited resources in value chain interventions show that many of these actors are finding opportunities in expanding agri-food markets, pointing to inclusive value chain development, though unintentionally some results have promoted the exclusion or adverse inclusion of others (Vicol et al., 2018).

The upgrading notion explains how businesses and industries move toward producing better products, doing so more effectively or entering more skilled activities, all of which improve their performance and rewards in high-value marketplaces (Neilson et al., 2018). Agri-value chains are being upgraded by modifying manufacturing procedures to increase productivity and produce goods that are increasingly governed by national and international quality standards and food safety regulations (Macchiavello & Morjaria, 2022).

For disadvantaged producers to engage in lucrative markets, these studies emphasize the importance of building multi-actor linkages and interactions that enable information exchange, capacity enhancement, collaborative learning, and ongoing issue-solving. Therefore, the facilitation of multi-stakeholder processes through interventions that have been variously conceptualized in the literature as well as operationalized in practice and go by different terms such as innovation platforms (Galema et al., 2024), public-private partnerships, is a common feature in recent agri-value chain development initiatives, inspired by agricultural innovation systems approaches (Upla et al., 2022). The organization of these processes and how this supports coordinated action for innovation have been the main foci of most multi-stakeholder process studies in smallholder-dominated agri-value chain interventions (Verburg et al., 2019).

2.5: Factors affecting the choice of smallholder coffee value chain upgrading

Coffee producers must innovate to improve the value of their products and the effectiveness of their production and marketing operations to take advantage of market opportunities (Onyas, 2023). By the acquisition of knowledge and the capacity to adapt to shifting market conditions, farm-level upgrading can give farmers higher returns and a consistent, more stable income.

Moreover, upgrading boosts industry competitiveness and boosts overall national prosperity (Yadava et al., 2022). Increasing the competitiveness of all processes involved in the creation, processing, and/or marketing of a good or service, as well as reducing the limitations affecting the performance of the value chain, are the main goals of upgrading at the industry level (Bamwesigye et al., 2020).

A multifaceted process called upgrading aims to improve a company's or industry's economic competitiveness (profits, employment, skills) as well as its social conditions (working conditions, low salaries, education system) (Behuria, 2020). Farmers and/or other chain actors learn through the upgrading process, gaining knowledge and skills that can be translated into innovations or improvements that raise the value of their goods or services. This learning process is frequently facilitated by their relationships with other value chain players (Vicol et al., 2018). The ability of a farmer to innovate, assure ongoing product and process improvement, and learn from past mistakes are all key components of upgrading. The ability and opportunity to learn are crucial components of upgrading, as are the incentives for farmers to invest in upgrading. Farmers are less likely to devote time or resources to upgrading if they do not anticipate tangible returns on their investments, such as higher incomes, stable markets, or reduced risks (Gereffi, 2019).

Farmers have a lot of options when they pursue upgrading, including better productivity and efficiency as well as access to new market channels and knowledge of the sector (Richey & Ponte, 2021). Opportunities for upgrading are impacted by a variety of factors, such as: access to investment capital and inputs, physical and social distance, trust between players in a value chain, dissemination of market information on end-market opportunities and characteristics, the nature

and dynamics of the relationships between players in a value chain, and power dynamics between players (Behuria, 2020).

When there are enough opportunities for people to learn about alternatives, upgrading is most likely to happen. Farmers are typically risk-averse and unable to afford to suffer a loss in the hope of gaining in the future (Piao et al., 2019). Farmers are better able to evaluate the current condition the more they are informed about improving chances. Rarely do small-scale coffee growers have complete knowledge of the results of upgrading, nor do they know the precise amount of future income (Stofya, 2023). They must therefore consider this uncertainty and base their upgrade choices on risk-adjusted profits (Piao et al., 2019). Moreover, upgrading is more likely to take place when there are advantageous structural factors including robust end-market demand, a supportive business environment, wide links between enterprises, and efficient supporting markets (Gereffi, 2019).

The size of their operations may restrict a smallholder farmer's opportunities for advancement. Establishing horizontal relationships among producer groups may give them the scale they need to attract the attention of influential lead farmers or secure support from sustaining markets (Rifin & Naully, 2020). Also, the shortage of makes it difficult for farmers to invest in new equipment, inventory, and labor to take advantage of new product lines in the value chain. In other instances, farmers are constrained by their incomplete understanding of markets outside of local marketplaces. In this situation, they are unable to identify emerging market trends and are unable to profit from them (Rifin & Naully, 2020).

By enhancing factors that influence upgrading, such as infrastructure, creating and facilitating easier access to markets that support upgrading, increasing producers' understanding of the costs

and benefits of various types of upgrading, and emphasizing the significance of creating strong horizontal and vertical linkages while also encouraging the development of these linkages, the business enabling environment can increase the availability of upgrading opportunities to farmers (Parente-Laverde, 2020). Also, it's best to avoid concentrating all farmers into one particular sales channel. A sensible response to volatile markets, diversification of sales channels aids farmers in risk management. A farmer's risk-adjusted returns may not always be maximized by selling only to the highest-priced market, for instance. Farmers may not always profit from upgrading, and upgrading is not for everyone. The risks and conditions specific to each person may outweigh the possible rewards, or the existing scenario may be suitable for a farmer's goals.

2.7: Summary of literature review

The literature reviewed on the characterization of smallholder coffee farmers reveals significant socio-economic and demographic features that influence their farming practices and productivity. The reliance on agriculture as the primary occupation underscores the importance of interventions to improve agricultural productivity and market access, as supported by (Kamau et al., 2017). Limited access to credit and market information further constrains their ability to scale operations and improve profitability, emphasizing the need for improved financial and informational support systems (Rosenberg, 2023). In examining the extent of coffee value chain upgrading opportunities, the literature points to a significant engagement of smallholder farmers in the initial stages of the coffee value chain, primarily in producing red cherries and parchment coffee (Vicol et al., 2018).

However, there is a notable drop in involvement beyond these stages, suggesting missed opportunities for higher value-added activities. Small-scale operations and the urgent need for cash are primary motivations for farmers to upgrade, but these factors also highlight the precarious

economic positions they face (Schuit et al., 2021). The literature identifies critical barriers to value chain upgrading, such as poverty, high costs, and risks associated with production, indicating the need for financial support and risk mitigation strategies (Pradeepa Babu et al., 2019; Addisie & Tebarek, 2023). Probit regression analysis of factors affecting the choice of upgrading opportunities reveals that farm size, access to extension services, and awareness of social benefits significantly influence farmers' decisions (Issa & Chrysostome, 2015; Stofya, 2023). However, misaligned private company incentives pose a challenge, suggesting that more targeted and farmer-oriented interventions are necessary (Nguyen & Sarker, 2016).

CHAPTER THREE: METHODOLOGY

3.1: Study area

This study was conducted in the West Nile districts of Nebbi and Zombo in Northern Uganda.

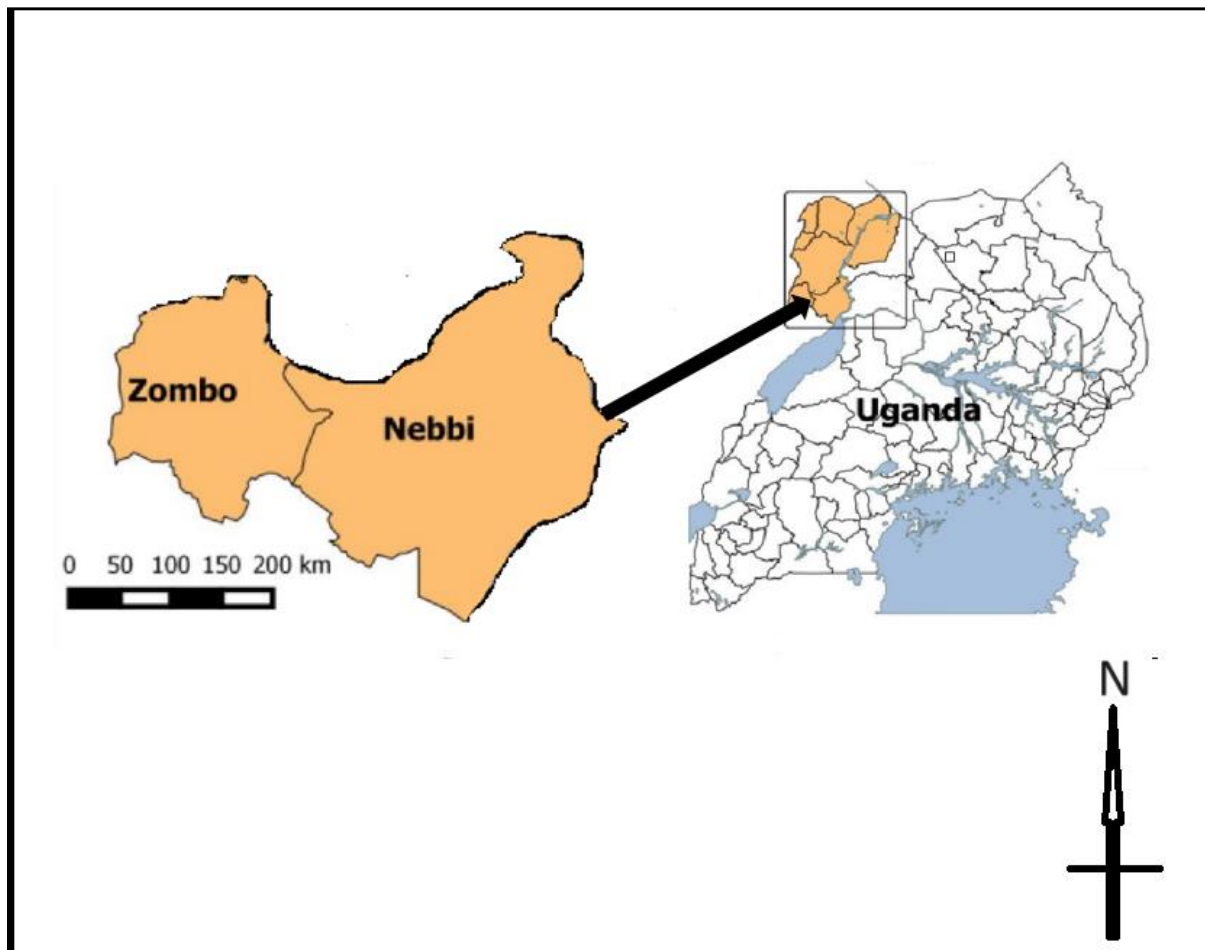


Figure 2: Map showing study area (Source: Google).

Zombo district was created by an Act of Parliament and became functional in 2010. Zombo district is 70 km (43 miles) south of Arua City and 382 km (237 miles) northwest of Kampala, the Capital City of Uganda. The district is bordered by Arua District to the North, Nebbi District to the East, and the Democratic Republic of Congo to the South and West. Spatially, it lies at 02° 30N,

30° 54E; 2.5000N 30.900°E. Zombo district is composed of 2 counties, 4 town councils, 11 sub-counties, 61 parishes/wards & 752 villages/cells. The district sits on a total land size of 939.3 km² out of which 91% is arable land, 5% is swamped and running water and the remaining 4% comprises forests and forest reserves. According to the Uganda Bureau of Statistics figures the district had a total population of 240,081 in 2014 with a projected population of 266,200 in 2018 of which 51.8% are female (Zombo DLG, 2022).

Meanwhile, Nebbi District Local Government is bordered by Madi Okollo District to the north, Pakwach District to the east, Democratic Republic of the Congo (DRC) to the south, and Zombo District to the west. The coordinates of the district are 02 27N, 31 15E (Latitude: 2.4500; Longitude: 31.2500). Nebbi District has a population of 298,300 (Male: 48.7%; Female: 51.3%), 153,000 females, and 145,300 males (Population projection). The local language spoken in Nebbi is Alur. The majority of the district population is engaged in subsistence farming. Much of what is produced is consumed at the household level and less than 40% is marketed. The main crops grown are cotton, coffee, simsim, sorghum, millet, sweet potatoes, beans, cassava, maize, and vegetables. Argo-processing is done small scale (Nebbi District Planning Office, 2022).

The Zombo and Nebbi districts of Uganda are pivotal to this study due to their significant roles in the country's coffee production. Both districts are located in the West Nile region, known for its favorable climatic conditions for coffee cultivation, including rich soils and adequate rainfall. Coffee is a major cash crop in these areas, providing a primary source of income for many smallholder farmers. Understanding the specific socio-economic and operational characteristics of coffee farmers in these districts can shed light on the broader challenges and opportunities within Uganda's coffee sector. By focusing on Zombo and Nebbi, this study aims to capture the unique

dynamics and potential for value chain upgrading in regions that are crucial to the country's agricultural economy.

The choice of Zombo and Nebbi districts is also driven by the need to address the prevalent economic disparities and developmental challenges faced by coffee farmers in these areas. These districts have shown potential for increased coffee productivity and quality improvement, but they are often hindered by limited access to education, credit, and market information. By examining these specific regions, the study seeks to identify tailored interventions that can enhance the livelihoods of coffee farmers, promote sustainable agricultural practices, and boost economic growth. The findings from Zombo and Nebbi can serve as a model for other coffee-producing regions in Uganda, demonstrating how targeted strategies can effectively address local challenges and harness opportunities for value chain upgrading.

3.2: Research design

This study employed a cross-sectional descriptive research design, which is deemed appropriate for exploring the Analysis of Coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda. The cross-sectional element of the design enabled the researcher to collect data from a sample of the population at a single point in time, providing a snapshot of the existing conditions and relationships between the study variables. Sekaran (2003) notes that cross-sectional studies are effective for examining current phenomena within a specific timeframe, especially when time and resources are limited. Given that this study is being conducted within a defined research period, this design aligns well with the study's objectives.

The descriptive component of the design has helped to generate detailed information on key aspects of socio economic characteristics, external support systems, market dynamics and how these influence different dimensions of coffee value chain upgrading opportunities in term of process, product and functional upgrading. As Creswell (2009) emphasizes, descriptive research is ideal for capturing and interpreting the views and experiences of individuals regarding specific phenomena, making it suitable for this study's context. Thomas (2011) further supports the use of descriptive design in development research, noting its ability to reveal patterns that can guide planning and implementation.

3.3: Research approach

This study employed a quantitative research approach, which provide a more holistic understanding of Analysis of Coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda. A quantitative approach is particularly useful in development research because it allows for the convergence of numerical trends, thus improving the comprehensiveness and credibility of the findings (Plano Clark & Ivankova, 2018).

The quantitative approach of this study involved the collection and analysis of numerical data to determine the influence of sociodemographic characteristics, external support systems and market dynamics on coffee value chain upgrading opportunities. This was operationalized through structured questionnaires distributed to selected smallholder coffee farmers. The aim was to measure the frequency, marginal effects of factors influencing coffee value chain upgrading opportunities and to identify statistical relationships between them.

3.4: Sample size determination and sampling procedure

3.4.1: Sample size determination

The sample size (n) of the study was determined using the Cochran formula in equation one (Cochran, 1977)

Cochran's formula was preferable used because it ensures that the selected sample is statistically representative of the larger smallholder coffee farmers' population, thereby enhancing the reliability and validity of the findings. By factoring in a margin of error and confidence level, the method allows for robust estimates while maintaining feasibility in terms of time and resources. Including an attrition adjustment also safeguards the study's integrity by ensuring that the final sample remains adequate even if some participants withdraw.

$$n = \frac{Z^2 p(1-p)}{e^2} \dots \dots \dots (1)$$

Where n = required sample size, Z is the confidence level of 95% (Standard value of 1.96), P = estimated percentage of households involved in coffee farming, e = Margin of error (standard value 0.05)

Using the formula,

$$n = \frac{1.96^2 * 0.25(0.75)}{0.05^2} = \mathbf{288 \textit{ respondents}}$$

3.4.2: Sampling procedure

The population of interest in this study constituted 288 smallholder coffee farmers respondents where the list was obtained from the District Production Department and Uganda Coffee Development Authority Offices in Zombo and Nebbi Districts. The sampling unit were the smallholder coffee farmers. A multistage sampling technique was employed in arriving at a representative sample size for the study. In the first stage, Zombo and Nebbi districts were purposively selected, because they are the leading districts in coffee farming and trade in West Nile region, Uganda. In the second stage, Paidha and Nyapea sub-counties in Zombo district; Jupangira and Erussi sub counties in Nebbi District were purposively selected to participate in the study based on their greater involvement in coffee production and marketing. In the third stage, simple random sampling was used to select 288 smallholder coffee active farmers who ultimately were interviewed with 72 respondents per sub-county simple randomly selected since coffee farming is primarily spread at the household level.

3.5: Data collection method

This study utilized a quantitative data collection strategy to provide a well-rounded understanding of how socioeconomic characteristics, external support systems and market dynamics influence the coffee Value Chain Upgrading Opportunities in Zombo and Nebbi Districts, Uganda. The structured questionnaire was used to collect measurable data from smallholder coffee farmers. These questionnaires captured numerical information on factors influencing coffee value chain upgrading opportunities. The questionnaires were administered face-to-face by trained research assistants to ensure clarity, accuracy, and inclusion of respondents who may have limited literacy skills.

3.5.1: Data collection Instruments

The study utilized quantitative data collection instruments. Structured questionnaire was used to collect quantitative information from smallholder coffee farmers involved in coffee value chain upgrading. These instrument was pre-tested to ensure clarity, reliability, and contextual relevance to the target population.

The study employed a structured questionnaire as the primary instrument for collecting quantitative data. This tool was consist mainly of closed-ended questions to ensure uniformity in responses and to facilitate straightforward coding and statistical analysis. The questionnaire was carefully designed to cover the core dimensions of factors affecting value chain upgrading opportunities.

Implementation involved administering 288 questionnaires to smallholder coffee farmers, following ethical approval and informed. The data collection was conducted through face-to-face interviews by trained research assistants to ensure clarity and inclusiveness, particularly for respondents with varying literacy levels. Questions were tailored to capture respondents' experiences, access to services regarding value chain upgrading.

The questionnaire method is preferred because it allows the researcher to collect standardized, comparable, and statistically analyzable data from a relatively large sample within a short timeframe. This approach not only facilitates the identification of measurable trends of factors influencing coffee value chain upgrading but also enhances the credibility of the findings by ensuring that each respondent answers the same set of questions in a consistent manner.

3.6: Data analysis

Data was edited to ensure completeness, uniformity, and accuracy. The Statistical Package for Social Scientists (SPSS) version 20 was to measure descriptive statistics and STATA software was employed to measure the marginal effects where SPSS can't accurately determine.

3.6.1: Characterizing the coffee farmers

To characterize the smallholder coffee farmers in Zombo and Nebbi Districts, descriptive statistics were employed to analyze the data collected. The study used means, frequencies, and percentages to summarize the demographic and socio-economic characteristics of the farmers. Key variables analyzed included gender distribution, age, education level, farm size, and primary occupation. Frequencies and percentages provided a clear picture of the gender composition, with a particular focus on the dominance of male farmers. The mean and standard deviation were calculated for continuous variables like age and farm size to provide an understanding of the average and variability within the sample. This descriptive statistical approach offered a comprehensive overview of the smallholder coffee farmers' profiles in the study areas, enabling a detailed understanding of their characteristics and the context in which they operate.

3.6.2: Identifying existing coffee value chain upgrading opportunities

To determine the extent of coffee value chain upgrading opportunities in Zombo and Nebbi Districts, descriptive statistics played a crucial role in analyzing the data collected. Measures such as frequencies, percentages, and averages were utilized to assess the level of engagement in various stages of the coffee value chain upgrading. The analysis focused on calculating the percentage of farmers involved in upgrading to different stages such as red cherries and parchment coffee, as

well as their participation rates in activities like drying and pulping. Mean values were computed to understand the average scale of production and sales quantities among farmers. These descriptive statistics provided a quantitative snapshot of the extent to which smallholder farmers in Zombo and Nebbi districts are upgrading within the coffee value chain, highlighting areas where there is significant participation and areas where opportunities for further upgrading may exist. This approach allowed for a comprehensive assessment of the current state of coffee value chain upgrading in the study area, essential for identifying potential areas for intervention and improvement.

To examine the factors influencing the choice of coffee value chain upgrading opportunities in Zombo and Nebbi Districts, Probit regression analysis was employed. Probit regression is suitable for binary dependent variables, in this case, whether farmers engage in coffee value chain upgrading or not. The model included several independent variables hypothesized to affect upgrading decisions, such as farm size, access to extension services, awareness of market prices, and participation in farmer groups.

$$P(Y_i = 1) = \Phi(\beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki}) + \varepsilon_i \dots \dots \dots \mathbf{2}$$

$\Phi =$ is the cumulative distribution function of the standard normal distribution,

β_0 = is the intercept term,

$\beta_1, \dots, \beta_k$ = are coefficients representing the effects of independent variables $X_{1i}, \dots, X_{ki}$ on the probability of upgrading.

$X_{1i}, \dots, X_{ki}$ = Independent variables (factors influencing value chain upgrading)

The independent variables $X_{1i}, \dots, X_{ki}$ include factors such as farm size (measured in hectares), access to extension services (binary variable), awareness of market prices (continuous variable), and participation in farmer groups (categorical variable). The coefficients β indicate the direction and strength of each variable's effect on the likelihood of engaging in coffee value chain upgrading. The analysis involved estimating these coefficients using maximum likelihood estimation to determine which factors significantly influence farmers' decisions to upgrade within the coffee value chain. This methodological approach allowed for a rigorous examination of the determinants shaping farmers' choices regarding value chain upgrading, insights into policy and intervention strategies aimed at promoting sustainable agricultural development in the study area.

Table 1: Variables for the Probit regression model

Variable	Description/Measurement of variable	Expected sign
Age	Age of respondent (years)	+
Education	Number of years spent in school	+
Income Level	Income level (Ugandan shillings)	+
Marital status	Marital status of respondent (1=married, 0 = not married)	+
Sex	Gender of the respondent (1 = Male, 0 = Female)	+
Location	Residential location (Urban = 1, 0 = Otherwise)	+/-
Household size	Number of persons	+
Occupation	Farming, Trading, Civil Service	+/-
Credit Access	Dummy 1 = Yes, 0 = No	+
Income control	Dummy 1 = Yes, 0 = No	+
Information access	Dummy 1 = Yes, 0 = No	+
Experience	Years	+

Note: The expected signs in Table 1 indicate a positive, Negative or a mixed effect on choice of type of value chain upgrading.

3.7: Ethical consideration of the study

The study followed all the laws of the country and demonstrate high level of integrity without any form of compromise. The researcher sought clearance from the Gulu University Research and Ethics Committee (GUREC). The study further sought the authorization and administrative permission to conduct the study from CAOs of the districts, get administrative Clearance from all the County Chief of participating sub-counties and District Agricultural Officer of the participating district in the study. The respondents were asked before interviewing them and also, they were further requested to agree to participate by signing the consent form and be interviewed. To achieve privacy, and confidentiality, the researcher did abide by the principle of voluntarism and maintain the highest level of confidentiality of the respondent's details.

CHAPTER FOUR: PRESENTATION OF RESULT

4.1: Characteristics of coffee farmers

The findings show that about 49.7% of the respondents came from Zombo District, while 50.3% were from Nebbi District, indicating that the sample was almost evenly distributed between the two study areas. The majority of respondents were male (78.8%). In terms of education, only 19.8% of farmers had attained post-primary education, implying that most farmers had completed only primary education. Furthermore, agriculture remains the backbone of household livelihoods, as 88.2% of respondents reported farming as their main occupation. On average, the respondents owned 4.66 acres of land, of which 1.70 acres were allocated to coffee production. This suggests that coffee occupies a significant proportion of household farmland and continues to serve as an important cash crop in the study area.

Regarding access to information, 27.8% of farmers received market information through radio, while 58.7% accessed price information through various channels. However, only 16.7% reported receiving price quality information, which highlights a gap in the flow of detailed market intelligence that could influence farmers' decisions about quality and pricing. Financial access was found to be relatively low. Only 28.5% of respondents had access to credit, and 26.4% had received credit for coffee production.

Group membership was relatively high, with 71.5% belonging to marketing groups, 38.5% involved in processing groups, and 74.0% participating in production groups. The analysis also revealed that 60.8% of farmers received input incentives, while 20.8% benefited from equipment incentives. Additionally, 20.5% received support from non-governmental organizations (NGOs),

68.1% benefited from the Uganda Coffee Development Authority (UCDA), and only 11.8% reported receiving incentives from the private sector.

The average coffee farming experience among respondents was 22 years, showing that most farmers have long-term experience in coffee cultivation and are likely to have accumulated substantial indigenous knowledge. The average household size was 4.7 members, which is consistent with rural family patterns in Uganda.

Access to extension services was found to be generally good, with 86.5% of farmers reporting access to extension advice, mainly on Good Agricultural Practices (GAP), which was received by 82.6% of respondents. However, fewer farmers (40.6%) received extension training on coffee processing, and only 6.3% benefited from Business Development Services (BDS). In terms of coffee quality awareness, 93.8% of farmers were aware of premium coffee, 85.4% knew about off-grade coffee, and 63.5% were familiar with specialty coffee. This relatively high level of awareness reflects the impact of recent sensitization efforts and training on coffee quality improvement by UCDA and development partners.

Table 2: Descriptive statistics for socio-economic and explanatory variables

Variable	Description	Mean	Std. Dev.
Zombo district	Dummy(1=yes, 0=Nebbi)	0.497	0.501
Male	Dummy(1=Yes, 0=Female)	0.788	0.409
Education	Dummy(1=Post Primary, 0=Primary)	0.198	0.399
Main occupation	Dummy(1=Farming, 0=Others)	0.882	0.323
Farm size	acres	4.662	3.562
Land allocated to coffee production	acres	1.696	3.291
Receive market Information through radio	Dummy(1=yes, 0=no)	0.278	0.449
Receive price information	Dummy(1=yes, 0=no)	0.587	0.493
Receive price quality	Dummy(1=yes, 0=no)	0.167	0.373
Credit Access	Dummy(1=yes, 0=no)	0.285	0.452
Received credit for production	Dummy(1=yes, 0=no)	0.264	0.442
Member of a group involve in marketing	Dummy(1=yes, 0=no)	0.715	0.452
Member of group involve in processing	Dummy(1=yes, 0=no)	0.385	0.488
Member of group involve in production	Dummy(1=yes, 0=no)	0.740	0.44
Receives input incentive	Dummy(1=yes, 0=no)	0.608	0.489
Receive equipment incentive	Dummy(1=yes, 0=no)	0.208	0.407
Receives incentive from NGO	Dummy(1=yes, 0=no)	0.205	0.404
Receives incentive form UCDA	Dummy(1=yes, 0=no)	0.681	0.467
Receives incentive from private sector	Dummy(1=yes, 0=no)	0.118	0.323
Coffee production experience	Years	22.201	12.201
Household size	Number	4.715	1.978
Access to extension	Dummy(1=yes, 0=no)	0.865	0.343
Receives extension on GAP	Dummy(1=yes, 0=no)	0.826	0.379
Receives extension on processing	Dummy(1=yes, 0=no)	0.406	0.492
Receives extension on Business Development Services	Dummy(1=yes, 0=no)	0.063	0.242
Aware of Specialty Coffee	Dummy(1=yes, 0=no)	0.635	0.482
Aware of premium coffee	Dummy(1=yes, 0=no)	0.938	0.242
Aware of off grade coffee	Dummy(1=yes, 0=no)	0.854	0.354

4.2.0: The Extent of coffee value chain upgrading

The result in Figure 3, indicates that red cherries and Parchment are the most frequently used product upgrading in the study area with 52% and 48% of smallholder coffee farmers involved.

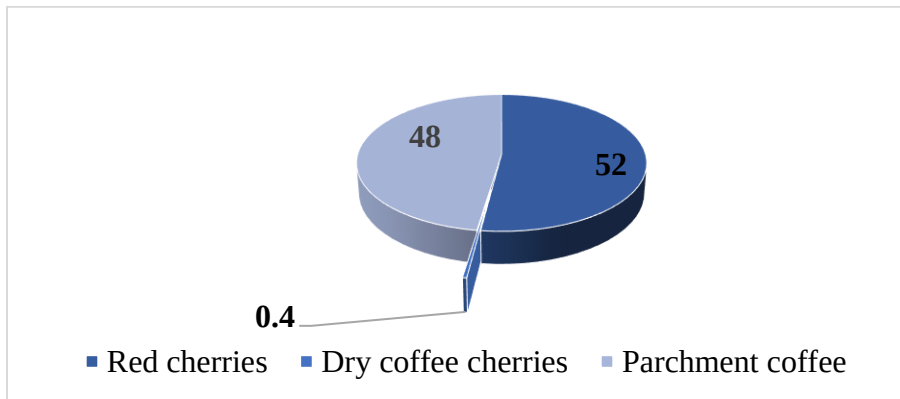


Figure 3: The Extent of Coffee Value Chain Upgrading (product)

In Figure 4, 30% of the smallholder coffee farmers carry out drying, 30.3% carry out pulping, and 29% of the coffee farmers sort their coffee as part of process upgrading. Only a few farmers participated in grading, roasting, cleaning and hulling of coffee as part of upgrading.

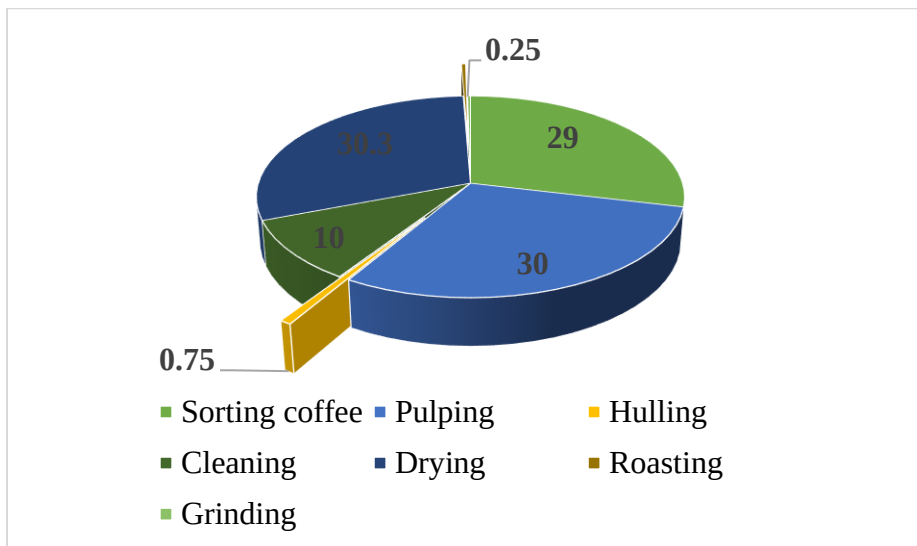


Figure 4: The Extent of Coffee Value Chain Upgrading (Process)

Figure 5 indicates that the majority of the smallholder coffee farmers 46.9% are carrying functioning upgrading of pick, pulp, dry, and sell followed by pick, pulp, dry, grade, and sell. Only 13.5% of the smallholders were involved in picking and selling the coffee.

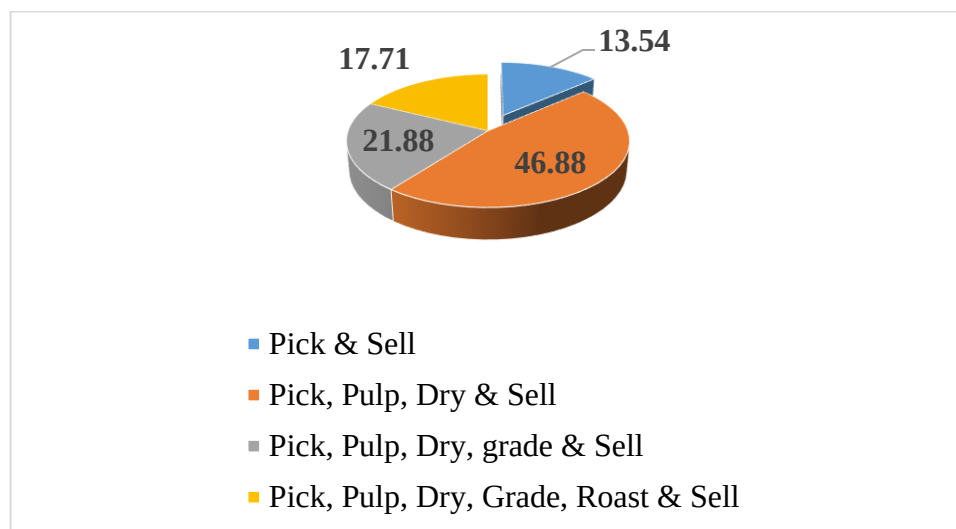


Figure 5: The Extent of Coffee Value Chain Upgrading (Function)

4.2.1: Quantity of Red cherries and parchment coffee sold

As seen in Table 3, most farmers sold parchment coffee and red cherries less than 500 kg the previous year.

Table 3: Quantity of red cherries and parchment coffee sold in the previous year

Quantity	Coffee products	
	Red Cherries (%)	Parchment (%)
Below 500 kg	81.5	87.9
501-1000 kg	14.4	9.3
1001-5000 kg	4.1	2.0
5001-10000 kg		0.8

4.2.2: Motivation for coffee value chain upgrading

Motivation for product upgrading

For products upgrading, majority of farmers sold either red cherries or parchment coffee (In Table 4). The main motivation for selling red cherries was the urgent need for money (85%), while for parchment coffee, the primary driver was customer demand (87%). This implies that the main driver for product upgrading was majorly urgent need money as other forms of upgrading which involved high cost and more time.

The primary intension of process upgrading was to fetch high price and ready market for processed coffee, with customer requirements (91%), high prices (80%), and increased profitability (68%) (Table 5).

For functional upgrading, the major driver was the need to sell coffee at a higher prices compared to other form of upgrading (Table 6). The vast majority (95%) of farmers associated some level of processing with potentially higher profits.

Table 4: Product upgrading

Motivation	Products	
	Red cherries coffee (%)	Parchment coffee (%)
Urgent need for cash	84.5	8.1
Available market	37.3	80.2
Profitable	36.9	67.3
Customer demand	24.0	86.7
Attracts high price	11.8	78.2
Peer influence/Group influence	8.1	23.0
Access to processors	1.1	29.0

Table 5: Process upgrading

Motivation for undertaking the process	Process			
	Sorting	Pulping	Cleaning	Drying
	%	%	%	%
Increased profits	68.4	31.4	15.0	71.2
High price	79.7	63.6	67.5	86.8
Ready market	57.1	83.7	57.5	85.2
Quick Cash	8.2	16.3	12.5	6.6
Customer requirements	91.3	83.7	90.0	93.0

Table 6: Functional upgrading

Motivations	Functional			
	Pick & sell	Pick, Pulp, Dry & Sell	Pick, Pulp, Dry grade & sell	Pick, Pulp, Dry Grade, Roast & Sell
	%	%	%	%
High profits	64.1	94.8	23.8	25.5
High price	7.7	97.0	90.5	82.4
Ready market	66.7	93.3	74.6	37.3
Urgent need for cash	84.6	14.1	38.1	62.7

4.2.3: Barriers to coffee value chain upgrading

The primary barrier for product upgrading was high levels of poverty (77%) and the high cost of processing, especially for parchment coffee (91%). For process upgrading, high cost of operations and processing machine Acquisition was the major barrier to upgrading. While for functional upgrading, the primary barrier for function upgrading was low prices (Table 7-9).

Table 7: Barriers to product upgrading

Barrier	Coffee Products	
	Red cherries Coffee	Parchment Coffee
	(%)	(%)
Poverty/Need to increase income	77.1	33.5
No group support	38.4	2.4
Low prices	34.3	27.4
Limited market	8.5	6.9
Risk of losses	4.1	52.4
High cost involved	4.1	91.1

Table 8: Barriers to process upgrading

Barrier	Process Upgrading			
	Sorting	Pulping	Cleaning	Drying
	%	%	%	%
Risk of losses	24.2	8.8	40.0	60.9
Low prices	16.9	16.3	46.3	24.7
Limited market	13.4	13.0	27.5	16.5
No group support	5.2	9.2	5.0	7.0
High cost involved	92.2	84.5	81.3	89.7

Table 9: Barriers to functional upgrading

Barriers	Functional upgrading				
	Pick & sell	Pick, Pulp & Sell	Pick, Pulp, grade & sell	Pick, Pulp, Grade, Roast & Sell	
	%	%	%	%	
Risk of losses	30.8	56.3	44.4	0.0	
Limited market	28.2	22.2	12.7	15.7	
Need to increase income	97.4	26.7	68.3	88.2	
No group support	61.5	10.4	28.6	68.6	
Weather conditions	15.4	89.6	68.3	9.8	

4.3.0: Factors influencing coffee value chain upgrading

Factors Influencing Product Upgrading

This section presents the results of the analysis on the factors influencing product upgrading among coffee farmers, specifically focusing on the production of red cherries and parchment coffee. The model used was statistically significant with a chi-square value of 1350.151 and a p-value of 0.000, indicating a good overall fit and that the explanatory variables jointly influence farmers' decisions to upgrade their coffee products. The model was based on 288 observations, and the detailed results are presented in Table 10.

Factors Influencing Production of Red Cherries

The analysis revealed that farm size had a positive and significant relationship with the likelihood of producing red cherries (Coefficient = 0.59, SE = 0.29, $p < 0.05$). This suggests that farmers with larger land holdings are more capable of investing in quality-enhancing practices such as timely harvesting and proper handling of red

cherries. In practical terms, a one-acre increase in farm size increased the probability of producing red cherries by about 4% ($dy/dx = 0.04$).

Similarly, access to extension services on coffee processing showed a positive and significant effect on red cherry production (Coefficient = 1.04, SE = 0.42, $p < 0.05$). This means that farmers who received training or guidance on coffee processing techniques were more likely to produce red cherries, increasing their likelihood by about 4% ($dy/dx = 0.04$). These findings emphasize the importance of technical training in improving product quality at the initial stage of upgrading.

On the other hand, several variables had negative effects on the likelihood of producing red cherries. Farmers in Zombo District were less likely to engage in red cherry production compared to those in Nebbi District (Coefficient = -0.78, SE = 0.43, $p < 0.10$), possibly due to variations in infrastructure, market access, or local processing facilities. Similarly, those whose main occupation was coffee farming were less likely to focus on red cherry production (Coefficient = -0.66, SE = 0.49, $p < 0.10$), indicating that many smallholders may still sell unprocessed coffee due to labor or capital constraints.

Access to equipment was also negatively and significantly associated with red cherry production (Coefficient = -1.53, SE = 0.34, $p < 0.01$), suggesting that farmers who invest in equipment tend to focus more on later stages of processing such as parchment coffee rather than the red cherry stage.

However, being aware of premium coffee had a positive and marginally significant effect on red cherry production (Coefficient = 0.70, SE = 0.36, $p < 0.10$). This implies that knowledge about the higher market value of premium coffee motivates farmers to maintain better harvesting and handling practices that improve red cherry quality.

Factors Influencing Production of Parchment Coffee

Regarding parchment coffee production, several variables were found to be statistically significant and positively associated with upgrading. Farm size remained a significant determinant (Coefficient = 0.59, SE = 0.30, $p < 0.05$), confirming that farmers with larger landholdings are more likely to invest in processing and drying coffee into parchment.

Access to credit significantly increased the likelihood of producing parchment coffee (Coefficient = 0.60, SE = 0.30, $p < 0.05$), raising the probability by about 8% ($dy/dx = 0.08$). This result suggests that credit enables farmers to purchase inputs, hire labor, or acquire basic processing tools, which are essential for value addition.

Farmers who received Business Development Services (BDS) extension were also significantly more likely to engage in parchment production (Coefficient = 1.24, SE = 0.39, $p < 0.01$). Access to BDS extension increased the probability of parchment upgrading by about 70% ($dy/dx = 0.70$), reflecting the importance of market-oriented and entrepreneurial training in enhancing coffee value addition.

Provision of incentives also played a major role. Support from NGOs had a strong positive effect (Coefficient = 6.31, SE = 0.52, $p < 0.01$), indicating that NGO-led programs significantly contribute to farmers' capacity to produce parchment coffee, possibly through supply of processing equipment or technical assistance. Incentives from the Uganda Coffee Development Authority (UCDA) also had a positive and significant influence (Coefficient = 0.89, SE = 0.48, $p < 0.10$), while private sector incentives were highly significant (Coefficient = 0.94, SE = 0.32, $p < 0.01$), highlighting the collective role of institutional support in promoting coffee upgrading.

Awareness variables were equally influential. Farmers who were aware of specialty coffee had a very strong and significant association with parchment production (Coefficient = 5.38, SE = 0.75, $p < 0.01$), increasing the likelihood by about 10% ($dy/dx = 0.10$). Similarly, those aware of premium coffee had a positive and

significant effect (Coefficient = 0.89, SE = 0.37, $p < 0.05$). This implies that knowledge of coffee quality categories and market preferences encourages farmers to process their coffee further into parchment to fetch better prices.

Gender also played a role. Male farmers were more likely to produce parchment coffee than female farmers (Coefficient = 0.59, SE = 0.31, $p < 0.10$), suggesting that men often have greater access to resources, credit, and information needed for processing.

However, similar to red cherries, main occupation had a negative and significant influence on parchment production (Coefficient = -0.90, SE = 0.51, $p < 0.10$). Farmers engaged primarily in non-coffee-related livelihoods were less likely to upgrade their coffee products, indicating that part-time or casual farmers tend to sell lower-quality outputs.

Table 10: Factors influencing product upgrading

Variables	Red cherries		Parchment	
	Coefficient (SE)	dy/dx(SE)	Coefficient (SE)	dy/dx(SE)
Constant	2.73(0.88)***		-0.45(1.03)	
Zombo	-0.78(0.43)*	-0.06(0.03)	-0.04(0.33)	-0.01(0.04)
Male	-0.31(0.37)	-0.02(0.03)	0.59(0.31)*	0.07(0.03)
Household size	-0.54(0.35)	-0.04(0.03)	-0.31(0.33)	-0.04(0.04)
Main occupation	-0.66(0.49)	-0.05(0.04)	-0.90(0.51)*	-0.10(0.06)
Farm size	0.59(0.29)**	0.04(0.02)	0.59(0.30)**	0.07(0.03)
Price information	-0.43(0.26)	-0.03(0.03)	-0.05(0.36)	0.07(0.03)
Credit access	-0.43(0.34)	-0.03(0.03)	0.60(0.30)**	0.08(0.08)
Extension on GAP	-0.45(0.39)	0.07(0.03)	0.74(0.70)	0.01(0.04)
Process extension	1.04(0.42)**	0.04(0.04)	0.06(0.38)	0.14(0.04)
Extension on BDS	0.56(0.56)	-0.01(0.05)	1.24(0.39)***	0.70(0.09)
Incentive (NGO)	-0.03(0.64)	0.04(0.04)	6.31(0.52)***	0.10(0.05)
Incentive (UCDA)	0.50(0.54)	0.03(0.03)	0.89(0.48)*	0.10(0.03)
Incentive private sector	0.34(0.33)	-0.11(0.03)	0.94(0.32)***	-0.05(0.05)
Equipment	-1.53(0.34)***	-0.03(0.03)	-0.43(0.45)	0.60(0.11)
Aware specialty coffee	-0.40(0.46)	0.05(0.03)	5.38(0.75)***	0.10(0.04)
Aware of premium coffee	0.70(0.36)*	-0.01(0.03)	0.89(0.37)**	0.09(0.05)
Aware off grade coffee	-0.15(0.46)	0.02(0.02)	0.77(0.49)	-0.08(0.04)
Cultivated land		-0.03(0.02)		-0.05(0.04)
Number of obs	288		*** $p < .01$, ** $p < .05$, * $p < .1$	
Chi-square	1350.151			
Prob > chi2	0.000			
Akaike crit. (AIC)	272.910			

Factors Influencing Process Upgrading

This section presents the results of the probit regression analysis examining the factors influencing different process upgrading activities among coffee farmers. The dependent variables include sorting, pulping, cleaning, and drying coffee, while the independent variables cover a range of socio-economic, institutional, and informational factors as shown in Table 11

The model results show a significant overall fit, with a Wald chi-square of 621.75 ($p = 0.000$), indicating that the included variables jointly explain variations in farmers' engagement in process upgrading activities. The log pseudo-likelihood of -279.45 and a chi-square (6) = 157.09 ($p = 0.000$) further confirm the model's robustness.

a) Sorting Coffee

The results indicate that education, farm size, credit access, extension services, group processing, and input access significantly influence farmers' engagement in sorting coffee. Specifically, education had a positive and significant effect ($\beta = 0.42$; $SE = 0.28$), implying that educated farmers are more likely to adopt sorting practices due to better awareness and technical know-how. Similarly, farm size positively influenced sorting ($\beta = 0.77$; $SE = 0.23$; $p < 0.01$), suggesting that larger farms have the capacity and labor to engage in value-enhancing practices.

Access to credit also exhibited a positive and significant association with sorting ($\beta = 1.20$; $SE = 0.34$; $p < 0.01$), implying that financially empowered farmers can afford sorting equipment or hire labor. Moreover, extension services significantly increased the likelihood of sorting ($\beta = 1.03$; $SE = 0.41$; $p < 0.01$), highlighting the role of advisory services in promoting quality improvement.

Group processing participation ($\beta = 0.75$; $SE = 0.34$; $p < 0.01$) and access to inputs ($\beta = 0.69$; $SE = 0.23$; $p < 0.01$) also positively influenced sorting. Conversely, being engaged mainly in farming as an occupation had a negative and significant effect ($\beta = -0.83$; $SE = 0.34$; $p < 0.01$), possibly because such farmers prioritize production quantity over processing quality.

b) Pulping Coffee

The findings show that farm size, credit access, extension services, group processing, and input access significantly influenced pulping activities. Specifically, farm size had a positive and significant effect ($\beta = 0.58$; $SE = 0.24$; $p < 0.01$), implying that larger farms tend to invest more in pulping equipment. Credit access was also strongly significant ($\beta = 1.37$; $SE = 0.29$; $p < 0.01$), showing that financial resources enable farmers to acquire pulping machinery.

Extension services significantly improved the likelihood of pulping ($\beta = 0.86$; $SE = 0.37$; $p < 0.01$), while group processing participation also had a positive influence ($\beta = 0.70$; $SE = 0.33$; $p < 0.01$). In contrast, market information accessed through radio negatively influenced pulping ($\beta = -0.56$; $SE = 0.25$; $p < 0.01$), suggesting that such information may not always translate into actionable skills for pulping.

c) Cleaning Coffee

Engagement in cleaning coffee was significantly associated with education, market and price information, group marketing, and group processing. Education positively influenced cleaning ($\beta = 0.57$; $SE = 0.25$; $p < 0.01$), implying that educated farmers are more aware of post-harvest quality standards. Similarly, access to market information had a significant positive effect ($\beta = 1.48$; SE

= 0.26; $p < 0.01$), as did price information ($\beta = 0.50$; $SE = 0.22$; $p < 0.05$), indicating that informed farmers are motivated to maintain coffee cleanliness to fetch better prices.

Group marketing participation also increased the likelihood of cleaning ($\beta = 0.58$; $SE = 0.30$; $p < 0.05$), as collective arrangements often promote quality control. However, group processing had a negative effect ($\beta = -0.75$; $SE = 0.28$; $p < 0.01$), possibly reflecting labor divisions where cleaning is handled individually rather than collectively.

d) Drying Coffee

The results indicate that education, farm size, credit access, and extension services positively influence drying activities. Education had a positive and significant coefficient ($\beta = 0.46$; $SE = 0.26$; $p < 0.05$), meaning that educated farmers are more likely to adopt proper drying practices. Farm size also had a significant positive influence ($\beta = 0.41$; $SE = 0.21$; $p < 0.05$), as larger farms tend to have better infrastructure for drying.

Access to credit remained a strong determinant ($\beta = 1.34$; $SE = 0.44$; $p < 0.01$), while extension services also had a significant positive impact ($\beta = 1.15$; $SE = 0.40$; $p < 0.01$), confirming that training and technical support encourage better drying practices. On the other hand, farmers whose main occupation was farming were less likely to engage in proper drying ($\beta = -0.80$; $SE = 0.34$; $p < 0.05$).

Table 11: Factors influencing process upgrading

Variables	Process upgrading							
	Sorting coffee		Pulping coffee		Cleaning coffee		Drying coffee	
	Coef. (SE)	dy/dx(SE)	Coef. (SE)	dy/dx(SE)	Coef. (SE)	dy/dx(SE)	Coef. (SE)	dy/dx(SE)
Constant	-1.17(0.61)**		-0.57(0.57)		- 2.05(0.55)***		0.04(0.51)	
Zombo	-0.35(0.31)	-0.05(0.05)	-0.45(0.25)*	-0.05(0.04)	1.32(0.28)***	0.31(0.07)	-0.64(0.27)**	-0.08(0.04)
Male	-0.05(0.27)	-0.06(0.04)	-0.16(0.24)	-0.07(0.03)	-0.16(0.25)	-0.02(0.06)	-0.13(0.24)	-0.06(0.02)
Education	0.42(0.28)	0.06(0.04)	0.06(0.25)	0.01(0.04)	0.57(0.25)***	0.19(0.10)	0.46(0.26)**	0.05(0.03)
Main occupation	-0.83(0.34)***	-0.08(0.04)	-0.40(0.40)	-0.01(0.06)	0.24(0.29)	0.11(0.04)	-0.80(0.34)**	-0.05(0.02)
Farm size	0.77(0.23)***	0.12(0.05)	0.58(0.24)***	0.06(0.04)	-0.08(0.21)	-0.07(0.05)	0.41(0.21)**	0.03(0.02)
Market information (radio)	-0.58(0.27)**	-0.11(0.07)	- 0.56(0.25)***	-0.07(0.05)	1.48(0.26)***	0.53(0.08)	- 0.61(0.26)***	-0.07(0.06)
Price information	0.77(0.24)***	0.14(0.05)	0.09(0.21)	-0.02(0.03)	0.50(0.22)**	0.09(0.05)	0.24(0.20)	0.02(0.03)
Information on quality	0.19(0.32)	-0.00(0.06)	0.20(0.31)	-0.00(0.04)	0.44(0.26)	0.02(0.07)	0.31(0.29)	0.02(0.04)
Credit access	1.20(0.34)***	0.11(0.04)	1.37(0.29)***	0.09(0.03)	-0.38(0.26)	-0.13(0.05)	1.34(0.44)***	0.06(0.03)
Extension	1.03(0.41)***	0.15(0.126)	0.86(0.37)***	0.03(0.07)	0.10(0.41)	-0.15(0.15)	1.15(0.40)***	0.13(0.12)
Group Marketing	-0.11(0.31)	-0.01(0.06)	0.09(0.30)	0.03(0.05)	0.58(0.30)**	0.12(0.05)	-0.12(0.31)	-0.02(0.04)
Group processing	0.75(0.34)***	0.07(0.05)	0.70(0.33)***	0.05(0.05)	- 0.75(0.28)***	-0.19(0.05)	0.30(0.27)**	-0.01(0.04)
Inputs	0.69(0.23)***	0.10(0.04)	0.46(0.25)*	0.07(0.04)	- 0.85(0.24)***	-0.24(0.06)	0.49(0.21)	0.04(0.03)
Equipment	-0.49(0.33)	-0.10(0.09)	0.04(0.28)	0.01(0.04)	0.14(0.29)	0.03(0.07)	-0.29(0.37)	-0.06(0.07)
Red cherries		0.10(0.12)		-0.01(0.06)		0.10(0.05)		-0.02(0.05)
Parchment		0.70(0.11)		0.80(0.09)		0.23(0.04)		0.82 (0.08)
chi2(6) = 157.089					Log pseudo likelihood = -279.4466			
Prob > chi2 = 0.0000					Number of obs = 288			
Wald chi2(56) = 621.75								
Prob > chi2 = 0.0000								

Factors Influencing Functional Upgrading

This section presents the results on the determinants of functional upgrading among coffee farmers. Functional upgrading refers to farmers' ability to participate in higher-value activities within the coffee value chain, such as processing, direct marketing, and value addition, rather than only producing raw coffee.

The regression model was statistically significant (Chi-square = 69.084; Prob > χ^2 = 0.000), indicating that the explanatory variables collectively influence farmers' engagement in functional upgrading. The Pseudo R-squared value of 0.182 suggests that approximately 18% of the variation in functional upgrading is explained by the factors included in the model. The model fit statistics, including AIC = 630.068 and BIC = 692.339, confirm that the model adequately captures the relationships in the data. The analysis was based on 288 observations, as shown in Table 12.

The results show that the main occupation, cultivated land size, access to credit for production, BDS (Business Development Services) extension, group production, equipment ownership, and awareness of premium coffee significantly affect farmers' engagement in functional upgrading.

Specifically, the main occupation had a positive and significant effect ($\beta = 0.943$; SE = 0.378; $p < 0.05$), implying that farmers whose primary occupation is coffee farming are more likely to engage in higher-value functions such as direct sales and on-farm processing. Similarly, cultivated land had a positive and marginally significant effect ($\beta = 0.525$; SE = 0.277; $p < 0.10$), suggesting that farmers with larger plots are better positioned to invest in upgrading activities due to economies of scale.

In contrast, access to production credit negatively influenced functional upgrading ($\beta = -0.806$; SE = 0.314; $p < 0.05$). This suggests that while credit supports production, it may not necessarily translate into investments for value addition, possibly because most loans are used for input purchase rather than for upgrading functions. Similarly, access to BDS extension services also had a negative and significant effect ($\beta = -0.820$; SE = 0.334; $p < 0.05$), implying that existing business advisory services may not adequately target functional upgrading, or that the support provided is not practically aligned with farmers' upgrading needs.

Participation in group production was also negatively associated with functional upgrading ($\beta = -0.541$; SE = 0.324; $p < 0.10$). This may indicate that collective production efforts tend to focus on volume rather than value addition. Moreover, equipment ownership had a significant negative relationship ($\beta = -0.769$; SE = 0.344; $p < 0.05$), suggesting that the type of equipment available at the household level may not be suitable for advanced upgrading activities.

Influence of Awareness and Product Type

Awareness of premium coffee had a positive and significant influence on functional upgrading ($\beta = 1.202$; SE = 0.660; $p < 0.10$), highlighting the importance of market knowledge in motivating farmers to move up the value chain. Additionally, engagement in the production of red cherries ($\beta = 1.430$; SE = 0.488; $p < 0.01$) and parchment coffee ($\beta = 4.784$; SE = 0.759; $p < 0.01$) were both highly significant and positive predictors of functional upgrading. This implies that farmers who process their coffee to parchment or sell red cherries are more likely to participate in higher-value functions such as direct marketing or quality-based selling.

Table 12: Factors influencing function upgrading

Variables	Functional upgrading	
	Coefficient	SE
Zombo	0.294	0.247
Male	-0.331	0.3
Education	0.304	0.316
Years of experience	-0.256	0.171
Household size	0.318	0.272
Main occupation	0.943**	0.378
Cultivated land	0.525*	0.277
Credit for production	-0.806**	0.314
BDS Extension	-0.82**	0.334
Group production	-0.541*	0.324
Equipment	-0.769**	0.344
Aware of Premium coffee	1.202*	0.66
Red Cherries coffee	1.43***	0.488
Parchment coffee	4.784***	0.759
Pseudo r-squared		0.182
Chi-square		69.084
Akaike crit. (AIC)		630.068
Number of obs		288
Prob > chi2		0.000
Bayesian crit. (BIC)		692.339
*** $p < .01$, ** $p < .05$, * $p < .1$		

CHAPTER FIVE: DISCUSSIONS

5.1: The characteristics of smallholder coffee farmers

The characteristics of coffee farmers in the study area, particularly in the Zombo and Nebbi districts of Uganda, highlight several significant socio-economic and operational factors that impact their productivity and overall economic status. This section of discussion analyzes the characteristics to support the results presented, focusing on gender distribution, education levels, primary occupation, access to information and credit, group memberships, and awareness of coffee grades.

The study reveals that the majority of the smallholder coffee farmers were men. This male dominance in coffee farming is consistent with broader trends in agricultural sectors in many developing countries, where men typically engage more in cash crop production, while women often manage subsistence crops and household responsibilities and were in agreement with the findings of (Bekele Bayu, 2017) on the expansion of cash cropping; implications on Gender Division of Roles but these findings were contrary to the study on group farms versus individual farms (Agarwal, 2018). This gender disparity could influence decision-making processes and access to resources, as men are more likely to control financial and agricultural inputs as confirmed by (Kangile et al., 2021; Hassen et al., 2016).

The result of this study also revealed that only a small portion of the smallholder coffee farmers have completed post-primary education, indicating a low educational attainment among coffee farmers. This low level of education can impede the adoption of modern farming techniques and limit farmers' ability to access and interpret market information effectively, these findings

concluded with the findings of (Fitriani et al., 2022). Education is crucial for understanding and implementing best agricultural practices, which can enhance productivity and quality as also confirmed by (Nabaasa et al., 2023).

A significant majority of the respondents primarily worked as farmers. This high percentage underscores the reliance on agriculture for livelihoods in these districts. Given the importance of coffee as a cash crop, the focus on farming highlights the necessity for interventions aimed at improving agricultural productivity and market access for these communities, these were in line with the findings of (Kamau et al., 2015).

The study notes that only a few farmers received market information via radio. Despite the high importance of timely and accurate market information for making informed decisions about selling crops, the low access rate suggests a gap in communication infrastructure, these findings were in agreement with the findings of (Anh & Bokelmann, 2019). Improving access to market information could empower farmers to make better pricing and sales decisions, potentially increasing their income as argued by (Borrella et al., 2015). The findings also revealed that a minority of farmers have access to credit, and have received credit for production. Limited access to credit is a significant barrier to scaling up operations and investing in necessary inputs like fertilizers and quality seeds. Credit access is crucial for farmers to improve their productivity and resilience against economic shocks, these findings conformed to the findings of (Hill et al., 2021).

A substantial proportion of farmers are involved in groups related to marketing, processing, and production, the findings were confirmed by the findings of (Kumar et al., 2015). Membership in these groups can provide numerous benefits, including better bargaining power, shared resources, and improved access to information and training. Such collective efforts can lead to enhanced

productivity and better market access as pointed out by (Courtois & Subervie, 2014); Agarwal, 2018).

The greater majority of smallholder coffee farmers were aware of the levels of different coffee grades like premium, off-grade, and specialty, indicating that most farmers understand the quality distinctions in coffee, these findings concurred with the findings of (Al-Zaidi et al., 2016). This awareness is vital for producing coffee that meets market standards and can command higher prices. It also reflects the impact of educational programs and extension services aimed at improving coffee quality and these were also spelled out clearly by (Kwon et al., 2015).

5.2: The Extent of coffee value chain upgrading

The findings indicated that the majority of smallholder coffee farmers were involved in upgrading to red cherries, and this was also linked with drying and pulping. This high engagement in coffee value chain upgrading suggests a robust involvement in the initial stages of the coffee value chain, which is crucial for adding value to the coffee before it reaches the market as (Vicol et al., 2018) also confirmed in their study. However, the involvement drops significantly for other forms of coffee such as dry coffee cherries, dried green coffee beans, roasted coffee beans, and ground powdered coffee, with less than one percent of respondents engaging in these forms. This indicates that most farmers were not moving beyond the initial stages of the value chain, potentially missing out on higher value-added opportunities (Vicol et al., 2018).

The majority of farmers sold less than 500 kg of both red cherries and parchment coffee in the previous year, these were in line with the findings of (Gereffi, 2019). This suggests that most farmers operate on a small scale, which could limit their bargaining power and ability to achieve

economies of scale as also highlighted by (Behuria, 2020) in his findings. The small quantities sold also reflect the potential limitations in production capacity or market access issues.

For red cherries, the primary motivation for upgrading was the urgent need for cash. This immediate financial necessity highlights the precarious economic position of many farmers who might prioritize short-term financial needs over potentially more profitable long-term investments in higher value-added coffee products, these findings correlated with the findings of (Schuit et al., 2021) and contrast to the findings of (Addisie & Tebarek, 2023).

In contrast, for parchment coffee, customer demand and market availability were the main drivers. This indicates that market forces and consumer preferences play a significant role in influencing farmers' decisions to upgrade their products, these findings were supported by (Addisie & Tebarek, 2023) and were at odds with (Schuit et al., 2021). The profitability of parchment coffee was also a great motivator for farmers, suggesting that despite the immediate financial pressures, farmers recognize the economic benefits of upgrading to parchment coffee (Schuit et al., 2021).

The study identifies poverty as one of the barriers to coffee value chain upgrading, affecting most of smallholder coffee farmers. This economic hardship underscores the need for financial support and interventions to help farmers overcome initial investment barriers, these were also confirmed by the findings of (Pradeepa Babu et al., 2019). Furthermore, the high cost involved and the risk of losses were the significant obstacles. The financial burden and potential risks associated with producing parchment coffee indicate a need for better access to affordable credit and risk mitigation strategies these findings were connected to the findings of (Addisie & Tebarek, 2023; Piao et al., 2019).

5.3: The factors affecting coffee value chain upgrading

Results reveal that the major factors affecting value chain upgrading included farm size, awareness of upgrading opportunities, access to market information, access to business development services, and access to credit. Coffee farmers with large farm sizes were more likely to engage in coffee value chain upgrading. This is likely because larger farms have more resources and economies of scale that make upgrading feasible and profitable as confirmed by the findings of (Issa & Chrysostome, 2015; Clay et al., 2018). The study also pointed out that access to extension services positively influences upgrading. These services provide farmers with the necessary knowledge and skills to implement upgrading practices effectively and these arguments were supported by the findings of (Kattel, 2015) and (Mulyati & Indrawan, 2021).

Awareness of the social benefits associated with upgrading also shows a statistically significant positive relationship with coffee value chain upgrading. The Community development and improved livelihoods, encourage farmers to invest in upgrading their products, these findings concurred with the findings of (Stofya, 2023; van Keulen & Kirchherr, 2021). Furthermore, farmers' awareness of off-grade risks was positively and statistically significant, therefore farmers who were aware of the risks associated with off-grade coffee were more likely to engage in upgrading to avoid the financial losses that come with lower-quality produce, these findings conformed to findings of (Stofya, 2023; van Keulen & Kirchherr, 2021).

The findings also revealed that private company incentives have a negative statistically significant relationship with coffee value chain upgrading. This might suggest that private sector interventions are either insufficiently targeted or not aligned with the needs and realities of smallholder farmers these findings disagreed with the findings of (Nguyen & Sarker, 2016). They highlighted that to

promote coffee value chain upgrading, interventions should focus on expanding farm sizes where feasible, enhancing extension services, and increasing awareness of the social and economic benefits of upgrading through private company incentives. The findings on access to price information were found to have a significant influence on farmers' decisions to upgrade to parchment. Knowledge of market prices empowers farmers to make informed decisions about when and how to sell their products to maximize profits as confirmed by the findings of (Gereffi, 2019).

CHAPTER SIX: SUMMARY, CONCLUSION, RECOMMENDATIONS

6.1: Summary

The coffee value chain involves the entire process from cultivation to the final consumer, including farming, processing, marketing, and distribution. Upgrading the value chain involves improving efficiency, quality, and profitability at each stage. Key strategies include enhancing agricultural practices, adopting advanced processing technologies, improving market access, and fostering stronger linkages between stakeholders. By focusing on these areas, smallholder farmers can increase their productivity and income, contributing to the overall sustainability of the coffee sector. Training and extension services are crucial for disseminating knowledge about sustainable farming methods and promoting sustainable farming methods. Post-harvest processing can also be improved by upgrading technologies for drying, hulling, and grading. Investments in infrastructure and certifications can open up premium markets for coffee producers. Strong linkages between different stakeholders in the coffee value chain are vital for successful upgrading.

This study investigates coffee production in Northern Uganda, focusing on the socio-economic and operational characteristics of smallholder farmers. The research aims to understand the unique dynamics and potential for value chain upgrading in these regions, which are crucial to Uganda's agricultural economy. The study uses a cross-sectional research design, collecting data from 288 smallholder coffee farmers and buyers. The findings can serve as a model for other coffee-producing regions in Uganda, demonstrating how targeted strategies can effectively address local challenges and harness opportunities for value chain upgrading.

The study revealed that the primary motivation for product upgrading was the urgent need for money, and the motivation for process upgrading was driven by the high price and the ready market whereas function upgrading was the selling coffee at the higher prices. The result also revealed that the main barrier to product upgrading was poverty while the hindrance to process upgrading was the high cost of operation, furthermore, the main barrier to function upgrading was the low price of coffee.

Product upgrading was majorly affected by factors like farm size, extension services, and private company incentives. Process upgrading was driven by factors such as primary occupation other than farming, access to market information, group membership, and post-primary education, on the other hand, function upgrading was mainly influenced by factors like farming, credit for production, equipment, and business development extension.

6.2: Study conclusion

The study concludes that smallholder coffee farmers exhibit distinct socio-economic and operational characteristics that significantly influence their productivity and economic well-being. Predominantly most coffee farmers were male, these farmers often lack post-primary education, which hampers their ability to adopt modern farming techniques and access market information. Most of these coffee farmers were primarily engaged in farming, the sector's importance for livelihoods is evident. However, the limited access to credit and market information points to significant barriers that hinder scaling operations and making informed decisions, emphasizing the need for targeted interventions to enhance education, financial access, and communication infrastructure.

In terms of value chain upgrading opportunities, the study reveals substantial engagement in the early stages of the coffee value chain, such as producing red cherries and parchment coffee. However, participation significantly drops for more advanced stages, with less than one percent of farmers engaging in higher value-added products like roasted coffee beans or ground coffee. This limited involvement highlights a missed opportunity for higher income through advanced processing. The motivations for upgrading vary, with immediate cash needs driving red cherry production and market demand influencing parchment coffee. Barriers such as poverty, high costs, and risks of losses underline the need for financial support, affordable credit, and risk mitigation strategies to facilitate value chain progression.

Regarding the factors affecting the choice of value chain upgrading, the study finds that larger farm sizes, access to extension services, and awareness of social benefits positively influence farmers' decisions to upgrade. These findings suggest that larger farms can leverage economies of scale, while extension services provide the necessary skills and knowledge for effective upgrading. Awareness of social benefits, such as community development and improved livelihoods, further encourages investment in value-added activities. However, private company incentives show a negative relationship with upgrading, indicating a possible misalignment with smallholder farmers' needs. The study emphasizes the importance of aligning private sector interventions with farmers' realities, enhancing extension services, and promoting awareness of the economic and social benefits of value chain upgrading to drive sustainable development in the coffee sector.

6.3: Recommendations

First, access to affordable and flexible credit facilities should be expanded. The study found that although credit availability supported input acquisition, it harmed functional upgrading, implying

that most loans were not tailored for value addition. Therefore, financial institutions, together with the Uganda Coffee Development Authority (UCDA) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), should design credit products specifically for value addition, equipment purchase, and processing investments.

Extension services need to go beyond agronomic advice to include business and market-oriented training. Farmers require not only technical knowledge on good agricultural practices (GAP) but also support in financial management, quality control, and marketing strategies. Integrating business development services (BDS) within extension programs would help farmers build the skills necessary to participate competitively in domestic and export markets.

Strengthening farmer cooperatives and producer groups is vital. Although group membership positively influenced process upgrading, it harmed functional upgrading, possibly due to limited governance capacity or lack of focus on value addition. Cooperatives should therefore be reoriented to emphasize collective marketing, value addition, and market linkages, supported by training in leadership, transparency, and quality management.

Information access also emerged as a strong determinant of upgrading. Local governments, UCDA, and NGOs should invest in radio programs, digital platforms, and community information centers to provide timely market and price updates. Reliable information will enable farmers to make informed production and marketing decisions, reducing exploitation by middlemen.

Further studies should also explore how different incentive mechanisms such as financial rewards, training, or input support, affect the sustainability of upgrading behaviors over time. Longitudinal

and comparative studies across regions would provide deeper insights into what drives persistent upgrading among farmers.

6.4: Areas for further studies

- a) Conduct further research to assess the effectiveness of various interventions in promoting coffee value chain upgrading. This could involve evaluating the impact of training programs, credit access schemes, and farmer group support initiatives.
- b) Investigate the feasibility and profitability of alternative value-addition options beyond parchment coffee, such as dry-processed specialty coffee or roasted coffee beans. This would require analyzing market demand, processing costs, and potential returns for these options.
- c) Conduct further research to understand why private company incentives have a negative relationship with upgrading in this context. Analyze the types of incentives offered, their reach, and their effectiveness in addressing the needs of smallholder farmers. Develop strategies for improving private sector engagement in a way that benefits both companies and farmers.
- d) Explore the potential of digital technologies such as mobile apps and online platforms to provide farmers with access to market information, extension services, and financial resources. Analyze the digital literacy levels of farmers and develop strategies for bridging the digital divide.

REFERENCES

Abdulsamad, A., Oyi, A., Isah, A., & Odidi, I. (2015). Derivatisation of Cashew Gum by

- Esterification Using Citric Acid and Glycerol. *British Journal of Pharmaceutical Research*, 6(3), 155–165. <https://doi.org/10.9734/bjpr/2015/16022>
- Abdulsomad, K. (2020). *Taking the Bitterness Out of Coffee : A Case Study of Value Chain Transformation in Ugandan Coffee Companies*.
- Addisie, G., & Tebarek, L. (2023). Upgrading Opportunities and Challenges for Small Coffee Producers in Sidama Region of Ethiopia. *International Journal of Rural Management*, 19(2), 234–252. <https://doi.org/10.1177/09730052221080884>
- African Development Bank Group. (2017). Africa's Coffee Sector: Status, Challenges and Opportunities for Growth. In *African Development Bank* (Issue December 2017).
- Agarwal, B. (2018). Can group farms outperform individual family farms? Empirical insights from India. *World Development*, 108, 57–73.
<https://doi.org/10.1016/j.worlddev.2018.03.010>
- Al-Zaidi, A. A., Baig, M. B., Shalaby, M. Y., & Hazber, A. (2016). Level of knowledge and its application by coffee farmers in the udeen area, governorate of IBB-Republic of Yemen. *Journal of Animal and Plant Sciences*, 26(6), 1797–1804.
- Anh, N. H., & Bokelmann, W. (2019). Determinants of smallholders' market preferences: The case of sustainable certified coffee farmers in Vietnam. *Sustainability (Switzerland)*, 11(10). <https://doi.org/10.3390/su11102897>
- Arslan, C., Gregg, D., & Wollni, M. (2023). Paying more to make less: value degrading in the coffee value chain in eastern Uganda. *American Journal of Agricultural Economics*, January, 1–22. <https://doi.org/10.1111/ajae.12389>
- Babu, P. (2019). Value Chain Upgrading Strategies for Integration of Indian Small Coffee Growers in Global Coffee Value Chain. *Economic Affairs*, 64(4), 717–723.

<https://doi.org/10.30954/0424-2513.4.2019.6>

- Bamwesigye, D., Doli, A., Adamu, K. J., & Mansaray, S. K. (2020). A review of the political economy of agriculture in Uganda: Women, property rights, and other challenges. *Universal Journal of Agricultural Research*, 8(1), 1–10. <https://doi.org/10.13189/ujar.2020.080101>
- Bartl, A. L. (2024). Perceptions of Deficiencies in the Basic Conditions for Farm Management and Quality of Life in Coffee-Growing Households: A Panel Analysis of a Rural Community in Eastern Uganda. *Global Challenges*, 8(4), 1–14. <https://doi.org/10.1002/gch2.202300196>
- Behuria, P. (2020). The domestic political economy of upgrading in global value chains: how politics shapes pathways for upgrading in Rwanda’s coffee sector*. *Review of International Political Economy*, 27(2), 348–376. <https://doi.org/10.1080/09692290.2019.1625803>
- Bekele Bayu, T. (2017). The Expansion of Cash Cropping; Implications on Gender Division of Roles: A Case Study from Gedeo Community - Southern Nation Nationalities and Peoples Region, Ethiopia. *International Journal of Sustainable Development Research*, 3(2), 7. <https://doi.org/10.11648/j.ijdsr.20170302.11>
- Borrella, I., Mataix, C., & Carrasco-Gallego, R. (2015). Smallholder Farmers in the Speciality Coffee Industry: Opportunities, Constraints and the Businesses that are Making it Possible. *IDS Bulletin*, 46(3), 29–44. <https://doi.org/10.1111/1759-5436.12142>
- Boudreau, L., Cajal-Grossi, J., & Macchiavello, R. (2023). Global Value Chains in Developing Countries: A Relational Perspective from Coffee and Garments. *Journal of Economic Perspectives*, 37(3), 59–86. <https://doi.org/10.1257/jep.37.3.59>
- Bracken, P., Burgess, P. J., & Girkin, N. T. (2023). Opportunities for enhancing the climate resilience of coffee production through improved crop, soil and water management.

- Agroecology and Sustainable Food Systems*, 47(8), 1125–1157.
<https://doi.org/10.1080/21683565.2023.2225438>
- Bro, A. S., Ortega, D. L., Clay, D. C., & Richardson, R. B. (2020). Understanding individuals' incentives for climate change adaptation in Nicaragua's coffee sector. *Climate and Development*, 12(4), 332–342. <https://doi.org/10.1080/17565529.2019.1619506>
- Choudhary, A. K. (2023). *Prifysgol Bangor / BAngor University Acceptance of bio-degradable Stoverpack among agricultural products market actors in Kampala and Wakiso districts Charlton,. December 2013.*
- Clay, D. C., Bro, A. S., Church, R. A., Ortega, D. L., & Bizoza, A. R. (2018). Farmer incentives and value chain governance: Critical elements to sustainable growth in Rwanda's coffee sector. *Journal of Rural Studies*, 63(January), 200–213.
<https://doi.org/10.1016/j.jrurstud.2018.06.007>
- Courtois, P., & Subervie, J. (2014). Farmer bargaining power and market information services. *American Journal of Agricultural Economics*, 97(3), 953–977.
<https://doi.org/10.1093/ajae/aau051>
- Diirro, G., Kawooya, D., Lybbert, T. J., & Wunsch-Vincent, S. (2023). Upstream innovation leakage in Uganda's coffee planting material pipeline. *European Review of Agricultural Economics*, 50(3), 1013–1038. <https://doi.org/10.1093/erae/jbad003>
- Dillon, B., & Dambro, C. (2017). How Competitive Are Crop Markets in Sub-Saharan Africa? *American Journal of Agricultural Economics*, 99(5), 1344–1361.
<https://doi.org/10.1093/ajae/aax044>
- East African Community. (2022). *East African Community The East African Community Food and Nutrition Security Action Plan 2018-2022*. 255(0).

- Elias, R. (2021). *Climate Change Perception and Adaptive strategies among Smallholder Coffee Farmers in Sheema District, Southwestern Uganda*.
- Fitriani, Arifin, B., Ismono, R. H., Prasmatiwi, F. E., Lestari, D. A. H., Sutarni, & dan Didik Kuswadi. (2022). Lisensi Ciptaan disebarluaskan di bawah Lisensi Creative Commons Atribusi-BerbagiSerupa 4.0 Internasional.'s Perspective On Facing Unsustainable Risks Of Coffee Farming. *Jurnal Penelitian Pertanian Terapan*, 22(1), 96–103.
- Franzin, M. L., Moreira, C. C., da Silva, L. N. P., Martins, E. F., Fadini, M. A. M., Pallini, A., Elliot, S. L., & Venzon, M. (2022). Metarhizium Associated with Coffee Seedling Roots: Positive Effects on Plant Growth and Protection against *Leucoptera coffeella*. *Agriculture (Switzerland)*, 12(12). <https://doi.org/10.3390/agriculture12122030>
- Fromm, I. (2011). Upgrading in Agricultural Value Chains: The Case of Small Producers in Honduras. *SSRN Electronic Journal*, 64. <https://doi.org/10.2139/ssrn.1071669>
- Galema, S., Male, D., Mbabazi, M., Mutambuka, M., Muzira, R., Namboozee, J., Ruma, D.H., Byakika, S., Muyanja, Ingram, J., Dengerink, J. (2024). *AAAn overview of the Ugandan Food System: Outcomes, Drivers & Activities*.
- Garner, O., Goultnik, M., & Muller, C. (2020). *Sustainable coffee for san martin reinventing the agricultural value chain through cooperatives and agroforestry*. 1–30.
- Gelaw, F., Speelman, S., & van Huylenbroeck, G. (2017). Impacts of Institutional Intervention on Price Transmissions: The Case of the Ethiopian Commodity Exchange. *Review of Development Economics*, 21(4), e88–e106. <https://doi.org/10.1111/rode.12312>
- Gereffi, G. (2019). Economic upgrading in global value chains. *Handbook on Global Value Chains*, November, 240–254. <https://doi.org/10.4337/9781788113779.00022>
- Giraldo-Liévano, X. F. Q.-R. and T. (2022). Quality and Value Appropriation by Colombian

- Coffee Producers: Starting to Fill the Gap from a Gender Perspective. In *Alpine Landgesellschaften zwischen Urbanisierung und Globalisierung*.
<https://doi.org/10.1007/978-3-658-36562-2>
- Grabs, B. J., Mathe, A., & Lambert, S. (2022). *An overview and analysis of global climate-related interventions in the coffee sector*. 1–25.
- Hassen, K., Zinab, B., & Belachew, T. (2016). Gender and education as predictors of food insecurity among coffee farming households of the Jimma zone, Southwest of Ethiopia. *BMC Nutrition*, 2(1), 1–7. <https://doi.org/10.1186/s40795-016-0116-0>
- Hill, R. V., Maruyama, E., Olapade, M., & Frölich, M. (2021). Strengthening producer organizations to increase market access of smallholder farmers in Uganda. *Agricultural and Resource Economics Review*, 50(3), 436–464. <https://doi.org/10.1017/age.2021.19>
- International Coffee Organization (ICO). (2023). *Coffee Report and Outlook*.
- International Coffee Organization - ICO. (2021). *The future of Coffee. Investing in youth for a resilient and sustainable coffee sector*. 1–98.
- Israel, G. D. (2013). *Determining Sample Size 1. November 1992*, 1–5.
- Issa, N., & Chrysostome, N. J. (2015). Determinants of Farmer Participation in the Vertical Integration of the Rwandan Coffee Value Chain: Results from Huye District. *Journal of Agricultural Science*, 7(9), 197–211. <https://doi.org/10.5539/jas.v7n9p197>
- Jassogne, L., van Asten, P. J. A., Wanyama, I., & Baret, P. V. (2013). Perceptions and outlook on intercropping coffee with banana as an opportunity for smallholder coffee farmers in Uganda. *International Journal of Agricultural Sustainability*, 11(2), 144–158.
<https://doi.org/10.1080/14735903.2012.714576>
- Jezeer, R. E., Santos, M. J., Verweij, P. A., Boot, R. G. A., & Clough, Y. (2019). Benefits for

- multiple ecosystem services in Peruvian coffee agroforestry systems without reducing yield. *Ecosystem Services*, 40(September), 101033. <https://doi.org/10.1016/j.ecoser.2019.101033>
- Kamau, V., Ateka, J., Mbeche, R., & Kavoi, M. M. (2017). Assessment of Technical Efficiency of Smallholder Coffee Farming Enterprises in Muranga, Kenya. *Technical Efficiency in Coffee Farming JAGST*, 18(1), 12.
- Kangile, J. R., Kadigi, R. M. J., Mgeni, C. P., Munishi, B. P., Kashaigili, J., & Munishi, P. K. T. (2021). The role of coffee production and trade on gender equity and livelihood improvement in Tanzania. *Sustainability (Switzerland)*, 13(18), 1–14. <https://doi.org/10.3390/su131810191>
- Kattel, R. R. (2015). Adoption of Technology Upgrading by Rural Smallholders in the Nepalese Coffee Sector. *Sukkur IBA Journal of Management and Business*, 2(2), 1–19. <https://doi.org/10.30537/sijmb.v2i2.91>
- Kilelu, C., Klerkx, L., Omore, A., Baltenweck, I., Leeuwis, C., & Githinji, J. (2017). Value Chain Upgrading and the Inclusion of Smallholders in Markets: Reflections on Contributions of Multi-Stakeholder Processes in Dairy Development in Tanzania. *European Journal of Development Research*, 29(5), 1102–1121. <https://doi.org/10.1057/s41287-016-0074-z>
- Kobusinge, J., Gabiri, G., Kagezi, G. H., Sseremba, G., Nakitende, A., Arinaitwe, G., & Twesigye, C. K. (2023). Potential of Moisture Conservation Practices to Improve Soil Properties and Nutrient Status of Robusta Coffee Plant. *Agronomy*, 13(4), 1–19. <https://doi.org/10.3390/agronomy13041148>
- Kumar, V., Wankhede, K. G., & Gena, H. C. (2015). Livelihood of Farmers on Sustainable Basis. *American Journal of Educational Research*, 3(10), 1258–1266.

<https://doi.org/10.12691/education-3-10-8>

Kwon, D. J., Jeong, H. J., Moon, H., Kim, H. N., Cho, J. H., Lee, J. E., Hong, K. S., & Hong, Y. S. (2015). Assessment of green coffee bean metabolites dependent on coffee quality using a ¹H NMR-based metabolomics approach. *Food Research International*, 67, 175–182.

<https://doi.org/10.1016/j.foodres.2014.11.010>

Lauren F. Bergquist, Benjamin Faber , Thibault Fally, Matthias Hoelzlein, E., & Andrés Rodríguez-Clare. (2022). *Scaling Agricultural Policy Interventions*. 0, 1–23.

Liebig, T., Jassogne, L., Rahn, E., Läderach, P., Poehling, H. M., Kucel, P., Van Asten, P., & Avelino, J. (2016). Towards a collaborative research: A case study on linking science to farmers’ perceptions and knowledge on Arabica Coffee Pests and Diseases and Its Management. *PLoS ONE*, 11(8), 1–23. <https://doi.org/10.1371/journal.pone.0159392>

Mercy W. Kamau, Lawrence Mose, Ricardo Fort, R. R. (2015). The Impact of Certification on Smallholder Coffee Farmers in Kenya: The case of ‘UTZ’ certification program. *AgEcon Search*, 18.

Morjaria, R. M. A. (2022). Acquisitions, Management, and Efficiency in Rwanda’s Coffee Industry. *Angewandte Chemie International Edition*, 6(11), 951–952., 3(2), 1.

Mulyati, H., & Indrawan, D. (2021). Inclusive Business Models in Coffee Value Chain: Comparing Practical Evidence Between East Java and North Sumatera. *Jurnal Manajemen Dan Agribisnis*, 18(2), 122–130. <https://doi.org/10.17358/jma.18.2.122>

Nabaasa, E., Kalibwani, R. M., & Semakula, E. (2023). Institutional Factors and Technology Adoption amongst Smallholder Coffee Farmers in Kanungu District South-Western Uganda. *Journal of Agricultural Science and Food Research*, 14(2), 1–12. <https://doi.org/10.20944/preprints202204.0145.v1>

- Neilson, J., Wright, J., & Aklimawati, L. (2018). Geographical indications and value capture in the Indonesia coffee sector. *Journal of Rural Studies*, 59(May 2017), 35–48.
<https://doi.org/10.1016/j.jrurstud.2018.01.003>
- Onyas, W. I. (2023). Enacting overlapping exchanges to address market concerns: Evidence on sustainable and conventional coffee markets in Uganda. *Marketing Theory*, 23(3), 411–435.
<https://doi.org/10.1177/14705931221139317>
- Parente-Laverde, A. M. (2020). Value chain and economic development: The case of the Colombian coffee industry. *Organizations and Markets in Emerging Economies*, 11(1), 173–188. <https://doi.org/10.15388/omee.2020.11.29>
- Piao, R. S., Fonseca, L., Carvalho, E., Macchione Saes, M. S., & Florencio de Almeida, L. (2019). The adoption of Voluntary Sustainability Standards (VSS) and value chain upgrading in the Brazilian coffee production context. *Journal of Rural Studies*, 71(September), 13–22. <https://doi.org/10.1016/j.jrurstud.2019.09.007>
- Ponte, S. (2022). The hidden costs of environmental upgrading in global value chains. *Review of International Political Economy*, 29(3), 818–843.
<https://doi.org/10.1080/09692290.2020.1816199>
- Pradeepa Babu, B. N., Gokavi, N., Rudragouda, C. S., & Reddy, Y. B. V. (2019). Value Chain Upgrading Strategies for Integration of Indian Small Coffee Growers in Global Coffee Value Chain. *Economic Affairs (New Delhi)*, 64(4), 717–723.
<https://doi.org/10.30954/0424-2513.4.2019.6>
- Rangsaritvorakarn, N., & Nimsai, S. (2023). *The value chain analysis and margin analysis of Thai premium Arabica coffee in Japan market*. 9, 144–155.
- Richey, L. A., & Ponte, S. (2021). Brand Aid and coffee value chain development interventions:

- Is Starbucks working aid out of business? *World Development*, 143.
<https://doi.org/10.1016/j.worlddev.2020.105193>
- Rifin, Amzul; Naully, D. (2020). *The Impact Of Involvement In The Global Value Chain On Coffee Farmers In Indonesia : Case Study Of Margamulya Coffee Producer Cooperative And Mitra Malabar Cooperative , Bandung , Indonesia* Amzul Rifin And Dahlia Naully Asian Development Bank Institute. 1143, 1–17.
- Rosenberg, M. N. (2023). *Quality Matters : A Relational Approach to Transforming Coffee Production in Burundi* (Issue September).
- Ruben, R. (2024a). From market-based development to value chain transformation: What markets can (not) do for rural poverty alleviation? *Journal of Rural Studies*, 109(June), 103328. <https://doi.org/10.1016/j.jrurstud.2024.103328>
- Ruben, R. (2024b). *What Smallholders Want : Effective Strategies for Rural Poverty Reduction*.
- Sarker, G. N. T. N. and T. (2018). Sustainable coffee supply chain management: a case study in Buon Me Thuot City, Daklak, Vietnam. *International Journal of Corporate Social Responsibility*, 3(1), 1–17. <https://doi.org/10.1186/s40991-017-0024-x>
- Schuit, P., Moat, J., Gole, T. W., Challa, Z. K., Torz, J., MacAtonia, S., Cruz, G., & Davis, A. P. (2021). The potential for income improvement and biodiversity conservation via specialty coffee in Ethiopia. *PeerJ*, 9, 1–29. <https://doi.org/10.7717/peerj.10621>
- Stofya, H. (2023). The Effect of Environmental Sustainability and Value Chain Concept in the Context of Local Economy on Value Added of Coffee Commodities in Kerinci. *West Science Business and Management*, 1(03), 107–117.
<https://doi.org/10.58812/wsbm.v1i03.84>
- Uganda Coffee Development Authority (UCDA), U. C. D. A. (2019). *A Sustainable Coffee*

Industry with High Stakeholder Value for Social Economic Transformation.

- Uganda Coffee Development Authority (UCDA). (2013). Uganda Coffee Development Authority. *Uganda's Coffee Exports from 1964/65 - 2014/15*, 22, vii–1.
<http://www.ugandacoffee.org/index.php?page&i=15>
- Uganda Coffee Development Authority (UCDA). (2023). *Report CY 2022/23 Issue 4. January*.
- Upla, P., Reed, J., Moombe, K. B., Kazule, B. J., Mulenga, B. P., Ros-Tonen, M., & Sunderland, T. (2022). Assessing the Potential for Private Sector Engagement in Integrated Landscape Approaches: Insights from Value-Chain Analyses in Southern Zambia. *Land*, 11(9).
<https://doi.org/10.3390/land11091549>
- Utrilla-Catalan, R., Rodríguez-Rivero, R., Narvaez, V., Díaz-Barcos, V., Blanco, M., & Galeano, J. (2022). Growing Inequality in the Coffee Global Value Chain: A Complex Network Assessment. *Sustainability (Switzerland)*, 14(2), 1–27. <https://doi.org/10.3390/su14020672>
- van Keulen, M., & Kirchherr, J. (2021). The implementation of the Circular Economy: Barriers and enablers in the coffee value chain. *Journal of Cleaner Production*, 281, 125033.
<https://doi.org/10.1016/j.jclepro.2020.125033>
- Verburg, R., Rahn, E., Verweij, P., van Kuijk, M., & Ghazoul, J. (2019). An innovation perspective to climate change adaptation in coffee systems. *Environmental Science and Policy*, 97(April), 16–24. <https://doi.org/10.1016/j.envsci.2019.03.017>
- Vicol, M., Neilson, J., Hartatri, D. F. S., & Cooper, P. (2018). Upgrading for whom? Relationship coffee, value chain interventions and rural development in Indonesia. *World Development*, 110, 26–37. <https://doi.org/10.1016/j.worlddev.2018.05.020>
- Winarno, S. T., & Harijani, W. S. (2022). Robusta coffee (*Coffea canephora*) value chain in East

Java, Indonesia. *Agronomia Mesoamericana*, 33(3).

<https://doi.org/10.15517/am.v33i3.48082>

Yadava, C. G., Arun, M., Santhosha, K. M., Manohar, B. H., Chandrarekha, C., & Gagana, M.

D. (2022). Value Chain Upgrading Strategies for Sustainable Coffee Industry:- A Visionary SWOT Approach. *Asian Journal of Agricultural Extension, Economics & Sociology*, 40(12), 232–244. <https://doi.org/10.9734/ajaees/2022/v40i121786>

APPENDICES

APPENDIX 1: QUESTIONNAIRE

Questionnaire on coffee value chain Upgrading

I am **Vincent Orach Ochaya**, student from the Faculty of Agriculture and Environment, Gulu University. I am conducting a study on coffee value chain upgrading opportunities. You have been selected as a respondent to this study based on your experience concerning coffee production, processing and marketing. We request you to reserve some time to respond to the questions. For your self-assurance, your responses to our questions will be treated with utmost confidentiality. Neither your identity nor your responses will be shared or used for any other purposes except this study. If you agree, we kindly request you to confirm by signing in this space.

Date

Questionnaire number:

Village/Town.....Sub- County..... (1=Paidha, 2=Nyapea 3=Erussi & 4=Jupangira)

District..... (1=Zombo & 0=Nebbi)

Section A: socio-demographic Information

- 1) Sex of Household Head: ☐ Male ☐ Female
- 2) Age of household head (respondent)
- 3) Marital Status (Tick appropriate): ☐ Married ☐ Divorced ☐ Single ☐ Widowed
- 4) Level of education (Tick) ☐ Primary ☐ Secondary ☐ Tertiary ☐ University
- 5) How many people live in your household?
- 6) What is your primary occupation? ☐ Farming ☐ Civil servant ☐ Business
☐ Pensioner ☐ Religious ☐ Cultural ☐ Others (Specify)
- 7) How many acres of land are you using for agriculture?
- 8) What is nature of your land ownership ☐ Rented ☐ Leased ☐ Customary ☐ Family ☐ Given
☐ Others specify
- 9) How many acres of your land have you allocated for growing coffee?
- 10) How many years have you been producing coffee?
- 11) Other than producing coffee, what other coffee activities are you involved in? ☐ Pulping

- ☐ Hulling ☐ Buying ☐ Storage ☐ Training ☐ Selling ☐ Processing ☐ Transporting
- ☐ Packaging ☐ Others specify _____

Section B: Institutional factors

B1 - Access to Coffee Marketing Information

- a) Do you have access to information on coffee marketing? ☐ Yes ☐ No
- b) If yes in (B1a) above, from where do you get this information? ☐ Extension Worker ☐ NGO ☐ UCDA ☐ Government ☐ Radio ☐ Television ☐ Newspaper ☐ Internet ☐ Others (specify) _____
- c) If Yes in (B1b) above, how often do you get the marketing information? ☐ Daily ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Half-Yearly ☐ Yearly ☐ Others _____
- d) What kind of information do you get? ☐ Pricing ☐ Marketing ☐ Profit ☐ Quality ☐ Grading ☐ Input ☐ Others (specify) _____

B2 – Access to Credit

- b) Do you have access to credit: ☐ Yes ☐ No
- c) If yes in (B2a) above, from where do you get this credit? ☐ Banks ☐ Microfinance ☐ SACCO ☐ Cooperatives ☐ Government ☐ NGO ☐ Family ☐ Donation ☐ VSLA group ☐ Others specify _____
- d) How frequent do you access the credit in (B2c) above? ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Half Yearly ☐ Yearly ☐ Seasonally ☐ Others Specify _____
- e) For what purpose did you get the credit? ☐ Production ☐ Coffee Buying ☐ Equipment ☐ Marketing ☐ Packaging ☐ Transportation ☐ Exportation ☐ Others specify _____

B3 Extension Workers Services:

- a) Do you have access to coffee extension services: ☐ Yes ☐ No

- b) If yes in (B3a) above, what is the source of the extension worker come from? ☐ Government
☐ Local Government ☐ UCDA ☐ Banks ☐ Cooperatives ☐ NGO ☐ Others
specify _____
- e) How frequent do the extension workers visit you? ☐ Monthly ☐ Quarterly ☐ Half Yearly
☐ Yearly ☐ Seasonally ☐ Others Specify _____
- f) What kind of extension services do you get from these workers? ☐ Good Agronomic practices
☐ coffee marketing ☐ coffee processing ☐ financial access ☐ business skills ☐ Others
(specify) _____

B4 Farmer Group (Cooperative) Belonging:

- a) Do you belong to a Coffee farmer group: ☐ Yes ☐ No
- b) If yes in (B4a) above, what type of group is it? ☐ VSLA
☐ Farmers groups ☐ Buyers group ☐ Transporters ☐ Exporters ☐ cooperative ☐ Others
specify _____
- c) What kinds of activities are conducted by the group? ☐ Production ☐ Marketing ☐
Processing ☐ Upgrading ☐ Credit Facility ☐ Incentives ☐ Extension services ☐
Others (specify) ____

B5. Incentives to Farmers

- a) Do you get some form of coffee incentives: ☐ Yes ☐ No
- b) If yes in (in B5a) above, what type of incentive do you get? ☐ Input ☐ Training
☐ Equipment ☐ Subsidies ☐ Transport ☐ Others specify _____
- c) If yes in (B5b) above, what was the source of the incentives? ☐ Government
☐ Private business entity ☐ NGOs ☐ UCDA ☐ Coffee cooperative ☐ Others Specify

- d) Are you aware of the different coffee grades and standards? ☐ Yes ☐ No
- e) If yes in (B5d) above, which coffee grades you are aware of? ☐ Speciality coffee ☐ Premium
Coffee ☐ Exchange Coffee ☐ Standard Coffee ☐ Off-grade coffee ☐ Others Specify

- f) If yes in (B5e) above, which grades are you producing and selling? ☐ Speciality coffee ☐ Premium Coffee ☐ Exchange Coffee ☐ Standard Coffee ☐ Off-grade coffee ☐ Others Specify _____

Section C: Value chain upgrading opportunities

C1. Product Upgrade

- a) Other than red cherries coffee, do you process other coffee products? ☐ Yes ☐ No
b) If yes in C1 (a) above, please answer the following questions

S/N	Products	Quantity sold in the last one year?	What is the Motivation behind producing this product? (tick all that apply)	What are the barriers for not producing this product?
1.	☐ Red coffee cherries	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs ☐ Others.....
2.	☐ Dry coffee cherries	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs ☐ Others.....
3.	☐ Parchment Coffee	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs

S/N	Products	Quantity sold in the last one year?	What is the Motivation behind producing this product? (tick all that apply)	What are the barriers for not producing this product?
				☐ Others.....
4.	☐ Dried green coffee beans	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs ☐ Others.....
5.	☐ Roasted coffee beans	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs ☐ Others.....
6.	☐ Ground powdered coffee	☐ Below 500kgs ☐ 501 – 1000kg ☐ 1001 – 5000kgs ☐ 5001-10000kgs ☐ 10001-50000kgs ☐ 50001- 100000kgs ☐ Above 100,000kgs	☐ Profitable ☐ Attract High Price ☐ Access to market ☐ Access to Processing ☐ Demand by customers ☐ Need for cash ☐ Farmer group influence	☐ Losses ☐ Low Prices ☐ Limited Market ☐ Poverty ☐ No Group supports ☐ High costs ☐ Others.....

C2. Process Upgrade

- c) Other than picking red cherries as a product, what other coffee processing activities are you undertaking? ☐ Pulping, ☐ Hulling, ☐ Washing ☐ Drying, ☐ Sorting, ☐ Grading, ☐ Roasting, ☐ Grinding ☐ Others (specify) _____

- d) Are you involved in upgrading any of the processes in (d) above? ☐ Yes ☐ No
- e) If yes, which of coffee process upgrade are you undertaking, what has changed in 5 years, what motivated you and what are the challenges faced? (tick in the appropriate box in the table below)

S/ N	Process Upgrade you are undertaking	What has changed over the past 5 years?	What Motivated you?	What are the Challenges faced?
1.	Sorting Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other
2.	Pulping Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other
3.	Hulling Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other
4	Cleaning Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other

S/ N	Process Upgrade you are undertaking	What has changed over the past 5 years?	What Motivated you?	What are the Challenges faced?
5.	Drying Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other
6.	Roasting Coffee	<u>Changes after 5 years</u> <u>roast</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other
7.	Grinding Coffee	<u>Changes after 5 years</u> ☐ Better Equipment used ☐ Labour improved ☐ The Time Taken reduced ☐ Technology added ☐ More Capital secured ☐ Access to Finance ☐ Others	☐ High Profit ☐ High Price ☐ Ready Market ☐ Quick Cash ☐ Customer Needs ☐ Others.....	☐ Loses ☐ Low Prices ☐ Limited Market ☐ No Group ☐ High Costs ☐ Other

C3 **Functional Upgrade**

- f) Apart from production, do you perform other coffee value chain functions? i.e., transporting, processing, bulking, marketing? ☐ Yes ☐ No
- g) If yes in (g), to what extent do you perform the function, the motivation and the challenges faced to perform the function? (Please fill the table below by ticking the appropriate both with your answer)

S/N	Types of Function Upgrade	What is the Motivation behind adopting more functions?	What are the challenges faced?
1.	Picking red cherry from farm and selling right away to buyers. (Pick & retail)	☐ High Profit ☐ High Price ☐ Ready Market	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group

S/N	Types of Function Upgrade	What is the Motivation behind adopting more functions?	What are the challenges faced?
		☐ Need for Cash ☐ Others.....	☐ Weather conditions ☐ Other
2.	Picking red cherry from farm, pulping and selling while wet (Pick, pulp and retail wet)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
3.	Picking red cherry from farm, pulping, drying, hulling, and selling (Pick, pulp, hull, dry and sell)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
4.	Picking red cherry, picking red cherry from farm, pulping, hulling, drying, grading and selling (Pick, pulp, hull, dry, grade and retail)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
5.	Picking red cherry from farm, pulping, hulling, drying, grading, packaging and selling (Pick, pulp, hull, dry, grade, package and retail)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
6.	Picking red cherry from farm, pulping, drying, hulling, roasting, packaging, marketing and selling (Pick, pulp, hull, dry, grade, roasting, package, market and retail)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
7.	Picking red cherry from farm, pulping, drying, hulling, grading, roasting, grinding, packaging, marketing and selling <i>(Pick, pulp, buy, hull, dry, grade, roasting, package, market and retail)</i>	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
8.	Picking red cherry from farm, pulping, drying, hulling, buying	☐ High Profit	☐ Loses ☐ Limited Market

S/N	Types of Function Upgrade	What is the Motivation behind adopting more functions?	What are the challenges faced?
	grading, roasting, grinding packaging, marketing, transporting, wholesaling and retailing (Pick, pulp, buy, hull, dry, grade, roasting, package, market, transport and retail)	☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other
9.	Picking red cherry from farm, pulping, drying, hulling, buying grading, roasting, grinding. packaging, marketing, retailing, wholesale, transporting and exporting (Pick, pulp, buy, hull, dry, grade, roasting, package, market, transport, export and retail)	☐ High Profit ☐ High Price ☐ Ready Market ☐ Need for Cash ☐ Others.....	☐ Loses ☐ Limited Market ☐ Poverty ☐ No Group ☐ Weather conditions ☐ Other

Thank you very much for your valuable time

APPENDIX 2: GUREC APPROVAL

GULU

P.O. Box 166, Gulu (U)
Website: www.gu.ac.ug
Email: gurec@gu.ac.ug



UNIVERSITY

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+256 776 812 147

RESEARCH ETHICS COMMITTEE

14/10/2023

To: Vincent Ochaya

Gulu University
0772648768

Type: Initial Review

Re: GUREC-2023-650: ANALYSIS OF COFFEE VALUE CHAIN UPGRADING OPPORTUNITIES IN ZOMBO AND NEBBI DISTRICTS, UGANDA

I am pleased to inform you that at the **104th** convened meeting on **06/07/2023**, the Gulu University REC meeting voted to approve the above referenced application.

Approval of the research is for the period of **14/10/2023** to **14/10/2024**.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **14/10/2024** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Gulu University REC:

No.	Document Title	Language	Version Number	Version Date
1	Protocol	English	2.0	2023-10-11
2	Data collection tools	ENGLISH	3.0	2023-09-22
3	Informed Consent forms	ENGLISH	3.0	2023-09-22
4	Informed Consent forms	ALUR	3.0	2023-09-22
5	COVID 19 RISK MANAGEMENT PLAN	ENGLISH	2.0	2023-06-26

Yours Sincerely



Dr. Gerald OBAI
For: Gulu University REC

APPENDIX 3: ACCEPTANT LETTER

GULU UNIVERSITY

P. O. BOX 166
Gulu-Uganda

TEL: +256 471 432518
FAX: +256 471 432994
Email: fac@gu.ac.ug
URL: www.gu.ac.ug

FACULTY OF AGRICULTURE & ENVIRONMENT

Date: 24th October 2023

The Chief Administrative Officer,
Nebbi District.

Dear Sir,

RE: INTRODUCTION OF MR. ORACH OCHAYA VINCENT

I would like to introduce the bearer of this letter (Mr. Orach Ochaya Vincent) who is a student of Gulu University Pursing a Master of Science in Agri-enterprises Development registration number: 21/U/2397/MAE/PS.

He is conducting academic research on the topic: **"ANALYSIS OF COFFEE VALUE CHAIN UPGRADING OPPORTUNITIES IN ZOMBO AND NEBBI DISTRICTS"**. He will be meeting smallholder coffee farmers in your district to obtain information on coffee production.

All information obtained will majorly be used for academic purposes and as well, it may help policy makers and programme designers to select and tailor new coffee value chain opportunities uptake, interventions and innovations in improving smallholder coffee livelihood in this country.

All the necessary support rendered to him Shall be highly appreciated.

Thank you.

 24/10/23

Dr. Walter Odongo
Head of Department Rural Development and Agribusiness
Tel. +256-777 036100,
Email: odongo78@gmail.com

Permission granted

P. O. BOX 1, NEBBI

GULU

P. O. BOX 166
Gulu-Uganda



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TEL: +256 471 432518
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Email: fac@gu.ac.ug
URL: www.gu.ac.ug

FACULTY OF AGRICULTURE & ENVIRONMENT

Date: 24th October 2023

The Chief Administrative Officer,
Zombo District

Dear Sir,

RE: INTRODUCTION OF MR. ORACH OCHAYA VINCENT

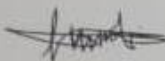
I would like to introduce the bearer of this letter (Mr. Orach Ochaya Vincent) who is a student of Gulu University Pursing a Master of Science in Agri-enterprises Development registration number: 21/U/2397/MAE/PS.

He is conducting academic research on the topic: "ANALYSIS OF COFFEE VALUE CHAIN UPGRADING OPPORTUNITIES IN ZOMBO AND NEBBI DISTRICTS". He will be meeting smallholder coffee farmers in your district to obtain information on coffee production.

All information obtained will majorly be used for academic purposes and as well, it may help policy makers and programme designers to select and tailor new coffee value chain opportunities uptake, interventions and innovations in improving smallholder coffee livelihood in this country.

All the necessary support rendered to him Shall be highly appreciated.

Thank you.

 24/10/23

Dr. Walter Odongo
Head of Department Rural Development and Agribusiness
Tel. +256-777 036100,
Email: odongo78@gmail.com



APPENDIX 4: PLAGIARISM CERTIFICATE

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P.O. Box 166
Gulu, Uganda



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Emails: ul@gu.ac.ug
URL: www.gu.ac.ug

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PLAGIARISM CHECK

Declaration for Originality Form

This form must be completed and signed for all scholarly work produced.

Name: ORACH OCHAYA VINCENT (MR.)

Personal File No.(staff) Reg. (student). 21/U/2397/MAE/PS

Faculty/Institute: AGRICULTURE AND ENVIRONMENT, GULU UNIVERSITY

Department: RURAL DEVELOPMENT AND AGRIBUSINESS

Title and bibliographic description of the work

**ANALYSIS OF COFFEE VALUE CHAIN UPGRADING OPPORTUNITIES
IN ZOMBO AND NEBBI DISTRICTS, UGANDA**

Declaration.

1. I understand what plagiarism is and I am aware of the University policy on this regard,
2. I declare that this **Dissertation** ... (thesis, Proposal, essay, assignment, paper, report etc.) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my work has been used, this has been properly acknowledged and referenced in accordance with Gulu University requirements,
3. I have not sought or used the services of any professional agency to produce this work,
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own,
5. I understand that any false claim of this work shall result in disciplinary action in accordance with University Policy on Plagiarism.

Signature

Date

29/08/2024

Originality Report

The article/thesis/document titled above have been subjected to plagiarism check and the level was found to be.....**16%** (percent) this is classified as:

- ☒ Minor
☐ Moderate
☐ Serious

Yours sincerely,

Manana N Herbert
Ag. University Librarian



APPENDIX 5: ANALYSIS OUTPUT

Correlation matrix for product upgrading

```
. cor Zombo Male log_hhsize Main_occupation log_farm log_Cland Price_info CreditAccess GAP_ext Proce
> ss_ext BDS_Ext Incentive_NGO Incentive_UCDA Incentive_PrivateBusines Equipment Aware_Sociality Awa
> re_Premium Aware_offgrade
(obs=288)
```

	Zombo	Male	log_hhsize	Main_occupation	log_farm	log_Cland	Price_info	CreditAccess	GAP_ext	Process_ext	BDS_Ext	Incentive_NGO	Incentive_UCDA	Incentive_PrivateBusiness	Equipment	Aware_Sociality	Aware_Premium	Aware_offgrade
Zombo	1.0000																	
Male	-0.0121	1.0000																
log_hhsize	-0.1084	0.0987	1.0000															
Main_occupation	0.0620	0.0474	0.0270	1.0000														
log_farm	-0.1037	0.1315	0.2614	0.0109	1.0000													
log_Cland	0.0578	0.1274	-0.1647	-0.0638	0.1615	1.0000												
Price_info	-0.0411	0.1000	0.0155	-0.0448	0.0338	0.0432	1.0000											
CreditAccess	0.1275	-0.0496	-0.2642	-0.1507	-0.0539	0.2164	0.2013	1.0000										
GAP_ext	0.1435	0.0316	-0.0841	0.0596	0.0319	0.1299	0.2670	0.2282	1.0000									
Process_ext	-0.4538	-0.0384	0.0728	-0.0698	0.0199	-0.0006	0.1342	-0.0832	0.3418	1.0000								
BDS_Ext	0.0879	-0.0417	0.0132	-0.1723	0.0586	0.1668	0.1001	0.3139	0.1183	0.0201	1.0000							
Incentive_NGO	0.4079	0.0105	0.0218	-0.0009	0.0854	-0.0463	-0.0633	0.0229	0.2099	-0.0695	0.1533	1.0000						
Incentive_UCDA	0.0101	-0.0635	-0.1627	-0.0199	0.0274	0.1758	0.0603	0.2837	0.4331	0.3089	0.1461	0.2186	1.0000					
Incentive_PrivateBusiness	0.3254	0.0316	0.0139	0.0005	-0.1413	-0.0204	0.0011	0.1507	0.1393	-0.1493	0.0834	0.0276	-0.0032	1.0000				
Equipment	0.0207	0.0357	-0.3009	0.0287	0.0690	0.3217	0.2047	0.4721	0.2126	0.0283	0.0088	-0.1968	0.2414	-0.0022	1.0000			
Aware_Sociality	-0.0413	0.1900	-0.0857	0.0135	-0.0048	0.1774	0.3899	0.2701	0.3956	0.1712	0.0764	-0.0981	0.0999	0.1206	0.2642	1.0000		
Aware_Premium	-0.0592	0.1119	-0.1093	-0.0945	0.0924	0.0855	0.0164	0.0675	0.0710	0.1260	-0.0519	0.0600	0.1615	-0.0834	0.0618	0.1024	1.0000	
Aware_offgrade	-0.2193	0.0747	0.0192	-0.0902	0.0729	0.0360	0.0928	-0.0445	0.0444	0.2216	0.0660	-0.1072	0.1389	-0.1842	0.0666	0.1163	0.2185	1.0000

Correlation matrix for process upgrading

```
. cor Zombo Male Education Main_occupation log_farm Mkt_info_Radio Price_info Info_quality CreditAcc
> ess Extension Group_Mkt Group_process Input Equipment
(obs=288)
```

	Zombo	Male	Education	Main_occupation	log_farm	Mkt_info_Radio	Price_info	Info_quality	CreditAccess
Zombo	1.0000								
Male	-0.0121	1.0000							
Education	0.1690	0.0442	1.0000						
Main_occupation	0.0620	0.0474	-0.3314	1.0000					
log_farm	-0.1037	0.1315	-0.0598	0.0109	1.0000				
Mkt_info_Radio	-0.1662	0.1128	0.1005	-0.0133	-0.0256	1.0000			
Price_info	-0.0411	0.1000	0.0452	-0.0448	0.0338	-0.0149	1.0000		
Info_quality	-0.3323	0.0950	-0.0585	0.0481	0.0563	0.3051	0.1482	1.0000	
CreditAccess	0.1275	-0.0496	0.0535	-0.1507	-0.0539	0.1241	0.2013	-0.0551	1.0000
Extension	0.1698	0.0432	-0.0836	0.0753	0.0017	-0.2756	0.2862	0.0681	0.2047
Group_Mkt	-0.0198	0.1061	-0.1308	0.1268	0.1155	-0.2271	0.2519	0.0963	0.1594
Group_process	-0.3869	0.0438	-0.1606	0.0023	0.0820	-0.2841	0.1864	0.1819	-0.0254
Input	0.1864	-0.0163	-0.0113	0.0145	-0.0335	-0.1843	0.0478	-0.0604	0.0027
Equipment	0.0207	0.0357	0.0671	0.0287	0.0690	0.1591	0.2047	0.0459	0.4721

	Extension	Group_Mkt	Group_process	Input	Equipment
Extension	1.0000				
Group_Mkt	0.6273	1.0000			
Group_process	0.3134	0.4996	1.0000		
Input	0.3886	0.2967	0.1980	1.0000	
Equipment	0.2030	0.1153	0.0856	-0.0606	1.0000

Correlation matrix for function upgrading

```
. cor Function_up2 Zombo Male Education log_exp log_hhsize Main_occupation log_Cland Credit_prodn BDS
> S_Ext Group_prodn Equipment Aware_Premium Red_Cherries Parchment
(obs=288)
```

	Function_up2	Zombo	Male	Education	log_exp	log_hhsize	Main_occupation	log_Cland	Credit_prodn
Function_up2	1.0000								
Zombo	0.0181	1.0000							
Male	0.0063	-0.0121	1.0000						
Education	0.0286	0.1690	0.0442	1.0000					
log_exp	0.0043	0.1061	0.0324	-0.2040	1.0000				
log_hhsize	0.0331	-0.1084	0.0987	-0.0382	0.2743	1.0000			
Main_occupation	0.0447	0.0620	0.0474	-0.3314	0.1678	0.0270	1.0000		
log_Cland	0.0492	0.0578	0.1274	0.0364	-0.1373	-0.1647	-0.0638	1.0000	
Credit_prodn	-0.1372	0.1145	-0.0367	0.0585	-0.1041	-0.2542	-0.1228	0.1781	1.0000
BDS_Ext	-0.0749	0.0879	-0.0417	0.0878	-0.0246	0.0132	-0.1723	0.1668	0.2685
Group_prodn	0.0493	0.0196	0.0409	-0.1222	0.2042	0.0211	0.1507	0.0343	0.1937
Equipment	-0.0756	0.0207	0.0357	0.0671	-0.0935	-0.3009	0.0287	0.3217	0.4688
Aware_Premium	0.1671	-0.0592	0.1119	-0.0158	-0.0321	-0.1093	-0.0945	0.0855	0.0895
Red_Cherries	0.1490	-0.1933	-0.0217	-0.0975	-0.0295	-0.0280	-0.0460	-0.0634	-0.0840
Parchment	0.4142	0.0173	0.0867	0.0483	0.0922	-0.0680	-0.0847	0.1039	0.2177

	BDS_Ext	Group_prodn	Equipment	Aware_Premium	Red_Cherries	Parchment
BDS_Ext	1.0000					
Group_prodn	0.0225	1.0000				
Equipment	0.0088	0.1096	1.0000			
Aware_Premium	-0.0519	0.1083	0.0618	1.0000		
Red_Cherries	0.0038	0.0528	-0.0529	0.0571	1.0000	
Parchment	0.1037	0.3794	0.2060	0.2281	0.0272	1.0000

Factors influencing product upgrading

Seemingly unrelated bivariate probit

Red_Cheries Parch~t	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Zombo	-.781	.434	-1.80	.072	-1.633	.07	*
Male	-.306	.368	-0.83	.405	-1.027	.414	
log_hhsize	-.54	.346	-1.56	.119	-1.218	.139	
Main_occupation	-.661	.493	-1.34	.181	-1.628	.306	
log_farm	.585	.286	2.04	.041	.024	1.146	**
log_Cland	-.427	.261	-1.63	.102	-.939	.085	
Price_info	-.429	.339	-1.27	.206	-1.093	.235	
CreditAccess	-.452	.387	-1.17	.244	-1.211	.308	
GAP_ext	1.043	.418	2.49	.013	.224	1.863	**
Process_ext	.557	.561	0.99	.32	-.542	1.656	
BDS_Ext	-.03	.64	-0.05	.963	-1.284	1.225	
Incentive_NGO	.498	.541	0.92	.357	-.562	1.557	
Incentive_UCDA	.339	.331	1.02	.306	-.31	.988	
Incentive_PrivateB	-1.527	.344	-4.43	0	-2.202	-.852	***
~s							
Equipment	-.396	.463	-0.86	.392	-1.303	.51	
Aware_Sociality	.701	.361	1.94	.052	-.007	1.409	*
Aware_Premium	-.151	.461	-0.33	.743	-1.055	.752	
Aware_offgrade	.225	.324	0.69	.488	-.41	.859	
Constant	2.731	.88	3.10	.002	1.007	4.456	***
Zombo	-.041	.327	-0.13	.9	-.681	.599	
Male	.594	.31	1.92	.055	-.013	1.202	*
log_hhsize	-.311	.326	-0.95	.34	-.951	.328	
Main_occupation	-.903	.509	-1.77	.076	-1.901	.095	*
log_farm	.594	.298	1.99	.047	.009	1.178	**
log_Cland	-.451	.355	-1.27	.204	-1.148	.245	
Price_info	.603	.298	2.02	.043	.019	1.188	**
CreditAccess	.742	.703	1.05	.292	-.637	2.121	
GAP_ext	.057	.383	0.15	.882	-.693	.807	
Process_ext	1.236	.39	3.17	.002	.473	2	***
BDS_Ext	6.309	.515	12.25	0	5.299	7.318	***
Incentive_NGO	.889	.476	1.87	.062	-.043	1.821	*
Incentive_UCDA	.935	.323	2.89	.004	.301	1.569	***
Incentive_PrivateB	-.43	.452	-0.95	.342	-1.315	.456	
~s							
Equipment	5.382	.747	7.20	0	3.918	6.847	***
Aware_Sociality	.892	.368	2.43	.015	.172	1.613	**
Aware_Premium	.777	.489	1.59	.112	-.182	1.736	
Aware_offgrade	-.711	.399	-1.78	.075	-1.493	.072	*
Constant	-.448	1.03	-0.43	.664	-2.466	1.57	
athrho	.008	.218	0.04	.97	-.418	.435	
Mean dependent var		0.861	SD dependent var			0.346	
Number of obs		288	Chi-square			1350.151	
Prob > chi2		0.000	Akaike crit. (AIC)			272.910	

*** $p < .01$, ** $p < .05$, * $p < .1$

Factors influencing process upgrading (Multivariate probit)

	Robust					
	Coef.	Std.Err.	z	P>z	[95%Conf.	Interval]
Grade_SpecialtyCoffee						

Zombo	0.227	0.219	1.040	0.299	-0.202	0.656
Male	0.228	0.238	0.960	0.339	-0.239	0.694
Education	0.586	0.230	2.550	0.011	0.135	1.038
HouseholdSize	0.073	0.049	1.480	0.139	-0.024	0.169
Main_occupation	-0.389	0.295	-1.320	0.187	-0.967	0.189
ln_farm_land	-0.436	0.203	-2.150	0.032	-0.834	-0.039
log_C_land	0.349	0.220	1.580	0.113	-0.083	0.781
Ln_exp	-0.220	0.139	-1.580	0.113	-0.492	0.052
KindOfService_CoffeeProcessing	-0.929	0.221	-4.200	0.000	-1.363	-0.495
CreditAccess	0.070	0.193	0.360	0.717	-0.308	0.448
TypeMarketInform_quality	0.024	0.251	0.100	0.924	-0.469	0.516
TypeMarketInform_pricing	0.411	0.192	2.140	0.032	0.034	0.787
FarmerGroup	1.845	0.445	4.140	0.000	0.972	2.717
CoffeeIncentives	0.493	0.550	0.900	0.370	-0.586	1.572
_cons	-1.650	0.591	-2.790	0.005	-2.808	-0.491
Grade_PremiumCoffee						
Zombo	-0.206	0.265	-0.770	0.438	-0.726	0.314
Male	0.221	0.213	1.040	0.299	-0.196	0.638
Education	-0.433	0.245	-1.770	0.077	-0.913	0.046
HouseholdSize	-0.116	0.057	-2.040	0.041	-0.227	-0.005
Main_occupation	-0.735	0.456	-1.610	0.107	-1.629	0.159
ln_farm_land	0.556	0.198	2.800	0.005	0.167	0.945
log_C_land	0.185	0.177	1.050	0.294	-0.161	0.532
Ln_exp	-0.132	0.120	-1.100	0.270	-0.366	0.103
KindOfService_CoffeeProcessing	0.637	0.261	2.440	0.015	0.125	1.149
CreditAccess	1.019	0.383	2.660	0.008	0.269	1.769
TypeMarketInform_quality	-0.408	0.291	-1.400	0.161	-0.979	0.163
TypeMarketInform_pricing	0.027	0.204	0.130	0.895	-0.372	0.426
FarmerGroup	-0.498	0.436	-1.140	0.254	-1.353	0.358
CoffeeIncentives	0.468	0.461	1.020	0.310	-0.435	1.371
_cons	1.293	0.706	1.830	0.067	-0.090	2.677
Grade_OffGradeCoffee						
Zombo	-0.037	0.219	-0.170	0.867	-0.466	0.392
Male	0.140	0.219	0.640	0.522	-0.289	0.569
Education	-0.400	0.232	-1.720	0.085	-0.856	0.055
HouseholdSize	-0.046	0.042	-1.090	0.276	-0.128	0.037
Main_occupation	-0.352	0.332	-1.060	0.288	-1.003	0.298
ln_farm_land	0.327	0.194	1.680	0.092	-0.053	0.708
log_C_land	0.407	0.229	1.780	0.075	-0.041	0.855
Ln_exp	-0.045	0.131	-0.350	0.728	-0.302	0.211
KindOfService_CoffeeProcessing	1.343	0.263	5.100	0.000	0.827	1.859
CreditAccess	0.638	0.226	2.830	0.005	0.196	1.080
TypeMarketInform_quality	-0.493	0.236	-2.090	0.037	-0.956	-0.031
TypeMarketInform_pricing	0.157	0.188	0.840	0.403	-0.211	0.526
FarmerGroup	-0.903	0.353	-2.560	0.011	-1.594	-0.211
CoffeeIncentives	0.829	0.394	2.110	0.035	0.057	1.600
_cons	-0.283	0.576	-0.490	0.623	-1.412	0.846
/atrho21	-0.474	0.131	-3.620	0.000	-0.731	-0.217
/atrho31	-0.160	0.115	-1.390	0.166	-0.386	0.066
/atrho32	0.726	0.140	5.180	0.000	0.451	1.001
rho21	-0.441	0.105	-4.180	0.000	-0.624	-0.214
rho31	-0.159	0.112	-1.410	0.159	-0.368	0.066
rho32	0.621	0.086	7.200	0.000	0.423	0.762

Likelihood ratio test of rho21 = rho31 = rho32 = 0: $\chi^2(3) = 50.2528$ Prob > $\chi^2 = 0.0000$

Multivariate probit (MSL, # draws = 5) Number of obs = 288

Wald $\chi^2(42) = 173.75$

Log pseudolikelihood = -358.49842 Prob > $\chi^2 = 0.0000$

Factors influencing function upgrading (Multivariate Probit Regression)

Robust						
	Coef.	Std.Err.	z	P>z	[95%Conf.	Interval]
Sort_Coffee						
Zombo	-0.354	0.307	-1.160	0.248	-0.955	0.247
Male	-0.049	0.274	-0.180	0.857	-0.586	0.488
Education	0.418	0.275	1.520	0.128	-0.121	0.957
Main_occupation	-0.831	0.342	-2.430	0.015	-1.501	-0.162
log_farm	0.765	0.233	3.280	0.001	0.308	1.221
Mkt_info_Radio	-0.582	0.265	-2.200	0.028	-1.101	-0.063
Price_info	0.765	0.244	3.130	0.002	0.285	1.244
Info_quality	0.189	0.320	0.590	0.555	-0.438	0.816
CreditAccess	1.199	0.336	3.570	0.000	0.541	1.857
Extension	1.028	0.412	2.490	0.013	0.220	1.837
Group_Mkt	-0.111	0.307	-0.360	0.717	-0.713	0.491
Group_process	0.746	0.343	2.170	0.030	0.073	1.419
Input	0.687	0.230	2.980	0.003	0.236	1.139
Equipment	-0.492	0.331	-1.490	0.137	-1.140	0.156
_cons	-1.168	0.608	-1.920	0.055	-2.360	0.023
Pulp_Coffee						
Zombo	-0.448	0.254	-1.770	0.077	-0.946	0.049
Male	-0.163	0.242	-0.670	0.501	-0.637	0.312
Education	0.057	0.248	0.230	0.817	-0.429	0.543
Main_occupation	-0.404	0.404	-1.000	0.317	-1.195	0.388
log_farm	0.577	0.242	2.390	0.017	0.103	1.051
Mkt_info_Radio	-0.560	0.250	-2.240	0.025	-1.050	-0.070
Price_info	0.085	0.214	0.390	0.693	-0.335	0.504
Info_quality	0.204	0.308	0.660	0.508	-0.400	0.808
CreditAccess	1.374	0.285	4.830	0.000	0.816	1.931
Extension	0.857	0.372	2.300	0.021	0.128	1.585
Group_Mkt	0.087	0.296	0.290	0.770	-0.494	0.667
Group_process	0.695	0.330	2.110	0.035	0.049	1.341
Input	0.458	0.252	1.820	0.069	-0.036	0.953
Equipment	0.044	0.277	0.160	0.875	-0.500	0.587
_cons	-0.572	0.572	-1.000	0.317	-1.694	0.549
Clean_Coffee						
Zombo	1.317	0.277	4.750	0.000	0.773	1.861
Male	-0.160	0.247	-0.650	0.518	-0.645	0.325
Education	0.567	0.250	2.270	0.023	0.078	1.057
Main_occupation	0.236	0.289	0.820	0.414	-0.330	0.801
log_farm	-0.083	0.214	-0.390	0.700	-0.503	0.338
Mkt_info_Radio	1.476	0.261	5.660	0.000	0.965	1.988
Price_info	0.495	0.220	2.250	0.024	0.064	0.926
Info_quality	0.442	0.275	1.610	0.108	-0.097	0.980
CreditAccess	-0.377	0.257	-1.460	0.143	-0.881	0.128
Extension	0.099	0.406	0.240	0.808	-0.698	0.895
Group_Mkt	0.578	0.299	1.930	0.053	-0.008	1.165
Group_process	-0.747	0.276	-2.710	0.007	-1.287	-0.207
Input	-0.848	0.242	-3.500	0.000	-1.323	-0.373
Equipment	0.138	0.286	0.480	0.628	-0.422	0.699
_cons	-2.053	0.553	-3.710	0.000	-3.137	-0.969
Dry_Coffee						
Zombo	-0.638	0.268	-2.380	0.017	-1.162	-0.113
Male	-0.125	0.239	-0.520	0.602	-0.593	0.344
Education	0.459	0.256	1.790	0.073	-0.043	0.961
Main_occupation	-0.799	0.338	-2.360	0.018	-1.461	-0.136
log_farm	0.414	0.213	1.950	0.052	-0.003	0.830
Mkt_info_Radio	-0.609	0.255	-2.390	0.017	-1.109	-0.109
Price_info	0.240	0.198	1.210	0.225	-0.148	0.628
Info_quality	0.312	0.294	1.060	0.288	-0.263	0.888

CreditAccess	1.343	0.435	3.090	0.002	0.491	2.195
Extension	1.154	0.398	2.900	0.004	0.374	1.934
Group_Mkt	-0.123	0.314	-0.390	0.696	-0.737	0.492
Group_process	0.299	0.273	1.100	0.273	-0.236	0.834
Input	0.485	0.213	2.270	0.023	0.067	0.903
Equipment	-0.285	0.367	-0.780	0.436	-1.004	0.433
_cons	0.038	0.511	0.070	0.940	-0.962	1.039
/atrho21	1.137	0.206	5.530	0.000	0.734	1.541
/atrho31	0.460	0.213	2.160	0.031	0.043	0.876
/atrho41	1.333	0.311	4.290	0.000	0.725	1.942
/atrho32	0.493	0.161	3.060	0.002	0.177	0.808
/atrho42	1.611	0.200	8.050	0.000	1.219	2.003
/atrho43	0.629	0.144	4.370	0.000	0.347	0.911
rho21	0.814	0.070	11.690	0.000	0.626	0.912
rho31	0.430	0.173	2.480	0.013	0.043	0.704
rho41	0.870	0.075	11.530	0.000	0.620	0.960
rho32	0.456	0.127	3.580	0.000	0.176	0.668
rho42	0.923	0.030	31.280	0.000	0.839	0.964
rho43	0.557	0.099	5.620	0.000	0.334	0.722

Likelihood ratio test of $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$:

$\chi^2(6) = 157.089$ Prob > $\chi^2 = 0.0000$

Multivariate probit (MSL, # draws = 5) Number of obs = 288

Wald $\chi^2(56) = 621.75$

Log pseudolikelihood = -279.4466 Prob > $\chi^2 = 0.0000$