

**MARKET CHAIN ANALYSIS OF WHITE HARICOT BEANS: THE
CASE OF HABRO DISTRICT, WEST HARARGHE ZONE, OROMIA
NATIONAL REGIONAL STATE, ETHIOPIA**

MSc THESIS

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Market Chain Analysis of White Haricot Bean: The Case of Habro District, West Hararghe Zone, Oromia National Regional State, Ethiopia

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DEDICATION

I dedicate this thesis in loving memory of my late mother, Fatuma Mohammed, and my late wife, Muna Juhar Mohammed, both of whom played significant roles in nurturing and educating me.

STATEMENT OF THE AUTHOR

By my signature below, I declare that this thesis is my bona fide work and that all sources of materials used for this Thesis have been duly acknowledged. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis, and compilation of the Thesis.

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ACRONYMS AND ABBREVIATIONS

ACOS	Agricultural Commodity Supply
COOP	Cooperative
CR	Concentration Ratio
CSA	Central Statistical Agency of Ethiopia
ECX	Ethiopian Commodity Exchange
EEA	Ethiopian Economics Association
EGTE	Ethiopian Grain Trade Enterprise
ERCA	Ethiopian Revenue and Custom Authority
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GMM	Gross Market Margin
HDANRO	Habro District's Agricultural and Natural Resource Office
IFAD	International Fund for Agricultural Development
IPMSEF	Improving Productivity and Market Success of Ethiopia Farmer
MM	Marketing margin
MOA	Ministry of Agriculture
MOARD	Ministry of Agriculture and Rural Development
MT	Meter per Tone
OLS	Ordinary least square
SCP	Structure Conduct Performance
SPSS	Statistical Package for Social Science
TGMM	Total Gross Market Margin
TGPM	Total gross profit margin
TLU	Tropical Livestock Unit
VIF	Variance Inflation Factor

BIOGRAPHICAL SKETCH

The author was born in January 1995 to Ahmed Mohammed and Fatuma Mohammed in the Habro District, West Hararghe Zone, Oromia National Regional State, Ethiopia. He completed his primary education at Gelemso 01 Elementary School and pursued his high school and preparatory studies at Gelemso Senior Secondary School. After successfully passing the Ethiopian National University Entrance Examination, he was admitted to Haramaya University in 2014, where he earned a B.Sc. degree in Agricultural Economics in 2016.

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Market Chain Analysis of White Haricot Beans: The Case of Habro District, West Hararghe Zone, Oromia National Regional State, Ethiopia

ABSTRACT

The study investigated market chain analysis of white haricot beans in the Habro district, analyzing the roles of market chain actors, market structure, conduct, performance, and factors influencing market participation using cross-sectional data from 352 farm households and 20 traders during the 2023-24 production year. Findings revealed a strong oligopolistic market structure with a concentration ratio (CR4) of 50.14% and non-transparent trader conduct due to a lack of organized market information systems. Approximately 62.5% of farmers participated in the market, with higher profitability observed when producers sold directly to primary cooperative rather than rural collectors. The Heckman two-stage model identified that factors such as sex, farm size, livestock holdings, frequency of extension contact, access to credit, cooperative membership, family size, transportation ownership, and off/non-farm income positively influenced the likelihood of market participation (Probit model), while farming experience, livestock holdings, access to credit, family size, education, quantity of beans supplied, and access to market information positively affected the extent of market participation (OLS model). Conversely, distance to the market, age of the household head, sex, and non-farm income negatively impacted the extent of participation. The study recommends policy interventions focused on capacity building through education, improving access to credit, enhancing extension services, promoting farmer group marketing, and improving infrastructure and market information dissemination to increase market efficiency and support greater participation in the white haricot bean market.

Keywords: Market chain, Heckman two-stage, SCP, OLS, haricot beans, Ethiopia

1. INTRODUCTION

1.1. Background of the Study

Haricot beans are one of the most important food and cash crops globally, playing a key role in nutrition and agriculture (Huang *et al.*, 2021; Wodajo *et al.*, 2021). They are among the main staple crops in Africa, contributing significantly to food security and rural economies (Zamukulu *et al.*, 2023). According to the Food and Agriculture Organization (FAO, 2023), Africa is the third-largest producer of haricot beans, accounting for 21.3% of global production, following Asia (43.9%) and the Americas (32.2%). The major haricot bean producers in Africa include Burundi, the Democratic Republic of Congo, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda, positioning East Africa as the most favorable region for haricot bean cultivation on the continent (Tigist *et al.*, 2023).

Originating in Peru, haricot beans were introduced to Africa in the 15th century by Spanish and Portuguese traders, and it is believed that they arrived in Ethiopia in the 16th century, most likely brought by the Portuguese (FAO, 2015). In Ethiopia, haricot beans are a vital legume crop, especially in the lowland and midland regions, where they are a major cash crop and a key source of protein for smallholder farmers (Cholo *et al.*, 2023). This haricot bean contributes significantly to the national economy, serving as a food source, export commodity, and income generator, and employing the supply chain (Tumsa *et al.*, 2014).

Rich in protein, minerals, vitamins, and dietary fiber, haricot beans offer significant commercial potential. Additionally, they contribute to food security by enhancing income opportunities, improving the affordability of protein-rich food items, and offering employment opportunities. These beans also play an essential role in improving soil fertility, as they are often intercropped with cereals like maize, sorghum, and enset, helping to fix atmospheric nitrogen and improve agricultural biodiversity (FAO, 2015; Demelash, 2018).

In 2022, haricot beans were cultivated on approximately 339,350 hectares in Ethiopia, with an annual production of 584,158 tons, yielding an average of 1.72 tons per hectare (CSA, 2022). Faba beans account for 36% of Ethiopia's pulse production, while haricot beans contribute 17% (Spielman, 2021). As the second-largest pulse crop in production volume, haricot beans are a crucial part of Ethiopia's agricultural export portfolio. They are increasingly recognized as an

important source of income and nutrition for smallholder farmers, significantly contributing to food security and improving livelihoods (MoA, 2023). Haricot bean has been an export pulse crop for Ethiopia for more than 50 years and has probably been grown as a food crop for a much longer period in the low and mid-land altitude areas of the country (Kassie, 2018). Although haricot beans remained the significant contributors to the export sector and the economy, their exports worsened in the past decade (Abdulkadir, 2020).

Haricot bean contributes to the national economy as a source of food, and export commodity, a source of income, and employment along the supply chain (Tumsa *et al.*, 2014). Furthermore, the haricot bean provides vital nutrients as a portion of food, including proteins, vitamins, and minerals, and the stems are also used as fodder for livestock, especially in the dry spell following the main cropping season (Kwabena *et al.*, 2016). Haricot bean is considered the primary cash crop and the most affordable source of protein for farmers in Ethiopia's midlands and lowlands among the pulse crops grown there (Asfaw and Blair, 2014). Its reasonable protein content (22%) made it the poor man's meat, securing more than 16.7 million rural people against hidden hunger (Zeleeke *et al.*, 2016). white haricot beans are mostly grown in Ethiopia for export. It can be found growing across the majority of the country's low- and mid-altitude agroecology zones. Market demand for white haricot beans, both in the export market and in the market, has become the main instrument for the growing trends in the volume of production (Frehiwot, 2010).

Approximately 972,039 smallholder farmers cultivate white haricot beans, accounting for 0.81% of the total grain production (103,280.5 hectares) and 0.52% (approximately 1,715,653.14 quintals) of the total grain crop (CSA, 2022). Owing to a surge in demand from both local and foreign markets, Ethiopia's haricot bean production more than tripled from 138,000 to 463,000 t between 2005 and 2012, taking the crop from 169 to 359 hectares. The contribution to national export earnings was US\$95.3 million in 2012 (FAO, 2015).

Market demand for white haricot beans in the export market has become the main instrument for the growing trends in the volume of production. white haricot beans are among the most important grain legumes produced by small-scale farmers for both subsistence and cash, mainly in the lowlands and in the rift valley areas of Ethiopia. They are high in starch, protein, and dietary fiber, and are an excellent source of minerals and vitamins. They are rich in dietary fiber,

protein, and carbohydrates and a great source of vitamins and minerals. In light of this, the government has connected with the ECX market to modernize its export commerce (Samrawit, 2017).

The pure red and white varieties are among the most popular commercial types of haricot beans. Several commercially viable white bean varieties exist, including Mexican 142, Awash 1, and Awash Melka (FAO, 2015). White haricot beans (*Phaseolus vulgaris* L.) are one of the most important pulse crops in Ethiopia, both for domestic consumption and export. Ethiopia is among the top producers of haricot beans in Africa, with the crop playing a significant role in the country's agricultural economy. The production and marketing of white haricot beans are particularly concentrated in regions such as Oromia, Amhara, and the Southern Nations, Nationalities, and Peoples' Region (SNNPR), where agroecological conditions are favorable for its cultivation (FAO, 2015; CSA, 2022).

In Ethiopia, white haricot beans are primarily grown for export, with the European Union (EU) being the largest market. The Ethiopian Commodity Exchange (ECX) has been instrumental in facilitating the trade of white haricot beans, providing a platform for transparent and efficient market transactions (ECX, 2018). The ECX ensures that beans meet quality standards, which enhances their competitiveness in international markets. The export of white haricot beans has been a significant source of foreign exchange earnings for Ethiopia, contributing to the national economy (MoA, 2023).

The Oromia Region, in particular, is a major hub for white haricot bean production. Districts such as West Hararghe, East Shewa, and West Arsi are known for their high production volumes. In these areas, white haricot beans are often intercropped with cereals like maize and sorghum, which not only improves soil fertility but also provides additional income for smallholder farmers (FAO, 2015). The Oromia region accounts for a substantial portion of the national production, with white haricot beans being a key cash crop for many farmers (CSA, 2022).

Despite the economic importance of white haricot beans, the market faces several challenges. These include limited access to improved seed varieties, inadequate market information, and high marketing margins due to the involvement of multiple intermediaries (Shewaye *et al.*,

2016; Fentabil, 2022). Additionally, the lack of organized market systems and infrastructure in rural areas often forces farmers to sell their produce at lower prices immediately after harvest, reducing their profitability (Woolfrey *et al.*, 2021).

The current national production of haricot beans in Ethiopia is estimated at 103,280.55 hectares and 208,295.03 hectares for white and red haricot beans, respectively, with a total area of 311,575.58 hectares; total production of about 552,564.074 tons per hectare, and average productivity of 1.65 tons per hectare (CSA, 2022). The average white and red haricot bean productivity is 1.79 tons/ha and 1.76 tons/ha, respectively. It is predominantly produced in Oromia region, Amhara region, and SNNPR, with area coverages of 120,048.28 ha, 89,577.86 ha, and 68,548.5ha, respectively (CSA, 2022).

White haricot beans grown in 2021/22 covered 0.81% (about 103,280.55 hectares) of the grain crop area, and the production obtained from haricot beans (white) was 0.52% (about 1,715,653.14 quintals), of the total grain production in 2021/2022 (CSA, 2022). According to ERCA (2021), data shows that haricot bean exports increased in total value from 31 million USD in 2016 to 624 million USD in 2020, with a quantity of 58 thousand MT in 2016 and 923 thousand MT in 2020. The main destination markets in terms of earnings over the 2016-2020 periods were Djibouti (75%), Yemen (18%), Somalia (5%), Kenya (3%), and Eritrea (0.1%).

Other varieties are mostly farmed for domestic use in national and regional markets, whereas white haricot beans are cultivated for the export business. The growth rate of each of these markets has been higher. Other edible bean varieties are also consumed or traded in local and regional markets, but the exported white haricot bean alone nearly tripled in value from 2004 to 2010 (Shahidur *et al.*, 2010), from USD 18 million to USD 50 million.

1.2. Statement of the Problem

The Ethiopian government has prioritized the bean industry as a key driver of food security, export revenue generation, and employment creation. Over the past two decades, significant efforts have been made to enhance haricot bean production, improve market access, and increase export earnings. These initiatives have resulted in notable growth in production volumes and values (Kebede, 2020). However, despite these advancements, smallholder farmers in Ethiopia continue to face persistent challenges that limit their full participation in the white haricot bean

market, particularly in understudied regions like Habro District in Western Hararghe. Farmers in Habro District encounter multiple barriers, including limited access to improved seed varieties, inadequate adoption of modern agricultural practices, and environmental constraints, all of which hinder productivity and profitability.

Additionally, socioeconomic factors such as poor access to credit, weak market infrastructure, and limited bargaining power often force farmers to sell their produce at low prices immediately after harvest (Fentabil, 2022; Woolfrey *et al.*, 2021). These challenges not only undermine farmers' income potential but also restrict their ability to engage in more competitive and lucrative markets, thereby stifling the growth of the white haricot bean sector. While previous studies have explored market participation and value chain dynamics in Ethiopia's agricultural sector, there is a glaring gap in the literature regarding white haricot beans, particularly in the eastern regions of the country. Existing studies, such as those by Shewaye *et al.* (2016), Abebe *et al.* (2018), and Fentabil (2022), have primarily focused on central and southern Ethiopia, with limited applicability to the unique agro-ecological and socio-economic context of Habro District. Furthermore, research on haricot beans, including studies by Yaynabeba and Tewodros (2013), kebato (2014), and others (Gashahun, 2015; Wogayehu and Tewodros, 2015; Ephrem, 2018; Besufekad *et al.*, 2018; Gebriel, 2018), has largely overlooked the eastern regions, leaving a critical knowledge gap. Even the few studies conducted in the East, such as those by Teshome (2020) and Selam (2020), did not specifically address white haricot beans, a distinct variety with unique market dynamics and production challenges.

Moreover, while studies like Samrawit (2017) and Mohammed (2021) have identified constraints such as limited access to quality inputs, poor storage facilities, and inadequate market outlets, they have not comprehensively analyzed the entire market chain or the factors influencing farmers' market participation decisions. Similarly, Tarekegn's (2018) study in Sayint District, Northern Ethiopia, assessed the haricot bean market chain but failed to examine the determinants of market participation, leaving a critical gap in understanding how farmers decide to engage with markets. This oversight limits the development of effective policies and interventions to enhance farmers' incomes and market access.

In Habro District, despite its significant potential for white haricot bean production, market participation remains suboptimal. Farmers struggle with low market access, weak bargaining

power, and limited profitability, which hinder the sector's growth and economic well-being. The lack of a comprehensive understanding of the market chain dynamics, coupled with the absence of region-specific studies, underscores the urgent need for targeted research to address these challenges.

This study seeks to fill this critical gap by conducting a comprehensive market chain analysis of white haricot beans in the Habro District. Using the Structure-Conduct-Performance (SCP) framework, the study will assess the market's structure, conduct, and performance while identifying the key determinants of farmers' market participation by the Heckman two-stage model. By providing actionable insights into the barriers and opportunities within the white haricot bean market chain, this research will equip stakeholders including farmers, traders, policymakers, and development organizations with the evidence needed to design targeted interventions. These interventions aim to enhance market efficiency, increase farmers' incomes, and promote the sustainable growth of the white haricot bean sector in Habro District and beyond.

1.3. Research Questions

- What are the main white haricot bean market chain actors and their functions in the study area?
- What is the market performance of white haricot beans in the study area? Who gets more benefits? And
- What factors determine the market participation decisions of white haricot bean producers and the extent of participation in the white haricot bean market in the study area?

1.4. Objectives of the Study

The general objective of this research is to Analyze market chain of white haricot beans in the Habro District. Specifically, the study attempted to:

- identify white haricot bean market chain actors and their functions in the study area.
- analyze the structure, conduct, and performance of the white haricot bean market in the study area

- identify the determinants that influence the market participation decision and the extent of market participation of white haricot beans in the study area.

1.5. Significance of Study

This study on the market chain of white haricot beans in Habro District, Ethiopia, provides critical insights into production and marketing challenges, offering actionable recommendations for policymakers, farmers, and development organizations. By identifying barriers such as limited access to improved seeds, inadequate market information, and high marketing margins, the study highlights inefficiencies in the market structure and trader conduct, guiding interventions to improve market efficiency and farmers' incomes. It emphasizes the importance of factors like access to credit, extension services, and cooperative membership in enhancing market participation and profitability, particularly for marginalized groups such as female-headed households. The findings also underscore the role of sustainable agricultural practices in promoting long-term environmental resilience and food security. Overall, the study contributes to economic development, poverty reduction, and gender equity, providing a foundation for future research and policy formulation to strengthen Ethiopia's agricultural sector.

1.6. Scope and Limitations of the Study

The study is geographically limited to the Habro District, which means that the findings may not be directly applicable to other regions of Ethiopia. The unique agroecological, socio-economic, and institutional contexts of Habro District may differ from those in other areas, limiting the generalizability of the results. The study was conducted within a specific time frame, which may have limited the depth of data collection and analysis. Seasonal variations in production and market dynamics could not be fully captured, potentially affecting the comprehensiveness of the findings. The study was constrained by budget and resource limitations, which may have restricted the ability to collect more extensive data or conduct a more detailed analysis. For instance, the sample size of traders (20) was relatively small, which may limit the robustness of the findings related to market structure and conduct. The study relied on both primary and secondary data. However, the availability and reliability of secondary data, particularly from government and non-government organizations, may have been limited. This could affect the accuracy and completeness of the analysis.

The study specifically focuses on white haricot beans, excluding other varieties of haricot beans or other crops. While this allows for a detailed analysis of the white haricot bean market chain, it may not capture the broader dynamics of the agricultural market in the district. Although the sample size of 352 farmers was determined using a statistical formula, the representativeness of the sample may still be limited due to the heterogeneity of the farming population in the district. Additionally, the purposive sampling of traders may introduce bias, as it may not fully represent the diversity of traders in the market. The use of the Heckman two-stage model, while appropriate for addressing sample selection bias, has its limitations. The model assumes that the error terms in the selection and outcome equations are normally distributed, which may not always hold. Additionally, the model may not fully capture all the complexities of market participation decisions.

1.7. Organization of the Thesis

This research paper is structured into five chapters. The first chapter introduces the study, covering the background, statement of the problem, objectives, significance, scope, and limitations. It provides an overview of the research context and sets the stage for the analysis. The second chapter presents the literature review, which explores the theoretical concepts of the market chain and examines relevant empirical studies. This chapter provides a foundation for understanding the factors influencing market participation and the performance of market chains in similar agricultural contexts. The third chapter outlines the research methodology. It describes the study area, data sources, data collection methods, sampling procedure, and the analytical techniques used for processing and interpreting the data. The fourth chapter presents the results of the study, followed by a detailed discussion. The findings are analyzed concerning the literature reviewed in Chapter 2, offering insights into the white haricot bean market chain in the Habro District. The fifth chapter summarizes the key findings, draws conclusions, and offers recommendations. The recommendations aim to improve the marketing system of white haricot beans in Habro District and enhance farmers' participation in the market.

2. LITERATURE REVIEW

2.1. Definitions of Basic Concepts and Term

Market: Market is the performance of activities that seek to accomplish an organization's objectives by anticipating customer needs and directing a flow of need-satisfying goods and services from producers to customers (Perreault *et al.*, 2017). On the other hand, agricultural marketing is the marketing of farm products by farmers, of farm inputs and services required by them in the production of the farm products, and it includes both product marketing and input marketing (Tnau, 2017).

Market Participation: The capacity to participate in a market successfully and efficiently is known as market participation. The transformation of farmers from subsistence farming to a market engagement mode, where inputs are increasingly bought and outputs are sold to merchants, is the focus of this study. It is a marketing procedure that yields a conclusion. The ability of farmers to produce goods that fulfill market demands in terms of quality standards, supply consistency, and capability to deliver goods on time for sale at a sustainable price affects the shift from low to high market participation (Poole, 2017).

Marketing: The American Marketing Association defines marketing as an organizational function and a collection of procedures for developing, conveying, and providing value to consumers, as well as maintaining client relationships in a way that is advantageous to the company and its stakeholders. According to the social definition of marketing, it is a social process whereby people and groups create, offer, and freely exchange valuable goods and services to fulfill their needs and desires. Marketing's job is to provide a better quality of life. According to Moyo (2010), marketing is the art of selling items in the managerial sense.

Agricultural marketing: agricultural marketing is the economic process by which agricultural goods are exchanged. The process of agricultural marketing determines the value of agricultural products in terms of money and delivers them to their final consumers (Moyo, 2010).

Marketing efficiency: efficiency in marketing is the most commonly used measure of market performance. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers, and society. It is a commonplace notation that higher efficiency

means better performance, whereas declining efficiency denotes poor performance. Most of the changes proposed in marketing are justified on the grounds of improved efficiency (Ponguru and Nagalla, 2016).

Market chain: describes the interconnected network of actors, activities, and transactions involved in the movement of agricultural goods from production to consumption. It encompasses all stages, including input supply, production, processing, distribution, and retail, ensuring that agricultural products flow from farmers to consumers while money and information flow in the reverse direction. Modern definitions also highlight the importance of value addition, coordination among stakeholders, and the integration of sustainability practices to enhance efficiency, equity, and environmental outcomes (FAO, 2021; UNIDO, 2020).

Market supply: The term "market supply" refers to the aggregate quantity of goods offered at different prices by all traders. The price of the product itself, the price of associated items, the price of agricultural inputs, the status of technology, the environment, and the institutional arrangements all affect the supply of agricultural products (Mankiw and Taylor, 2020).

Market channel: There needs to be a way for a certain product to get to its intended location. The word "channel" comes from the Latin word "canals," which refers to a pipeline or passageway that goods use to move from one agent to another. According to Muhammad (2011), the marketing channel is a broad conduit or pipeline that facilitates the movement of goods, product ownership, finance, communication, and associated hazards to the end user.

Marketing costs: are those associated with carrying out different marketing operations in the process of moving commodities from manufacturer to consumer. Marketing costs include handling costs (such as packing and unpacking), expenses associated with finding a partner with whom to exchange, vetting possible trading partners to determine their reliability, haggling with potential trading partners (officials) to reach a deal, shipping the product, keeping an eye on the terms of the agreement to ensure they are met, and enforcing the exchange agreement (Holloway and Ehui, 2002).

Marketing margin is a widely used metric to assess how well a marketing system is performing. According to Cramers and Jensen (1982), it can be described as the price differential

that results from the supply and demand for marketing services, or as the price that producers receive about the price that consumers pay.

Market structure: refers to a market's interconnected characteristics, including the number and relative strength of buyers and sellers, as well as the degree of collusion among them, the level and types of competition, the extent of product differentiation, and the ease of entry and exit from the market (Cramer and Jenson, 1982). Structural characteristics may be used as a basis for classifying markets. Markets can be perfectly competitive, monopolistic, or oligopolistic (Scott, 1995).

Market conduct: refers to traders' practices or strategies for increasing profits. The use of regular partners, long-term relationships with clients and suppliers, the use of intermediaries, and trade within personalized networks are examples of these practices (Wolday, 1994). It is about the firm's pricing and promotion strategy execution patterns, as well as its responsiveness to market realities.

Market performance: is influenced by various factors such as pricing strategies, production costs, and volume of goods produced. It is a measure of how the structure and behavior of a market impact its overall success (Scott, 1995). It encompasses the consequences of these measures, such as the connection between selling price and costs, the magnitude of output, efficiency in production, advancements in techniques and products, and other related factors.

2.2. Fundamental Approaches to Agricultural Marketing

The study of agricultural marketing involves various approaches. These include; the functional approach, system or institutional approach, commodity approach, Behavioral systems approach, and structural conduct and performance approach (Mandoza, 1995).

2.2.1. Functional approach

Functional approach: This is the study of marketing that aims to break up the whole marketing process into functions and specialized activities performed in accomplishing the marketing process (Kohls and Uhl, 1985). The approach helps to evaluate marketing costs for similar marketing middlemen and or different commodities and the costs and benefits of marketing

functions, and this approach promotes careful identification of corrective measures as it pays special attention to particular functions (Ashenafi, 2010).

2.2.2. Institutional /system approach

The institutional /system approach focuses on the quantity and variety of commercial enterprises, or different establishments, that carry out marketing operations. These entities, whether individuals or companies, act as intermediaries, carrying out the tasks required to move products' inputs and goods from producer to customer. All market actors are covered by it, including producers, assemblers, transporters, wholesalers, retailers, and consumers. The study of various institutions indicates marketing activities and the various firms involved in performing those activities required to create and deliver a product or service to ultimate consumers or industrial users (Kerin and Hartley, 2017).

2.2.3. Commodity approach

This approach is said to be the most practical as it helps to locate specific marketing problems for each commodity and improvement measures, that follow the commodity along the path between producer and consumer and are concerned with describing what is done and how the commodity could be handled more efficiently (Richard and Joseph, 2005).

2.2.4. Behavioral systems approach

This method pertains to the examination of the conduct of businesses, establishments, and associations that function inside the marketing system. It makes an effort to respond to the question of how the market or participant acts and functions. According to this method, marketing is a system whose subsystems are interconnected and interact with one another; the system's functioning is the outcome of these interactions and relationships. Thus, the behavioral systems method analyzes each subsystem's behavior and forecasts how it will affect the primary system. Individuals who are making choices to address specific marketing issues are of interest. Systems can be recognized with the specific issue being addressed thanks to this behavioral system (Jema, 2014).

2.3. Theoretical Framework

Random Utility Theory

Market participation decisions among smallholder farmers have been analyzed through various theoretical lenses. One prominent approach is Random Utility Theory (RUT), developed by McFadden (1974), which posits that farmers make market participation choices based on utility maximization, where the option with higher perceived benefits is selected (Hensher *et al.*, 1999). This theory is particularly useful for modeling discrete choices, such as whether or not to participate in a market, and has been widely applied in agricultural economics (Barrett, 2008). Random Utility Theory decomposes utility into observable factors (e.g., prices, income, farm characteristics) and unobservable random components, making it suitable for econometric modeling of participation decisions.

A random utility framework can be used to analyse white haricot beans producers' household decision to join market participation (Fischer and Qaim, 2012). Market participation is both a cause and an effect of economic progress (Boughton *et al.*, 2007). It enhances the links between the input and output sides of agricultural markets (Mbitsemunda and Karangwa, 2017). Higher market participation can drive productivity by providing incentives, information, and cash for purchasing inputs. Higher productivity could drive market participation because farmers with high productivity have a surplus to participate in the market, *ceteris paribus* (Barrett, 2008). Agricultural market participation leads farmers from subsistence production to market-oriented production, which further increases their market participation (Getahun *et al.*, 2017).

Alternative perspectives include the Structure-Conduct-Performance (SCP) paradigm, rooted in industrial organization theory (Bain, 1956). This framework examines how market structure (e.g., competition levels, entry barriers) influences trader behavior and overall market efficiency. While SCP helps explain macro-level market inefficiencies, it does not directly model individual farmer decisions. Behavioral theories, such as the theory of Planned Behavior (Ajzen, 1991) and Prospect Theory (Kahneman, 1979), introduce psychological dimensions. Theory of Planned Behavior suggests that participation depends on attitudes, social norms, and perceived control, while Prospect Theory highlights how loss aversion and risk

perceptions shape decisions. Although these theories provide valuable insights, they are less amenable to quantitative modeling compared to Random Utility Theory.

For this study, Random Utility Theory is the most pertinent framework because it aligns with the research objectives, analyzing both binary participation decisions and continuous supply levels while accommodating econometric techniques like the Heckman two-stage model. The SCP paradigm complements Random Utility Theory by contextualizing findings within broader market structures, such as oligopolistic tendencies among traders. Together, these theories offer a comprehensive understanding of white haricot bean market dynamics in Habro District, guiding policies to enhance smallholder participation and market efficiency. Future research could integrate behavioral theories to explore psychological barriers, such as risk aversion, that may not be fully captured by Random Utility Theory.

According to the framework, a farmer chooses to join the market when the utility of participating in the market (u_i) is greater than the utility of not participating in the market (u_0) or $(u_i - u_0) > 0$. Therefore, market membership can be modelled as a binary choice decision and it can be expressed as follows:

$$l_i = \mathbf{z}x_i + e_i$$

$$l_i = \begin{cases} 1 & \text{if } l_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

l_i^* is a latent variable that catches unobserved preferences associated with participation in primary white haricot beans producers of household (X) and the error term (e).

l_i is a binary variable equal to 1 if a white haricot beans producers' participants to market and 0 if not Z is a vector of parameters.

2.4. Analytical Framework

2.4.1. Structure, Conduct and Performance

2.4.1.1. Structure of the Market

Market structure refers to the characteristics that define the organization of a market, which strategically impact the nature of competition and pricing. It encompasses the number, size, and variety of participants at various levels within the marketing system. The organization of a market plays essential role in shaping competition and pricing. Market structure encompasses key elements such as the concentration of sellers and buyers, the level of product differentiation among sellers, and the presence of barriers to entry and exit. These factors collectively influence the dynamics of the market (Wolday, 1994).

Concentration ratio (CR): Concentration ratio is the method used to measure market domination by a small number of static firms. It is the percentage of total market output delivered by the largest firms (Mankiw, 2015). The concentration ratio serves as an indicator of the market share distribution among specific suppliers within a market. It represents the percentage of total market sales attributed to a select group of dominant firms. Higher levels of market concentration increase the likelihood of non-competitive behaviour. It calculates the percentage of the trading volume represented by a certain number of participants. It shows whether a few large firms or many small firms dominate an industry. Typically, literature suggests that a strong oligopolistic industry can be identified by a four-enterprise concentration ratio of 50 percent or higher. On the other hand, a ratio between 33-50 percent indicates a weak oligopoly, while anything below that signifies an unconcentrated industry. Thus, the more the market is dominated by a few large firms, the larger the concentration ratio will be (Wisdom *et al.*, 2014).

Herfindahl index: It is calculated by the sum of all firms' square market shares. In the calculation, HHI includes all firms. The problem with this measure is that it requires more data to be gathered. Squaring of the firms' market is share gives a proportionately greater weight to the larger firms' market shares. The Herfindahl index offers a more accurate measure of concentration by considering both the number of firms and the distribution of market shares. When the number of firms decreases, the market shares become less spread out, indicating a

higher level of concentration (Belleflamme and Peitz, 2010). A market with less than 1,000 HHIs is considered to be competitive. HHI in the range below 1000 shows a very low concentration, a moderate concentration in the range 1000–1800, a very high concentration of the marketing system in the range above 1800, whereas an index value equal to 10,000 shows a full monopoly of concentration. A low index value signifies a large number of firms with similar sizes, whereas an index close to 1 indicates a limited number of firms and/or significant disparities in their market shares.

Gini coefficient (GC): is the ratio of area between the distribution's Lorenz Curve and the equality line (uniform distribution) to the lower triangle. This demonstrates the sales distribution among the firms in the industry. Therefore, the Gini coefficient is used to demonstrate how the distribution of shares has changed over a period within an industry, so it is possible to see whether inequality increases or decreases. Gini coefficients can range from zero to one (perfect equality) anywhere (perfect inequality). The Gini coefficient is calculated most easily as the "relative mean difference" from unordered size data, which is the mean of the difference between any possible pair of individuals, divided by the mean size (Taru *et al.*, 2010). The problem with the Gini coefficient is that it Favors market share equality without considering the number of equalized companies.

2.4.1.2. Conduct of the Market

Market conduct refers to traders' practices or strategies for increasing profits. The use of regular partners, long-term relationships with clients and suppliers, the use of intermediaries, and trade within personalized networks are examples of these practices (Wolday, 1994). It is about the firm's pricing and promotion strategy execution patterns, as well as its responsiveness to market realities.

2.4.1.3. Performance of the Market

Market performance is determined by how the structure and behaviour of a market influence prices, costs, and the quantity of goods produced (Pomeroy and Trinidad, 1995). Market efficiency analysis serves as a method to assess the level of market performance. It comprises two primary elements: the effectiveness of marketing services execution and the impact of service-related costs and methods on production and consumption. It is crucial to arrange

consumer satisfaction while keeping costs low and sustaining high farm output levels (Ramakumar, 2001).

Marketing margin

A marketing margin refers to the variance between the price established by producers and the price funded by consumers. Producers and consumers alike are focused on the magnitude of marketing margins, fluctuations in these margins, and the effects of such changes. Marketing margins can be characterized as the disparity between the price consumers pay and the price received by producers, or as the cost associated with a range of marketing services resulting from the interplay of demand and supply for those services (Tomek and Robinson, 1990). According to Jema (2008), A marketing margin refers to the total price above the farm price, and it has been determined that this margin is positively and significantly influenced by the volume of trade. In a commodity subsystem framework, institutional analysis focuses on identifying marketing channels, which encompasses the examination of marketing costs and margins (Mendoza, 1995).

A marketing margin is the inconsistency between the price consumers pay and the price producers accept, or it can be seen as the cost of a bundle of marketing facilities determined by the collaboration of supply and demand for those services (Tomek and Robinson, 1990). It quantifies the portion of the final selling price that a specific agent in the marketing chain retains (Mendoza, 1995). In its most basic definition, it represents the disparity between the retail prices consumers pay for a product, such as bread, and the prices farmers receive when they sell their goods to assemblers or other initial handlers. The term marketing margin is often used to describe the disparity in prices between producers and consumers for the same quantity and quality of a product. However, it can also encompass price variations at unlike stages of the marketing process, such as between producers and wholesalers, or wholesalers and retailers (Scarborough and kydd, 1992).

Marketing Costs

Marketing costs encompass the expenses associated with executing a range of marketing activities involved in the distribution of goods from producers to consumers. The expenses associated with marketing encompass various elements such as handling costs (packing,

unpacking, loading, and unloading), transportation costs, product losses, storage expenses, processing costs, capital costs (interest on loans), market fees, commissions, and illegal payments (Heltberg and Tarp, 2001).

2.4.2. Determinants of market participation decision and extent

Different scholars use different analytical models to recognize factors manipulating market participation decisions and extents. The most commonly used analytical models to analyse market participation and extents are Ordinary Least Squares (OLS), Tobit, Double-hurdle, and Heckman two-stage. If and only if all households participate in the market, Ordinary Least Squares (OLS) is suitable. However, not every household participates in a particular commodity market. Some households may prefer not to participate in one market over another, while others may be barred from participating due to market conditions.

OLS regression is estimated in this case by excluding non-participants from the analysis; this may introduce sample selection bias into the model. As a result, the study did not adopt this model because it is biased and inconsistent. The Tobit model, introduced by James Tobin in 1958, is a statistical model used to analyze the association between an independent variable and a non-negative dependent variable. The modeling approach of Tobit (Tobin, 1958) implies that decisions regarding sales volume and participation are made concurrently, and that as a result, the factors influencing both decisions are the same. According to Wooldridge (2002), when the variable to be explained is partially continuous but has a positive probability mass at one or more points, censored regression models are appropriate.

The Tobit model is not suitable for this study because it assumes that both the probability of market participation and the level of participation are determined by the same set of parameters and variables, as the selection equation and the supply equation are assumed to be identical. By allowing various mechanisms to determine the discrete likelihood of participation and level of participation, the two-step model relaxes the Tobit model assumption. These models separate the decision to participate from the extent of participation.

Double-hurdle one alternative approach is to analyse the market participation and extent of participation of white haricot beans producers. In any agricultural decision-making process, farmers face two problems, according to this model (Cragg, 1971). The decision to participate

in an activity is made first, and then comes the decision regarding the level of participation in the activity. This model valuation procedure involves two stages, first hurdle decision to participate in the activity analysed by running a probit regression using all sample population, and second hurdle, level of participation analysed by the truncated regression model. Opposed to the Tobit model, in the double hurdle model, there are no restrictions regarding the elements of explanatory variables in each decision stage. Assume that different parameters affect participation and the level of participation. That is, the determinants of market participation decisions and the level of participation decisions can be studied separately. Due to sample selection issues, the double-hurdle model was not suitable for this study. In the case of incidental truncation, some of the dependent variable is not observed due to the outcome of another variable.

Heckman's two-stage model was developed by Heckman (1979) and was widely used to correct biases resulting from sample selection. Consistent and asymptotically efficient estimates for all parameters are provided by the Heckman procedure (Heckman, 1979). This model assumes that a missing value for the dependent variable indicates that it is not observed. Heckman's model first estimates the likelihood of market participation using a probit regression with all variable data. The inverse Mills ratio is subsequently employed alongside other explanatory variables to explain variations in the continuous, non-zero dependent variable. Therefore, a Heckman two-stage model was used in this study to determine factors influencing white haricot beans market participation decision and extent of market participation.

2.5. Empirical Literature Review

According to Previous empirical studies such as Tesfaw (2017), Demelash (2018), Ephrem (2016), FOA (2015), and Shewaye *et al.*(2015), the driving factors that lead to the inefficiency of haricot bean market include limited or lack of improved seed access, price volatility, high taxes, and various fees at different levels, overvalued exchange rate, poor coordination skill among traders, lack of product quality standard, unfair trade practices imposed by brokers at the market place, lack of market information to producers, long market chain, and few market channel choices, limited grading and quality control systems, and asymmetry of price information that result in low market participation of producer and a low share of the price for producers (excessive margins from traders over producers).

Shewaye *et al.* (2016), used the Heckman two-step model to investigate the factors influencing haricot bean producers' decisions to participate in the market and the degree of their involvement in the Misrak Badawacho district of southern Ethiopia. The Heckman two-step model estimates showed that factors such as household size, distance to all-weather roads, utilization of credit, ownership of oxen, access to communication facilities, and use of credit all had a significant impact on the decision to participate in the market. The distance to the closest market and the ownership of livestock had a negative and significant impact on the amount of market participation, whereas the number of horses owned, the size of the cultivated land, the perception of the lagged market price, the rental or shared farmland, and the use of credit all positively and significantly affected the extent of market participation.

Amare (2015), has employed the SCP approach to assess the haricot bean market in the Enebse Sar Midir district of Ethiopia. The market concentration and marketing margin measures were used to assess the structure and performance of the market. The results of the study revealed the existence of a strong oligopoly market, indicating few traders controlled the market, mainly due to barriers to entry such as a lack of financial capital. The marketing margin analysis indicated the existence of inefficient market performance.

Jemberu (2017), conducted a study on chickpea market chain analysis in the Gondar Zuria district of the North Gondar Zone, Amhara National Regional State, Ethiopia. The study found that the yield of chickpeas, land allocated for chickpea production, lagged market price, education level, and years of experience in chickpea production were significant variables that influenced the chickpea market supply at the level of farm households.

Ephrem (2018), employed an OLS regression model to examine the elements affecting the supply of haricot beans in the Boset woreda located in central Ethiopia. The findings indicated that owning livestock, the extent of land used for haricot bean cultivation, and the application of NPS fertilizer all had a significant and positive effect on the supply of haricot beans, whereas the proximity to the nearest market and the delay in market price notably impacted it negatively.

Besufekad *et al.* (2018), identified the elements that influence the marketed surplus of common beans among smallholder farmers in the Humbo and Damot Gale woredas located in southern Ethiopia. Using an OLS regression model, the results indicated that the marketed surplus of

common beans was positively and significantly influenced by the cultivated area, improved seed variety, and livestock ownership, while the distance to the nearest market had a negative and significant effect.

Based on empirical research conducted by Adeoti *et al.* (2014) and Shewaye *et al.* (2015), they pinpointed the key factors affecting market participation and its level across various country regions. In a similar vein, Abebe *et al.* (2018), Getahun *et al.* (2017), Takele *et al.* (2017), Tadie *et al.* (2019), and Shewaye *et al.* (2015) recognized the elements influencing the selection of market outlets in various regions of Ethiopia. Researchers discovered that the choice of different market outlets by farmers is influenced by demographic, socio-economic, institutional, farmer-specific, and marketing factors.

Teklu (2021), Propensity Score Matching (PSM). Mobile-based market information systems significantly increased market participation and reduced-price disparities among haricot bean farmers in Ethiopia. The study highlighted the role of digital platforms in bridging information gaps and improving market efficiency.

Ayele *et al.* (2023): effects of climate-smart agricultural practices on productivity and market supply, Adoption of climate-smart agricultural practices, such as drought-resistant seeds and conservation agriculture, significantly improved haricot bean productivity and stabilized market supply. The study underscored the importance of resilient farming practices in mitigating climate risks.

Kebede *et al.* (2022): Value Chain Analysis of Haricot Beans. The study identified inefficiencies in the haricot bean value chain, including weak linkages between producers and processors, and recommended interventions to strengthen value chain coordination.

Tadesse *et al.* (2023): Gender and Market Participation, used: Logistic Regression Model, Gender disparities significantly affect market participation, with female farmers facing greater barriers to accessing markets. The study called for gender-sensitive policies to promote inclusive market participation.

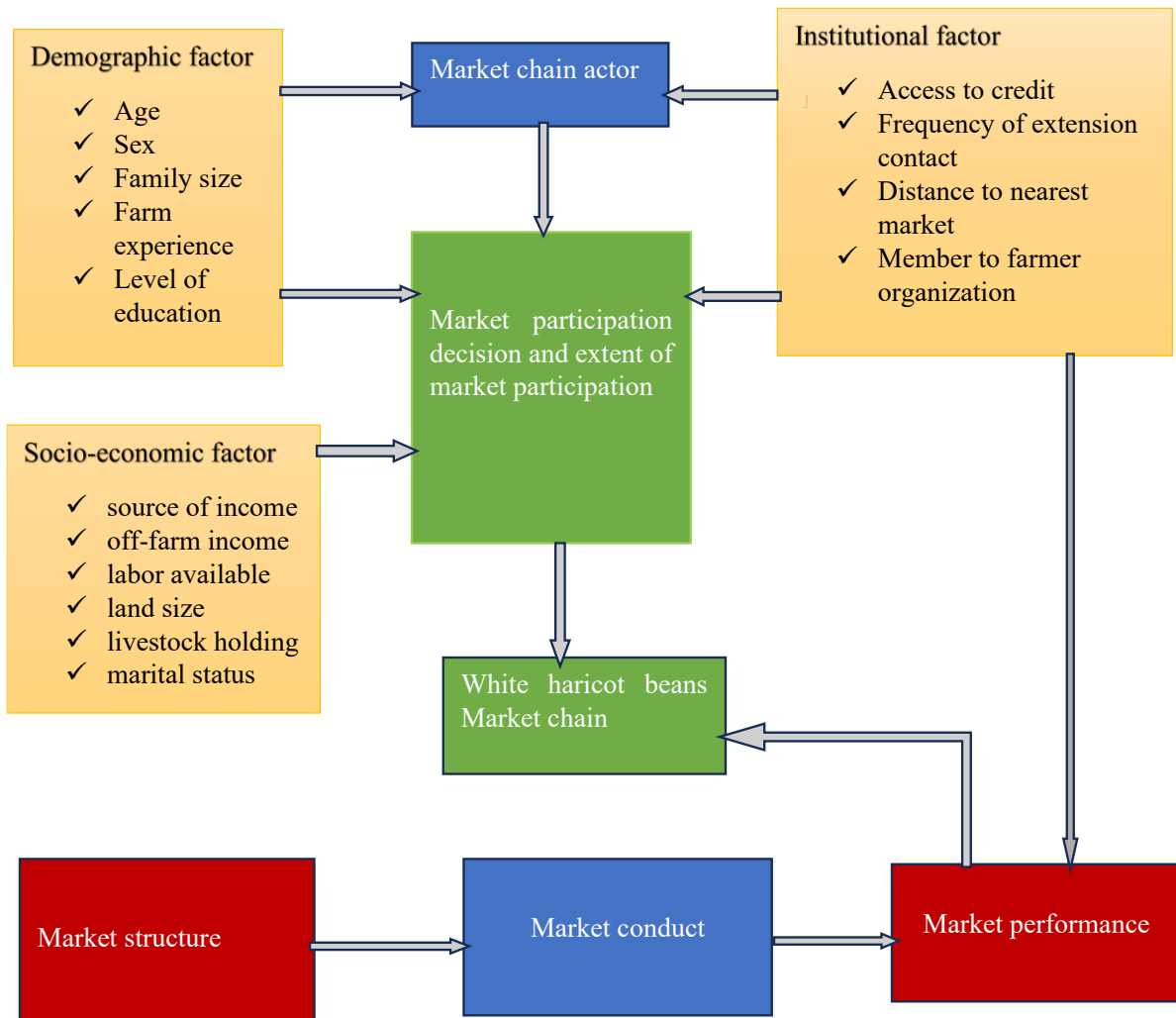
Consequently, this research seeks to recognize the participants in the white haricot bean market chain and their roles, to examine the structure, conduct, and performance of the white haricot

bean market, and to ascertain the elements influencing market participation decisions and the level of involvement of white haricot beans in the study area.

2.6. Conceptual Framework

The conceptual framework (Figure 1). This framework visually represents the interactions among the independent variables, which were identified through extensive literature reviews related to the white haricot beans market chain in the study area. The contribution of the sector to raising its market chain is to organize. Therefore, investigative marketing costs and margins identify the determinant of white haricot beans market participation, and the extent was required. There are determinant factor which affect white haricot beans market participation and extent include, demographic factors (sex, age, educational level, household size), socioeconomic factors,(the main source of income, farm experience, labor available, and quantity of white haricot beans, land size) and institutional factors (use of credit, extension, household membership, price, market information, market experiences), are factors affect market the participation and extent of participation of white haricot bean producers.

The main approach is that greater market participation by farmers results in more commodities being traded, which may lead to more returns being obtained by the farmers. This becomes an incentive to increase production, and hence, a positive supply response is achieved (Getahun *et al.*, 2017).



➡ Direction of Influence

Figure 1: Conceptual framework

Source: Adapted from Haregitu (2019)

3. RESEARCH METHODOLOGY

3.1. Description of the Study Area

The study was conducted in the Habro District, located in the Oromia Regional State of Ethiopia, within the West Hararghe Zone. It is one of the 15 districts in the zone and is bordered by Guba Koricha to the north, Boke and Daro Labu to the south, Boke and Oda Bultum to the east, and Daro Lubu to the west. Habro District is situated approximately 410 km southeast of Addis Ababa and 78 km from Chiro, the capital of the West Hararghe Zone.

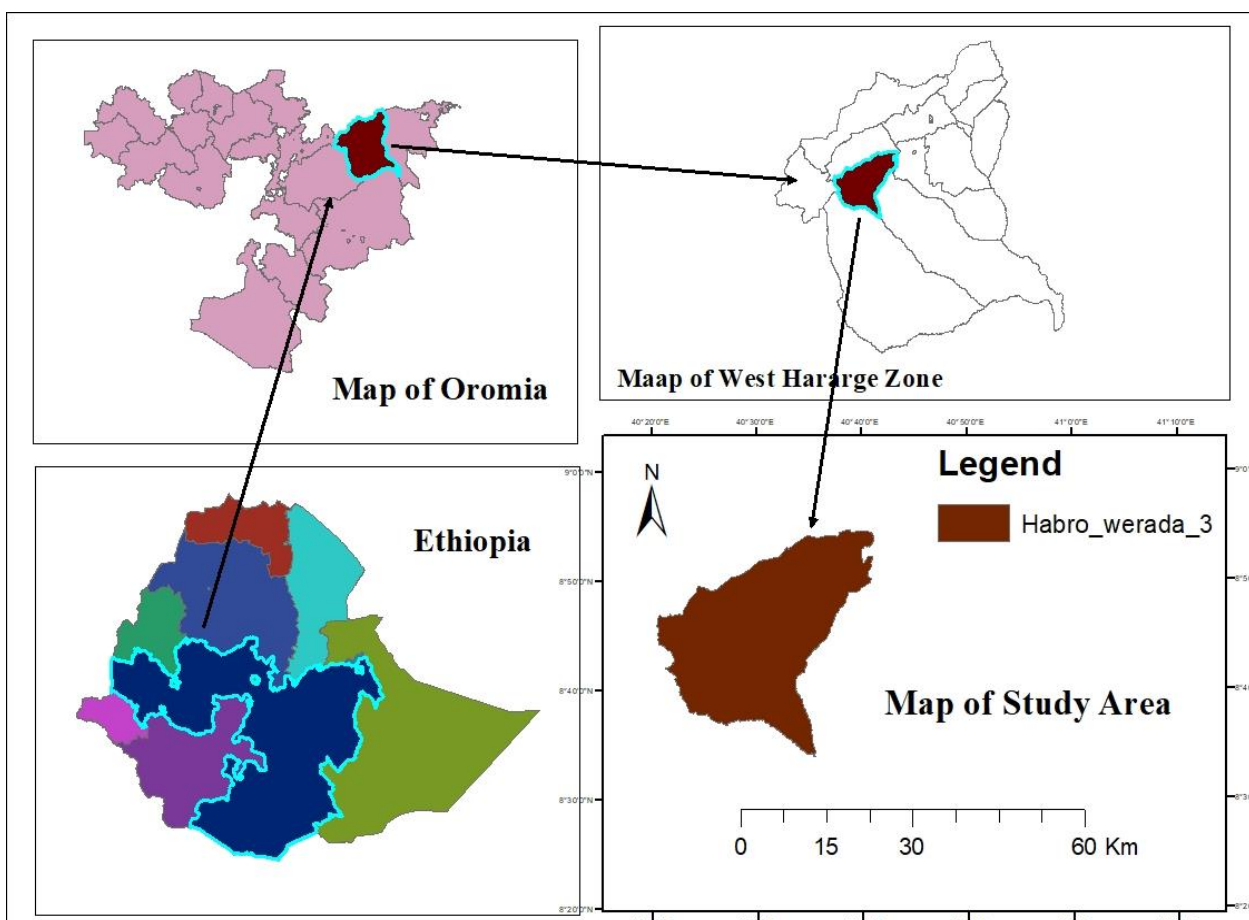


Figure 2: Location map of the study area; Source: From district office of agriculture, 2024

The district lies at latitude 8.8131°N and longitude 40.5203°E , with an average altitude of 1,814.38 meters (5,952.69 feet) above sea level. The mean annual rainfall in the district is 1,010 mm, and the temperature ranges from 5°C to 32°C , reflecting a variety of agroecological zones within the area. Habro's temperature range varies between a maximum of $25\text{--}30^{\circ}\text{C}$ and a

minimum of 7-20°C, with annual rainfall between 670-1,000 mm, depending on the specific locality (HDANRO, 2023).

There are four urban and thirty-two rural Kebeles in the district. Its altitude varies between 1,500 and 2,000 meters above sea level, and it is classified into three agroclimatic zones: dega (15%), woinadega (75%), and kola (10%). Major crops grown in Habro District include sorghum, maize, teff, barley, white haricot bean, and vegetables such as potatoes, tomatoes, cabbage, onions, shallots, and carrots (HDANRO, 2023). The district's diverse agroecological zones and favorable climate make it suitable for a wide range of agricultural activities, with white haricot bean being one of the important crops contributing to the local economy.

3.2. Data Type, Sources, and Methods of Data Collection

In this study, data from primary and secondary sources were used. A household survey, focus groups, and key informant interviews were used to gather the primary data. White haricot bean main data was then gathered using a structured questionnaire and unstructured questionnaires. The Bureau of Agriculture and Rural Development, government agencies, district marketing agency reports, and websites were among the several published and unpublished sources from which pertinent secondary data on the marketing of white haricot beans was gathered.

3.3. Sampling Procedures and Sample Size Determination

3.3.1. Sample size of white haricot bean producers

To choose sample respondents, a three-stage sampling procedure was employed to draw a sample from white haricot bean producers. The households in the Habro district that produce white haricot beans are the target population for this study. In the first stage, the study district was purposively selected among the white haricot bean-growing districts of the West Hararghe Zone, then based on the information obtained from the HDANRO, classify district kebeles into producers and non-producers of white haricot beans. In the district, white haricot bean is produced in 15 rural *Kebeles* out of 32 Kebeles (HDANRO, 2023). So, in the second stage, four sample *kebeles* namely *Gadisa*, *Ifa jiru*, *Bareda*, and *Haro carcar* were selected randomly from 15 produced white haricot bean Kebeles.

In the third stage, based on the population number of samples Kebeles, white haricot bean producers were selected randomly using probability proportional to the size sampling technique from each sample Kebeles. The desired sample size of 352 was set using the sampling formula (Kothari, 2004) and allotted to the respective *Kebeles* proportionally to the household size of white haricot bean farmers. The proportionality to the number of white haricot bean producers in each *Kebele* was used to determine the sample distribution in selected *kebeles*. The sample size of white haricot bean producers is estimated using the (Kothari, 2004) formula:

$$n = \frac{z^2 pqN}{e^2 (N-1) + z^2 pq} \quad (1)$$

$$n = \frac{z^2 pqN}{e^2 (N-1) + z^2 pq} = \frac{1.96^2 * 0.5 * 0.5 * 4264}{0.05^2 (4264 - 1) + 1.96^2 * 0.5 * 0.5} = 352.47$$

Were, Z= is the selected critical value of desired confidence level at 95%, N= total population size, n = is the sample size, e = is the level of precision, p=0.5 p represents the proportion of the population that has a specific characteristic or outcome you are interested in., q= (1-p), q represents the proportion of the population that does not have the characteristic or outcome. It is the complement of p.

Table1: Sample size determination

Name of kebele	Number of white haricot bean Producer household Heads	Number of sampled household heads
Haro carcar	1246	103
Bareda	1020	84
Gadisa	978	80
Ifa jiru	1020	85
Total population	4264	352

Source: Own calculation (2024)

3.3.2. Traders

One of the objectives of this research was to empirically capture the practices and behavior of the white haricot bean traders. The samples for the traders were taken following white haricot beans trade route. Moreover, 20 sample traders were selected purposively based on the potential

marketing of the white haricot beans traders and including respondents from each of the following categories: rural collectors, wholesalers, primary cooperatives, and union traders.

3.4. Methods of Data Analysis

Both descriptive statistics and econometric estimation were used for data analysis to meet the specific objectives of this study.

3.4.1. Descriptive statistics

Descriptive statistics are vital tools for conveying research findings succinctly and clearly. They aid in providing a thorough understanding of the traits of sample units. In this study, descriptive statistics were computed together with the quantitative models and structured so that their meanings may be quickly understood. The information gathered from sampled households, trader's market channels, and the performance of white haricot bean markets was explained and interpreted using descriptive statistics including mean, standard deviation, ratio, frequency, and percentiles. Inferential statistics such as chi-square and t-tests were used to compare the statistical significance of the mean household characteristics and institutional and different socioeconomic variables of both dummy and continuous variables. Microsoft Office Excel, SPSS 16, and STATA version 17 were used to evaluate the raw data that has been gathered.

3.4.2. The econometric model specification

Heckman's two-stage model was employed for this study due to survey data truncation and observed sample selection bias. In this paradigm, deciding whether or not to participate in the market and how much to participate can be seen as two stages of sequential decision-making.

In the first stage, when a farmer chooses whether or not to participate in the sale of white haricot beans, the Inverse Mills ratio (IMR), which is produced from this model, is assessed using a probit model. The participation equation aims to include the variables influencing participation decisions. The 'inverse mills ratio' is a selectivity term computed using this equation. One measure used to control bias resulting from sample selection is the inverse mills ratio (Heckman, 1979).

In the second stage, contingent upon their choice to participate in the market, they decided on the volume of market supply, which is estimated using an Ordinary Least Square (OLS) regression equation by adding IMR from the first model as independent variables and removing the model's bias against certain variables, and correcting the selection bias in the model.

If the selectivity value (Inverse Mill's ratio) is significant, the alternative hypothesis, which states that there is an unobserved selection process that governs the participation equation, is accepted/confirmed, and the null hypothesis, which states there is no unobserved selection process that governs the participation equation, is rejected. Ordinary least squares (OLS) analysis can be used to gauge how much participation there is in the surplus white haricot bean market. However, some white haricot bean producer households may decide not to take part in the white haricot bean market surplus in search of alternative opportunities, while other white haricot bean producer households might be altogether prohibited from engagement due to asset limits.

If OLS regression is performed and the non-participants are left out of the study, the model starts to exhibit sample selectivity bias. Heckman's (1979) two-stage selection model is used to explore the variables that determine whether and to what extent smallholder white haricot bean producers were engaged to address this issue.

The first stage of Heckman's two-stage model (probit model)

This model was used to identify determinants that influence a household's white haricot bean market participation decision and market supply. The dependent variable in this model has a value of 1 if the household participated in the white haricot bean market; and 0 otherwise. The probit model is built on a latent variable with the following formulation, according to (Osmani and Hossain, 2015).

$$Y_i^* = \beta_i X_i + u_i u_i \sim N(0,1) \quad (2)$$

$$Y = 1 \text{ if } y > y_i^*$$

$$Y = 0 \text{ if } y \leq y_i^*$$

Where: Y_i^* = is a latent variable representing farmers' discrete decision whether to Participate in white haricot bean market or not

X_i = is a vector of independent variables hypothesized to affect farmers' decisions to Participate in the white haricot bean market

β_i = is a vector of parameters to be estimated which measures the effects of explanatory variables on the farmers' decision

u_i = is normally distributed disturbance with a mean (0) and constant variance and Captures all unmeasured variables

Y = is a dependent variable that takes on the value of 1 if the farmers participate in the white haricot bean market and 0 otherwise.

The Second Stage of the Heckman Model (Ordinary Least Square)

Conditional on participation decisions, the variables determining the level of participation are modeled using the second-stage Heckman selection model (Heckman, 1979). The Heckman selection equation is specified as:

$$Y_i = x_i\beta_i + \mu\lambda_i + \varepsilon_i \quad (3)$$

W here y_i = the volume of white haricot beans sold/total supply of white haricot beans,

β_i = vector of the explanatory variables determining the volume sold,

x_i = explanatory variable to be estimated in the volume sold,

λ_i = an inverse Mill's Ratio, that controls sample selection bias.

μ = is the coefficient of IMR. It's a parameter that shows the impact of participation on the quantity traded,

ε_i = the error terms.

The second equation is the linear model of interest. The ordinary least squares regression technique would be to estimate the effect of the program using the equation.

As mentioned above; to estimate these models, Heckman has introduced the Heckman two-step estimator, which is as below.

$$E[y_i/d_i > x_i] = x_i\beta + \frac{\rho\sigma\phi(Z_i\gamma)}{\Phi(Z_i\gamma)} \quad (4)$$

Where the quantities $\lambda = \frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ are the inverse Mill's ratio evaluated at $Z_i\gamma$. (ϕ) and (Φ) is the standard Normal density and standard cumulative distribution functions, respectively? β is a vector of regression parameters for variable X . ρ is the correlation between observed determinant u_i and unobserved determinants e_i , σ is the standard deviation of the error term e_i .

The coefficient on the inverse mills' ratio indicates if the coefficient is statistically significant, then there was selection bias. The inverse mills' ratio is sometimes called a control function, i.e., literally a function that controls for selection bias.

Marketing Margin

According to Mekdes *et al.* (2017), the marketing margin is the contrast between the value of a product or group of products at one point in the marketing process and the value of an identical product or group of products at a later point. It calculates the portion of the ultimate selling price that a specific agent in the marketing chain keeps. The difference between the price per unit of that product at the farm gate and the price per unit when sold to the final customer is known as the total gross marketing margin, or TGMM (Mekdes *et al.*, 2017; Ali *et al.*, 2017). The marketing margin was calculated as the difference between producer and retail prices.

Producer's share: The ratio of producers' prices to consumers' prices is the generally used measure of producers' share, sometimes referred to as producers' gross margin (GMMp). Mathematically, producers' share can be expressed as:

$$P_s = \frac{P_x}{P_r} * 100 = 1 - TGMM \quad (6)$$

where; P_s = producer share

P_x = producer's price

P_r = retailer price paid by consumer or end-buyer price,

TGMM = Total gross marketing margin

As demonstrated by the equation above, a greater marketing margin reduces the producer's share and vice versa. Indicating the allocation of welfare among production and marketing agents is another benefit it offers.

Total gross marketing margin

Total Gross Marketing Margin (TGMM) is calculated as a percentage and is always associated with the final price paid by the customer (Mekdes *et al.*, 2017; Ali *et al.*, 2017). TGMM, or total gross marketing margin, is calculated using the following formula:

$$TGMM = \left(\frac{\text{consumer's price} - \text{producer's price}}{\text{consumer's price}} \right) * 100 \quad (7)$$

OR

$$TGMM = \left(\frac{\text{End buyer price} - \text{First seller price}}{\text{End buyer price}} \right) * 100 \quad (8)$$

To gauge the degree of equity in the allocation of benefits accumulated across the market chain. The producer's gross margin (GMMP), which is the percentage of the final buyer's price that goes to the producer, would be computed as follows:

$$GMMP = \left(\frac{\text{End price purchase} - \text{marketing gross margin}}{\text{End price purchase}} \right) * 100 \quad (9)$$

Due to price data restrictions, it is often impossible to ascertain precise marketing costs in many agricultural marketing chains in developing nations. For this reason, the gross marketing margin is estimated instead of the net marketing margin. Therefore, the gross marketing margin would be considered the marketing margin in this study (Mekdes *et al.*, 2017; Ali *et al.*, 2017). The advantages farmers received from each white haricot bean marketing channel are compared using the gross marketing margins; a greater number denotes a larger gross return to the farmers. The same idea would be used with some modifications to determine each actor's benefit share. When examining margins, the Total Gross Marketing Margin (TGMM) is first determined as indicated by the equation above. Then, the gross marketing margin at a given stage 'i' (GMM_i) is computed as:

$$GMM_i = \left(\frac{\text{selling price}(SP_i) - \text{purchasing price}(PP_i)}{\text{consumer's price}} \right) * 100 \quad (11)$$

where: GMM_i is the percentage of the total gross marketing margin at stage "i", SP_i is the selling price at the ith link and PP_i is the purchase price at the ith link.

3.7. Definitions of Variables and Working Hypotheses

3.7.1. Dependent variables

Market participation decision (Participation) (Y): This is a dummy dependent variable that takes a value of 1 if the household head participated in the white haricot bean market in 2023/24 years of production and 0 otherwise.

White haricot bean marketed supply (Market supply) (y): It is a continuous dependent variable that represents the extent of market participation by smallholder farmers in 2023/24 (measured in quintals).

3.7.2. Explanatory/Independent variables

Sex of the household head (Sex): It is a dummy explanatory variable that takes a value of 1 if the household head is male and 0 otherwise. Female-headed households have less access to improved technologies, land, and extension services as compared to male-headed households (Aman *et al.*, 2014). Male-headed households have been observed to have a better tendency than female-headed households to participate in the market and volume of supply. In opposite Nuri (2016), found a negative relation between sex and both market participation and the marketed surplus of Kocho. Thus, the sex of the household head was hypothesized to positively or negatively influence white haricot bean market participation decisions and the extent of market participation.

Age of the household head (AOHH): It is a continuous variable measured in years. Age is a proxy measure of the farming experience of the household. Lemma and Gashahun (2015), found that the age of the household head has a negative effect on the yield of white pea beans, which shows that older households are tradition-bound and expected to be reluctant to take up new technologies. However, according to Beriso (2018), farmers with more experience in potato production have a higher ability to produce potato products. Older farmers may have more market participation experience than younger ones, or as they age, they may be able to sell more of their produce than younger farmers because of social networks that have been established over time. Thus, in this study, the age of the household head was hypothesized to positively or negatively influence white haricot bean market participation decisions and the extent of market participation.

Family size (FASZ): It is a continuous explanatory variable measured in terms of number of family members in the household. Family size refers to the total number of members in the household. The white haricot bean market is determined by the number of families in the household. The availability of active family labour provides cheaper labour and produces more output, such that the proportion sold remains higher than the proportion consumed. Gebriel

(2018), revealed that family labour affected the quantity of haricot bean market supply positively. Tafesse *et al.* (2023), found that the family size of the household has a negative effect on the amount of maize supplied to the market. In this study, therefore, the family size was expected to positively or negatively influence white haricot bean market participation decisions and the extent of market participation.

Education level of the household head (EDLV): It is a continuous explanatory variable measured by the formal years of schooling of the household head at the time of the survey. Household heads with more years of formal education will be expected to have a higher ability to accept new ideas and innovations and therefore will be more willing to produce and supply white haricot beans for sale. Gashahun (2015), found that education had a positive effect on the quantity of haricot beans marketed. Thus, in this study, the household heads' years of formal education were hypothesized to positively or negatively influence white haricot bean market participation decisions and the extent of market participation.

Non/off-farm income (OFFI): It is a continuing explanatory variable measured in the amount of birr that income in thousands obtained from non-farming activities or income out of own farm by the household head. This income may strengthen the farming activity or make the household head reluctant to produce white haricot beans to generate money from white haricot beans. Gebriel (2018), found that an increase in off-farm income increases the number of haricot beans supplied to the market, which means a positive effect. The study by Hasen *et al.* (2016), confirmed that non-farm income has affected the decision of farmers to sell their wheat output negatively. Thus, in this study, off-farm income was hypothesized to positively or negatively influence white haricot bean market participation decisions and the extent of market participation.

Ownership of transportation (OMTN): It is a dummy variable that takes a value of 1 if the household head owns means of transportation and 0 otherwise. Households with their transportation means may be engaged in more white haricot bean production, which increases the farmers' volume of white haricot bean supply. Owning transport vehicles like donkeys and animal carts lowers the cost of moving inputs from the market to the farm and products from the farm to the market, which benefits market participation, claim (Efa *et al.*, 2016). Thus, in this study, ownership of transportation was hypothesized to positively affect white haricot bean market participation decisions and the extent of market participation.

Land Size (FARS): It is a continuous explanatory variable measured in hectares. Indicating the total size of land allocated to white haricot beans. Shewaye *et al.* (2016), found that the size of the farm affected the extent of participation in the haricot bean market, which was positively affected by cultivated land size. According to Wogayehu and Tewodros (2015), the amount of haricot beans delivered to the market was positively impacted by the farm's size. Thus, in this study, the farm size of white haricot bean production was expected to positively influence white haricot bean market participation and the extent of market participation.

Distance to the nearest market (DNMT): It is a continuous explanatory variable that would be measured in kilometers from the household residence to the nearest market center. Proximity to market centers lowers transportation costs and facilitates access to market opportunities, thereby encouraging the supply of white haricot beans to the market. Ephrem (2018), found that the distance from the nearest market negatively influenced the quantity of haricot beans marketed. Thus, in this study, distance to the nearest market was hypothesized to negatively influence white haricot bean market participation decisions and the extent of market participation.

Frequency of Extension Contacts (NEXTC): It is a continuous explanatory variable referring to the number of contacts of farmers with public extension workers per year, that is during the year 2023/24. It is through extension services that the farmers can acquire better skills and knowledge on production and marketing, which positively affect the production and marketed proportion of haricot beans. Gashahun (2015), found that the number of frequency extension contacts affected the quantity of haricot beans marketed significantly and positively. Thus, in this, several frequent contacts with extension workers were hypothesized to positively influence the white haricot bean market participation decision and the extent of market participation.

Access to credit (AOCT): This is a dummy explanatory variable taking a value of 1 if the household head has access to credit and 0 otherwise. When credit is used to buy farm equipment, other agricultural inputs, and technical advancements, agriculture becomes more productive. Additionally, credit can be a tool for maintaining market stability. According to Mbitsemunda and Karangwa (2017), access to credit had a positive impact on the probability of households' decisions to participate in the market of beans in Rwanda. Therefore, access to credit was

expected to positive effect on the white haricot bean market participation decision and the extent of market participation.

Membership in Cooperative (MICO): It is a dummy explanatory variable that takes a value of 1 if the household head is a member of an agricultural cooperative and 0 otherwise. Cooperatives work to overcome many of the hindrances that prevent individual farmers from participating in markets. Membership in the cooperative would acquire technical and market information, access to inputs, increased access to extension services and/or technical advice, transport to markets, and access to credit facilities. Yalew and Lemma (2019), found that membership in cooperative organizations was positively related to maize production and the extent of maize marketing. Thus, in this study, membership in the cooperative was expected to positively influence white haricot bean market participation decisions and the extent of market participation.

Farming Experience is a continuous variable measured in the number of years of household heads engaged in maize production and marketing. This variable was used as a proxy for the availability of an active labor force in the household. This variable was expected to affect farmers' decisions to participate in the market positively. Family size was expected to have a positive relationship with market participation and the extent of participation in the red bean market in the household head market (Kabeto, 2014).

Access to market information (MINFO): It is a dummy explanatory variable that takes a value of 1 if the household head has access to market information and 0 otherwise. It was expected to influence positive market participation decisions. Access to market information is important because it enables farmers to make more appropriate decisions on which market to sell and when to sell the commodity. According to Tewodros Tefera, (2013), found that there is a positive relationship between access to market information and participation decisions in the haricot bean market. Changalima *et al.* (2022), found that access to market information positively and significantly influenced the household maize market. Thus, in this study, access to market information was expected to positively influence white haricot bean market participation decisions and the extent of market participation.

Livestock holding (TLU): The number of livestock owned by farm households is represented by the tropical livestock units (TLU), a continuous explanatory variable. Farmers that have a higher TLU may sell it and use it for production, or they may use it to generate draft power for traction. A study by Ephrem (2018), on haricot beans, indicated that livestock owned positively affected haricot bean marketed surplus. Therefore, livestock holding was expected to positively influence the white haricot bean market participation decision and the extent of market participation.

Table 2: Description of independent variables used in the probit and OLS models

Variable	Description	Type	Measurement	Expected Sign	
				Market participation	Extent
Age	Age of household	Continuous	Year	+/-	+/-
Sex	Sex of household head	dummy	1, Male, 0, female	-/+	+/-
Education	Education level hh	Continuous	Year of schooling	+	+
Nonfam	Non-farm income	Continuous	Birr	+/-	+/-
Frequency	Frequency Extension contact	Continuous		+	+
Credit	Access to Credit	Dummy	1, Yes, 0, No	+	+
Distance	Distance to nearest market	Continuous	Kilometer	-	-
Livestock	Number of livestock owned	Continuous	TLU	+	+
Famlysize	Family size of household	Continuous	Headcount	+/-	+/-
Mktinfo	Access to market information	Dummy	1, yes 0, no	+	+
Owntprpt	Own transport of hh	Dummy	1, yes 0, no	+	+
Farmsize	Farm size	Continuous	Hectare	+	+
Farm exp	Farm experience of WHB	Continuous	year	+	+
memcooper	Member of a cooperative	Continuous	quintal	+	+

4. RESULTS AND DISCUSSIONS

This chapter presents results and a discussion of the findings analysis of the white haricot bean market chain in Habro District. First, it summarizes the socio-economic and demographic characteristics of the sample farmers and traders, including factors like age, education, family size, and income sources, which influence market participation. Second, it discusses the market performance of white haricot beans, identifying key market actors and their roles. The chapter examines the structure, conduct, and performance (SCP) of the market, including competition, pricing, and market integration. Finally, the chapter presents the results of the econometric analysis, which identifies the determinants that influence producers' decisions to participate in the market and the number of white haricot beans supplied. These results offer valuable information on the key determinants influencing market participation decisions and the extent of market participation in the Habro district.

4.1. Socio-economic and Demographic Characteristics of Respondents

To design an appropriate research and development initiative, one needs to understand the basic characteristics of the decision-making unit. Descriptive statistics of household demographic characteristics and socio-economic and institutional variables that were believed to influence decision-making were assessed, and the following results were obtained.

4.1.1. Demographic characteristics of white haricot beans producers

Results on the distribution of ages, family size, sex, education level, farm experience, and other demographic factors among white haricot bean-producing households are covered first. Out of the 352 households surveyed, the study revealed that 62.5% participated in the market, while the remaining 37.5% did not participate.

Sex of the household head: from a total of 352 sample respondents of white haricot beans producers most of them (65.1%) are male-headed households and the remaining (34.9%) are female-headed households. As shown in Table 4, among market participants, male-headed and female-headed households constitute 85% and 15%, respectively. Out of non-participants, 31.8% were male-headed while the remaining 68.2% were female-headed households. There is a significant percentage difference between market participants and non-participants based on their gender ($\chi^2= 4.20$). This is because, in comparison to their male-headed counterparts,

families headed by women have unique challenges in their participation in activities connected to agricultural production because they are involved in both farming and homemaking. Their limited access to and ownership of resources would also likely lead to several common economic and social problems that further lower their level of productivity, market involvement, and farming engagement.

Access to market information: Market information, which includes data on price, supply, and demand, influences producers' decisions to participate in the market. The study found that 69.5% of participant households had access to market information, while 30.5% lacked access to details on prices, demand, and supply. Among non-participant households, 37.9% have access to market information, while 62.1% do not access market information. The chi-square result ($\chi^2 = 101.5$) shows a positive and significant difference at a 1% significant level in access to market information between participant and non-participant households.

Cooperative membership: Table 4 shows that 65.9% of market participants are members of farmer cooperatives, compared to only 34.1% of non-participants. The chi-square result ($\chi^2 = 124.6$) confirms a significant difference at the 1% significance level, indicating that cooperative membership strongly influences market participation.

Access to Credit: The survey shows that 37.3% of participants accessed credit, while 62.7% did not have access to credit, often due to high interest rates, religious restrictions, or repayment fears tied to seasonal production. Among non-participants, 35.6% access credit, while 64.6% did not access credit. Table 4 shows that 37.3% of market participants had access to credit, while only 35.6% of non-participants had access to credit. Credit availability differs significantly between participants and non-participants, according to the chi-square test ($\chi^2 = 4.58$).

Table 3: Demographic and socio-economic characteristics of white haricot bean producers (categorical)

Variables	Category	Participants (220)		Non-participants (132)		Total		χ^2 -value	p-value
		freq	%	freq	%	freq	%		
Sex of the HH	Female	33	15	90	68.2	123	34.9	5.17	0.023
	Male	187	85	42	31.8	229	65.1		
Marital status of HH	Single	16	4.5	5	1.5	21	6	2.9	0.400
	Married	172	48.8	102	28.9	274	77.8		
	Divorced	21	5.9	18	5.1	39	11.1		
	Widowed	11	3.1	7	1.9	18	5.1		
Access to credit	yes	82	37.3	47	35.6	113	36.6	4.58	(0.032)
	no	138	62.7	85	64.6	239	63.4		
Access to market information	yes	153	69.5	82	37.9	235	66.8	101.5	(0.000)
	no	67	30.5	50	62.1	117	33.2		
Membership of cooperative	yes	145	65.9	47	64.4	203	65.3	124.6	(0.000)
	no	75	34.1	85	35.6	150	34.7		

Source: own survey result (2024)

Age of the household head: The difference in age between the heads of households that sold white haricot beans was analyzed in the survey. The average age of the heads of the sampled households was 44.89 years. While the average age of non-participants was 52.97, that of participants was 40.04. There was a statistically significant difference in age of households between participant and non-participant.

Farming experience: The households under investigation had an average of 18.20 years of farming experience, with a standard deviation of 4.59. The average farming experience of participating households was 18.48 years, whereas the average age of households not engaged in white haricot bean marketing was 18.03 years. The results of the marketing of white haricot beans showed a statistically significant difference in agricultural experience between those who took part in the sale of white haricot beans and those who did not ($p=0.0239$).

Distance to the nearest market: Distance from market center where farmers often sale their white haricot beans product influences their market participation. On average, the sampled households are at a distance of about 8.89 kilometers from the nearest market center. White haricot beans market participant households are at a closer distance from market center. This is because, the longer the distance from market center; the higher the transportation cost in terms of time spent and value

gained, which can decrease farmers' market participation. The mean distance from the nearest market for the whole sample was 8.89 kilometers. The mean distance from the nearest market for market participants was 8.69 kilometers while it was 9.23 kilometers for non-participants.

Education level of household head: Education is assumed to increase farmer's ability to search process and use information relevant to the white haricot beans market participation and supply. As shown in Table 4, the mean level of formal education of sample respondents during survey was 4.82 years with standard deviation of 2.4. The education level of the sample respondents indicated that the participants were more educated (average education level of 5.89 years with standard deviation of 2.10) than the non-participants (average education level of 3.0 with standard deviation of 1.7). The two groups were found to be significantly different in terms of education level at 1% significant level.

Table 4: Demographic and socio-economic characteristics of white haricot bean producers (continuous)

Variables	Participants (n=220)		Non participants (n=132)		Total		t-value
	Mean	Std	Mean	Std	Mean	Std	
Age of HH	40.04	5.62	52.97	4.86	44.89	8.2	-21.956***
Education	5.89	2.10	3.0	1.7	4.82	2.4	13.534***
Family size	6.35	1.93	6.03	1.89	6.23	1.9	-0.400
Farming experience	18.48	4.63	18.03	4.52	18.20	4.59	4.878***
Tropical livestock units	4.06	1.93	4.31	2.03	4.26	2.05	1.152
Farm size	0.83	0.286	0.76	0.297	.81	0.292	15.364***
Non/Off-farm income	33517.7	12893.1	35786.2	13585.7	34368.4	13183.8	-25.530***
Distance to market	8.69	4.38	9.23	3.96	8.89	4.233	-19.517***
extension contact	2.14	1.114	1.89	1.19	2.16	1.17	18.751***

Source: own survey result, 2024

Total land holding in ha: Production is nearly always correlated with an increase in the amount of land cultivated an increase in production cannot take place without an increase in the amount of land available for cultivation. The land used for crop production by the majority of smallholder farmers in Ethiopia is closely tied to land resources. Table (4) below also demonstrates that sample households in the study area allocate an average of 0.81 hectares of land for the production of white haricot beans, whereas households that are participants and non-participants in the market allocate an average of 0.83 hectares and 0.76 hectares, respectively, for the production of white haricot beans. The difference in means between participants and non-participants is significant

at the 5% significance level, . This means that households involved in the market tend to use more land for growing white haricot beans, leading to higher production. Because they produce more, they can participate in the white haricot bean market more than those who don't participate.

Non/off-farm income: The average non/off-farm income of household headed taken among participants and non-participants was 33517.7 and 35786.24 respectively. There was a statistically significant difference between the participants and non-participants in terms of annual non-farm income at 1 % significant level.

Frequency of extension contact: Producers' ability to grow and sell white haricot beans is strongly affected by their access to services like extension support. In the study area, there are development agents and extension workers to help farmers, but the number of visits varies. Farmers who see extension workers more often are more likely to produce white haricot beans and participate in the market than those who see them less often. According to the result of Table (4), the total sample households in the study area on average visit 2.05 days within the given production year or season by extension workers. There is a significant mean difference between market Participants and non-participants based on extension service at the 5% level of significance in which those market participants on average visit 2.14 days in their production season, while those non-participants visit 1.89 days. There was a statistically significant difference between the participants and non-participants in terms of frequency extension contact.

4.1.2 Demographic and Socio-economic Characteristics of Sampled Traders

Tables 5 and 6 Summarize the demographic and Socio-economic characteristics of traders including sex, marital status, family size, education level, age, and experience. The survey result indicates that 76% of the sample traders were male and 24% were female. With regards to marital status, from the total sample traders, 68% were married, 8% were single, 16% were divorced, and 8% were widowed.

Table 5: Demographic and socio-economic characteristics of sampled traders (categorical variable)

Variables	Description	Frequency	Percent
Sex	Male	12	76
	Female	8	24
Marital status	Married	13	68
	Single	2	8
	Widowed	2	8
	Divorced	3	16

Source: own survey result (2024)

The business experience describes the length of time that traders of white haricot beans have been involved in a trading activity where their business is essential to decision-making. The study results show that, with a range of 7 to 25 years, the average experience in the white haricot bean market is 12.96 years. The sampled traders had a mean age of about 35.75 years, with a minimum age of 26 and a maximum age of 40. The sampled traders had a mean family size of 5.44, with a minimum family size of 3 and a maximum size of 7. The sampled traders had an average of 6.12 years of education, with the minimum and maximum being 0 and 9 years, respectively.

Table 6: Demographic and socio-economic characteristics of sampled traders (continuous variables)

Variables	Frequency	Minimum	Maximum	Mean	Std. Deviation
Education	20	0	9	6.12	2.743
Family size	20	3	7	5.44	1.193
Experience of trader	20	7	25	12.96	4.578
Age	20	26	40	35.75	6.930
working capital	20	63200	899800	280721.25	252852.14
Initial capital	20	31600	273500	99020	62132.6

Source: own survey result (2024)

Financial resources such as starting capital, working capital, sources of capital, and loan sources are examples of socioeconomic traits. The average starting capital of the studied white haricot bean traders was birr 99020.0, with a range of 31600 to 273500 birr, as shown in Table 7. Furthermore, the survey result shows that the average working capital of sample white haricot beans traders was 280721 birr and 25cent ranging from 63200 to 899800 birr.

As indicated in Table 7, about 45% of the sampled traders were using their own capital while about 10% used sharing with others. Furthermore, about 35 percent of traders borrowed working

capital from banks, and the remaining 10% borrowed from friends. This indicates that the major source of loans for a trader was a bank.

Table 7: Source of working capitals for sampled traders

Traders' Source of working capital	Frequency	Percentage
Own capital	9	45
Banks	7	35
Friends/Relatives	2	10
From Another trader	2	10

Source: own survey result (2024)

4.2. White haricot bean market chain actors and their functions

Market chain analysis of the white haricot beans in the study area indicated the involvement of diverse actors who are involved in the production-to-consumption system of the white haricot bean. These include the actors who participated in the conventional white haricot bean market chain: producers, rural collectors, wholesalers, primary cooperatives, cooperatives unions, ECX (Ethiopian commodity exchange), and exporters. The major actors involved in the white haricot bean market chain are discussed below.

Producers: White haricot bean producers are the main players and the initial stage of the chain, handling and marketing the majority of the market chain's tasks from preparing farm inputs on their farms or obtaining them from outside sources. White haricot bean farmers are primarily responsible for plowing, planting, fertilization, irrigating, weeding, controlling pests and diseases, harvesting, and post-harvest management. In terms of marketing, the producers of white haricot beans had two choices: they could sell directly to collectors (rural collectors) and wholesalers or through brokers

Consumers: Households that purchased white haricot beans for eating straight from farmers or rural collectors are considered consumers.

Local Collectors: To resale white haricot beans to consumers or wholesalers in either rural or urban marketplaces, local collectors, farmers, or part-time traders in the chain, purchase modest amounts of the beans from farmers in village markets.

Wholesalers: Wholesalers are essential to the white haricot bean supply chain, especially in the Ethiopian market. By cleaning, sorting, packing, and storing the beans before they arrive at the trading floor, they ensure quality control in addition to purchasing vast quantities of beans from farmers and collectors. Their presence on the ECX trading floor demonstrates how important they are in connecting exporters and producers, which makes it easier for the product to be distributed.

Primary cooperatives: This system appears to be centered on primary cooperatives, which are made up of farmers from different regions (kebeles). They supply to the Chercher Oda Bultum Farmers Union with white haricot beans after buying them from both member and non-member farmers. These cooperatives carry out several duties throughout the district, including gathering, classifying, packing, storing, and eventually selling the beans to the cooperative union.

Cooperative Union: The district had a single cooperative union with which cooperative societies were linked, the Chercher Oda Bultum Farmers Union. Primary cooperatives operating in rural regions with production were the source of the produce purchased by the union. Red pepper, white bean, haricot bean, teff, wheat, and maize were among the commodities sold by the union. Through the primary cooperative, the union bought white haricot beans to participate in the market and lessen the volatility of commodity prices in the district. The inspection was conducted solely by visual inspection, and the cooperative union regarded the size, color, and variety of white haricot beans as important qualities.

ECX: ECX is expected to create market integrity through: the introduction of viable products with certified grades and standards; membership-based trading; and the enforcement of standardized terms and conditions for the enforcement of contracts under trading rules.

Exporter: In domestic trade, exporters are the final link in the supply chain. They purchase graded white haricot beans from cooperative unions and wholesalers at the ECX trading floor, move them to their warehouse from the ECX warehouse, reprocess them to meet export requirements, and obtain quality certification.

4.3 Market channels of white haricot bean

The study result indicates that there are six white haricot beans market channels in the study district and these are, Producers sell white haricot beans to consumers directly in the first channel, whereas producers sell the beans to rural collectors in the second channel, who resell them to consumers and wholesalers. This third channel involves rural collectors acting as a link between farmers and wholesalers. White haricot beans are bought directly from producers by wholesalers in four channels, and they subsequently sell to exporters via the ECX trading floor. In the fifth-channel primary cooperatives buy white haricot beans directly from the producer and they in turn sell the white haricot beans to the cooperative union, in this channel the primary cooperative is used as the bridge between producer and union. In the sixth channel, the cooperative union buys white haricot beans directly from the producer and they in turn sell the white haricot beans to export through the ECX trading floor. The main identified channels of white haricot beans during the survey in the study area are stated as follows:

Channel 1: Producers \Rightarrow Consumers.

Channel 2: Producers \Rightarrow Rural Collectors \Rightarrow Consumer

Channel 3: Producers \Rightarrow Rural Collectors \Rightarrow wholesaler \Rightarrow Consumer

Channel 4: Producers \Rightarrow Wholesaler \Rightarrow Auction Market (ECX) \Rightarrow Exporters.

Channel 5: Producers \Rightarrow primary Cooperatives \Rightarrow Union \Rightarrow (ECX) \Rightarrow Exporters

Channel 6: Producers \Rightarrow Union \Rightarrow Auction (ECX) \Rightarrow Exporters

In the years 2023/24, farmers in the study area sold about 1056 quintals of white haricot beans to various suppliers (HDANRO, 2023). The largest purchasers of these goods (559.68 quintals, or 53 percent) were wholesalers. rural collectors came in second place with 232.32 quintals, or 22% of the entire volume, followed by a primary cooperative, which had 116.16 quintals, or 11% of the total. Notably, the distribution channels showed that primary cooperatives and rural collectors had a direct flow to cooperative unions and wholesalers, respectively. Upon completion of these agreements, cooperative unions and wholesalers gave exporters their entire sums through the ECX trading floor. Due to their crucial role in the trading dynamics and considerable control over market volumes, wholesalers are in the most important position in the white haricot bean market in the study district.

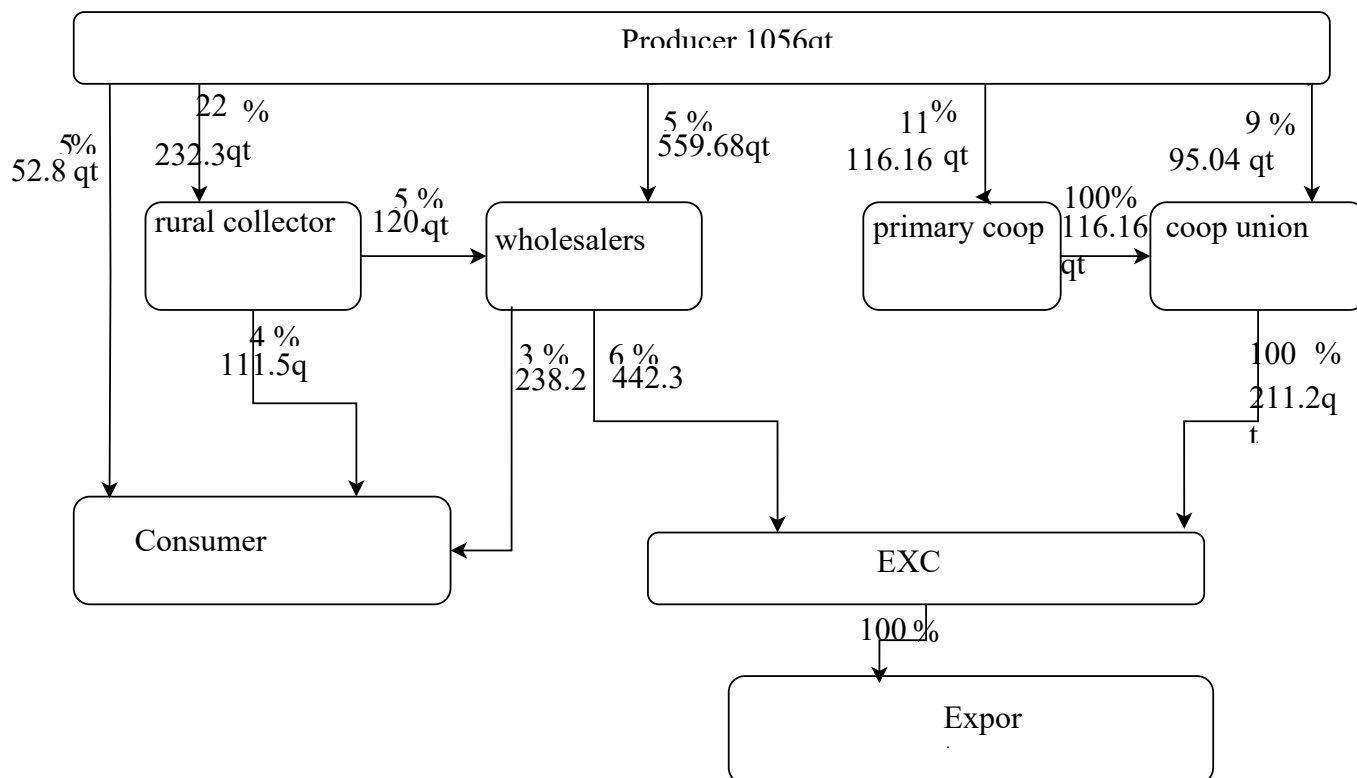


Figure 3: White haricot bean market channels for different market actors

Source: Own survey results, 2024

4.4. Structure, Conduct, and Performance of White Haricot Beans

4.4.1. Structure of white haricot beans market

Market performance has mostly been analyzed using the structure conduct-performance (S-C-P) paradigm. According to its assumption, some market features, such as market concentration and entry barriers, affect the profitability of individual businesses that operate in the relevant market (Aleksandrova and Lubys, 2004). The market concentration ratio, entrance requirements such as working capital availability and licensing processes, and degree of transparency (market information) are some of the factors used in this study to examine the market structure for white haricot beans. This subsection presents and discusses the characteristics of the white haricot bean market structure, including the concentration ratio, entry barriers, level of market transparency, marketing participants, level of concentration of buyers and sellers, and barriers to entry. Nearly every sample producer who responded to the survey stated that they produced an improved variety of white haricot beans during the survey year.

4.4.1.1. Degree of market concentration

The trader's survey data was used to compute the four-firm market concentration ratio. Four firm concentration ratios show how much of a market's volume is controlled by the top four companies (Kohls and Uhl, 1985). Additionally, market concentration was calculated using a sample of 20 traders in these investigations. CR_x, which represents the proportion of the market sector held by the largest X enterprises, is used to express the concentration ratio. A firm's or a group of enterprises' influence over the purchase and sale of produce is represented by the degree of concentration.

The most common concentration ratio used to assess market structure is the four firms (CR₄) concentration ratio (Kohls and Uhl, 1985). A strong oligopoly is typically defined as having a CR₄ greater than 50%, a moderate oligopoly as having a CR₄ between 33% and 50%, and a non-concentrated market as having a CR₄ less than 33%. Major players involved in the purchasing and selling of white haricot beans were taken into account for this study in terms of market structure.

The calculation of the concentration ratio by considering an average volume of white haricot beans handled by the largest wholesaler per week in peak production season based on the four firm criteria indicated the existence of oligopoly market power. Four firms control 54.7% of the total amount of white haricot beans sold in the market during peak production season at the Habro district market. Hence, based on the rule of thumb criteria, a strong oligopolistic market structure was observed in district markets, it is concluded that the white haricot bean market at the woreda level is inefficient and non-competitive. Therefore, as shown in the table below, the white haricot bean market concentration ratio in the study area was 54.7%, suggesting the existence of a strong oligopoly market type. It indicates the top four traders controlled 54.7% of the white haricot bean marketed in the 2023/24 production year.

Table 8: White haricot beans market concentration ratio

Frequency of traders (A)	Cumulative frequency of traders(B)	%share of traders C	Cumulative % of traders (D)	Quantity purchase in Qt (E)	Cumulative quantity purchase (F)	% share of purchase (G)	Percent Cumulative purchase $\sum S_i$
1	1	5	5	1900	1900	14.9	14.9
1	2	5	10	1880	3780	14.7	29.6
1	3	5	15	1700	5480	13.3	42.9
1	4	5	20	1500	6980	11.8	54.7
2	6	10	30	1360	8340	10.7	65.4
2	8	10	40	1350	9690	10.6	76
1	9	5	45	1300	10990	10.2	86.2
4	13	20	65	600	11590	4.7	90.9
3	16	15	80	450	12040	3.5	94.4
1	17	5	85	340	12380	2.7	97.1
1	18	5	90	190	12570	1.5	98.6
2	20	10	100	185	12755	1.5	100

Source: Own Survey result (2024) $C4 = C1 + C2 + C3 + C4 = 14.9 + 29.6 + 42.9 = 54.7\%$

4.4.1.2. Degree of market transparency

All traders had information from various sources in the sample markets. White haricot bean traders in the district markets contacted traders in Adama to get information about prices in the central market. Additionally, all sample traders have unequal access to market price information, suggesting they had access to it. For marketing decisions, traders rely on the accuracy and timeliness of market information.

In a transparent market, most participants are well-informed about their rivals' supply sources and purchasing costs, enabling them to make decisions. It is well recognized that timely and reliable market information improves market performance by increasing buyers' and sellers' understanding of supply and demand (Reardon and Timmer, 2005). One major monopoly source that influences horizontal and vertical linkages is exclusive access to market information, the control or concentration of information asymmetry, and the concentration of capital at the hands of very few traders. Gains from effective market price formation are distributed fairly when market knowledge is more balanced.

In the study area, there was no systematic way to give all market participants accurate market information. Approximately 50% were obtained over the phone, 25% from another trader, 15% from friends and neighbors, and 10% from white haricot bean brokers, TV, and radio. The timeliness and quality of the information obtained depended on the trader's access to market information channels and their assessments of the level of supply, demands, and prices gathered from various sources and at various times, as different categories of traders had very different sources and methods of obtaining information.

Despite this, media such as radio and television are valuable in providing market information quickly over a wider geographic area. Since no traders have used the media as a source of information, its impact on providing users with information about the grain market is quite small. Nevertheless, one of the main issues they encountered when selling white haricot beans in the study area was market information, which they continued to complain about, their buyers live far away, and they even offer them cheaper pricing than what was agreed upon at the time of the transaction.

Table 9: Source of market information

Source of market information	Frequency	Percent
Through the telephone	10	50
From other traders	5	25
From friends and neighbors	3	15
From brokers, TV and Radio	2	10

Source: Own Survey result (2024)

4.4.1.3. Barriers to entry

License: In many business sectors, acquiring a license is often a significant barrier to market entry. Typically, traders are restricted to operating only within the business activities specified in their licenses. However, this does not seem to hold for white haricot bean trading in the study area. Despite the theoretical requirement for a specific license to engage in grain trading, practical observations revealed that licensing did not pose a significant obstacle to entering the white haricot bean market. About 79% of the sample trader respondents were licensed in grain trading, while 21% of the traders had no licenses; most of them were rural assemblers and wholesalers in the study area.

The absence of a trading license for white haricot bean trading activities did not restrict traders from entering white haricot bean trading businesses in the study area. Therefore, the license is not a barrier to entry into the white haricot bean trade business. Even though, theoretically, it is compulsory to have a license to enter the grain market, the simplicity of having a grain license and the absence of strong restrictions to enter the grain market for licensing made grain marketing relatively free to enter. Thus, entry into white haricot beans trading is easy.

Difficult licensing procedures: Based on the survey results, about 94% of white haricot bean traders have considered the licensing procedure easy, and 6% of traders measured the licensing procedure as a difficult and discouraging factor for entry into the white haricot beans business.

Lack of Capital: In the survey, 60% of traders cited a lack of working capital as the main obstacle to starting their business, limiting both entry and operational efficiency. Complex loan requirements from banks and MFIs further complicate access to funds. Among respondents, 45% used personal capital, 35% relied on bank loans, 10% borrowed from friends or relatives, and 10% obtained funds from other traders in the study area.

4.4.2. White haricot beans market conduct

The ability of businesses or individual traders to impact or adapt to the market in which they operate is known as market conduct. The behavior of farmers and traders in the white haricot bean market is analyzed in this paper. Producer's and traders' pricing and purchasing tactics were examined regarding the market conduct of white haricot beans.

Producer price setting strategy: The survey's results on producers' selling price techniques revealed that 17.9% of sampled producers thought buyers and sellers negotiate pricing, while 11.4% of sample producers indicated that sellers set the selling price. 52% of the producers, said that the buyers set the selling price, and 18.7% of producers said that the market set the selling price.

Table 10: Producers selling price setting strategy

Variables	Description	Frequency	Percent
Selling setting price	Negotiation	63	17.9
	Sellers	40	11.4
	Buyers	183	52.0
	Market	66	18.7

Source: Own survey result 2024

Traders' price setting strategy: According to the study result from sampled traders 15% of traders said they negotiated the purchasing price, 40% reported that they set the purchasing price themselves, 20% stated that the sellers set the purchasing price, 25% said the market set the purchasing price. For the selling price set, 30 % of traders believed the selling price was set by negotiation, 25% thought the buyers set it, and 45% affirmed that the market set the selling price.

Table 11: Buying and selling price setting of traders

Variables	Description	Frequency	Percent
Purchase price setting	Negotiation	3	15
	Traders/buyers	8	40
	Sellers/producers	4	20
	Market	5	25
Selling price setting	Negotiation	6	30
	Buyers	5	25
	Market	9	45

Source: Own survey result (2024)

4.4.3. White haricot beans market performance

The level of marketing margins was used to evaluate the performance of the white haricot bean market, accounting for related marketing expenses for important marketing channels. The marketing margin or price spread is a commonly used measure of system performance that can be useful descriptive statistics if it is used to show how the consumer's price is divided among participants at different levels of participation. Thus, the marketing margins of white haricot beans were analyzed based on the cost and average sale price of various marketing agents in the marketing channels of producers, rural assemblers, primary cooperatives, cooperative unions, wholesalers, and retailers, based on the 2023/24 production years of the sampled households in the Habro district.

4.4.3.1. Costs and profitability of white haricot beans production

Marketing margins were used to analyze the market performance of white haricot beans while accounting for related marketing expenses for important marketing channels. Therefore, a study was done to examine the expenses and purchase price of channel actors, as well as the margin at the level of producers, rural assemblers, wholesalers, retailers, cooperatives, and exporters, in the 2023/24 production years.

The activities and related expenses involved in growing white haricot beans at the farm household level were the main emphasis of this section. This is to determine the expenses related to the production and selling of white haricot beans at the producer's level. Marketing margins and related costs were taken into account when assessing the white haricot bean market's performance. The farmers, local assemblers, cooperatives, unions, distributors, and exporters were the main players in the white haricot bean market. The purpose of this part is to list and measure the various costs that the sample producers incur during the production process.

Table 12, shows the sampled households in the study area had to pay 2230 and 2300 birr per hectare for labor for plowing, and harvesting, respectively. The cost of labor for weeding and sowing is 1200 birr per hectare. enhanced seed and fertilizer varieties, which were expected to cost 6078 and 3233 birr per hectare, respectively. During the survey period, the sampled households in the study area spent 15,041 birr per hectare. According to sample white haricot bean producers, 6 quintals of white haricot beans were produced per hectare.

Table 12: Average cost production of the white haricot beans in 2023/24 years (Birr/ha)

Production cost item	Birr/ha	Share (%)
Seed varieties	6078	41
Fertilizers	3233	21.4
Ploughing,	2230	14.8
sowing and weeding costs	1200	7.9
harvesting costs	2300	15.2
Total production cost (Birr/qt)	15,041	100
Average yield of white haricot bean (qt/ha)	6	
Total Production cost (Birr/ha)	15,041	
The total price of white haricot beans production is one quintal/birr	8000	

Source: Own survey results (2024)

4.4.2.1. White haricot bean marketing cost and margin analysis

Delivering white haricot beans from producers to exporters comes at a total cost, which is the marketing cost. These costs include labor costs for packing, loading, and unloading the sack, as well as transportation, storage, processing, agent commission, and tax-related charges.

Table 13: Marketing costs for different marketing agents in birr /quintal

Marketing costs	Primary Coop.	Coop. Union	Local collector	Wholesalers	Exporter
Purchase price	8600	8500	8000	8500	9000
Loading and unloading	40	30	25	20	30
Transportation fee	40	40	30	50	90
Packing cost	-	-	-	40	40
Storage and other losses	25	20	20	20	30
Wage	-	20	20	25	50
Telephone	-	20	-	35	30
Broker commission	-	-	-	30	30
Processing cost	-	-	-	-	170
Tax expense	30	50	40	40	60
Total marketing cost	135	180	135	260	530
Selling price	9000	9000	8500	9000	10000
Gross margin= sp-pp	200	500	500	500	1000
Net profit/ loss = gm-tc	65	320	365	240	470

Source: Own survey results, 2024.

The performance of market channels was analyzed using marketing margin. Hence, market-related marketing margins and producer and intermediary shares based on product prices are crucial for assessing the effectiveness of white haricot bean marketing. The cost and benefit for the primary participants in those six major channels producers, wholesalers, primary cooperatives, cooperative unions, and exporters involved in the marketing of white haricot beans are shown in Table 14.

According to the study results, producers of white haricot beans made the most money overall when they sold directly to the primary cooperative in channel V, while they made the least amount when they sold directly to rural collectors in channels II and III. This suggests that producers who sell to primary cooperatives and distributors make greater money. This might be the case since wholesalers pay more when they purchase white haricot beans straight from

growers because there is no brokerage fee involved. Because brokers are always there and obstruct farmers' paths, it is difficult for a particular farmer to sell their produce directly to wholesalers.

This showed that to increase the gross margin on their white haricot beans, producers should sell their products directly to the primary cooperative. The producer's market share falls as the number of market players rises because the more middlemen in the market channel, the more money they can keep for their services. When wholesalers bought straight from the producer and sold it to the exporter, they made the largest profit of any traders' market agents, 740 birr per quintal on channel IV. On Channel III, rural collectors earned 465 birr/quintal. Exporters made 570 birr/quintal on channel VI, cooperative unions made 320 birr/quintal on channel VI, and primary cooperatives made 365 birr/quintal on channel V.

This suggests that the primary cooperatives and cooperative unions made the least amount of money from the white haricot bean market, whereas wholesalers made the most money overall (see Table 14). The greatest TGMM was recorded in channel IV, representing an estimated share of 16.7% of the consumer price, followed by channels VI and III, which hold shares of 15.9 % and 15.8% of the consumer price, respectively. The minimal TGMM was identified in channel II, representing an estimated share of 4.8% of the consumer's cost. The largest percentage share of producers' marketing margin (GMM_{pr}) was observed in channel I, which accounts for 100% of the consumer's price. This is because producers sell their produce directly to consumers.

The lowest gross marketing margin of producer earnings was found in channels IV and VI, with an estimated percentage share of 83.3 and 82.2, respectively. According to the margin analysis result above, every actor benefits, and every participant in the white haricot bean market makes money. The profit split across white haricot bean traders is not similar, even if their gross profit is positive. The study found that significant pricing and cost disparities amongst actors led to variations in benefit shares. All things considered, it is impossible to conclude that the white haricot bean market in the study area is efficient based on the results of the structure-conduct and performance analysis. Market inefficiencies are shown by the study's results the white haricot bean market's imperfect behavior, untransparent market, the presence of entry obstacles, and the incomparable cost and profit share among market chain actors are all relevant.

Therefore, it may be said that the Habro district's white haricot bean market is performing inefficiently.

Table 14: Marketing margin for different channels (Birr/qt)

Actors	Market margin (%)	I	II	III	IV	V	VI
Producers	Selling price	8300	8000	8000	8500	8600	8500
	GMM _P	100	95.2	84.2	83.3	84.4	82.2
Local collector	Purchase price		8000	8000			
	Marketing cost		135	135			
	Selling price		8400	8600			
	Gross profit		265	465			
	GMM _{RA}		4.8	6.3			
Primary cooperative	Purchase price					8600	
	Marketing cost					135	
	Selling price					9000	
	Gross profit					365	
	GMM _{pc}					4	
Cooperative union	Purchase price					9000	8500
	Marketing cost					180	180
	Selling price					9500	9000
	Gross profit					320	320
	GMM _{cu}					5	4.95
Wholesalers	Purchase price			8600	8500		
	Marketing cost			260	260		
	Selling price			9500	9500		
	Gross profit			640	740		
	GMM _{ws}			9.5	9.8		
Export	Purchase price				9500	9500	9000
	Marketing cost				530	530	530
	Selling price				10200	10100	10100
	Gross profit				170	70	570
	GMM _{ex}		0		6.9	5.9	10.9
	TGMM (%)		4.8	15.8	16.7	14.9	15.9

Source: Own survey results, 2024.

Note: TGMM_p, GMM_p, GMM_{rc}, GMM_{pc}, GMM_{cu}, GMM_w, and GMM_{exp} are gross marketing margins of total producers, local collectors, primary cooperatives, cooperative unions, wholesalers, and exporters, respectively.

4.5. Determinants of Market Participation Decision and Extent of Participation in the white haricot beans market

4.5.1 Determinants of participation decision in the white haricot beans market

The possible econometric models expected to be employed in analyzing market participation decisions and the extent of participation were the Tobit, Heckman two-step, and Double-hurdle models. Therefore, it is essential to identify which econometric model to use when dealing with such kinds of problems. The likelihood ratio (LR) test was used to compare the goodness of fit of the Tobit, Heckman's two-stage, and Double-hurdle models in this study. Before executing the Heckman selection econometric model, identify the Inverse Mills Ratio (IMR), to assess the appropriateness of Heckman's two-stage models, the study employed the inverse Mills ratio test (IMR). The Inverse Mills Ratio (IML/Lambda) term was significant and positive at a 5% probability level. This suggests that farmers' decisions to participate in the white haricot bean market were non-random, and unobserved factors influencing participation also affected the quantity supplied. Consequently, conventional models such as the Tobit or Double-Hurdle which do not account for such bias would yield inconsistent estimates. The Heckman model, however, corrects for this bias by explicitly modeling the selection process (participation decision) alongside the outcome (market supply).

Maximum Likelihood ratio (LM): The study also conducted the maximum likelihood ratio test to check the interdependence between the participation equation and the outcome equation. The result revealed that $\chi^2(1) = 4.39$ Prob. $> \chi^2 = 0.0361$ which is significant at a 5% probability level and reject the null hypothesis ($\rho = 0$). The result further suggests that the error terms in the two equations (i.e., Heckman's first-step and Heckman's second-step equations) were highly positively correlated. This implies that unobserved factors that make both participation in white haricot beans marketing and market supply of white haricot beans are more likely to be associated with higher scores on the dependent variable. Heckman's econometric model assumes an independent relation between the error of the first decision (participation) and the error of the second decision (level of participation), so ρ must be different from zero, and ρ was 0.79 in the study. The model chi-square test, applying appropriate degrees of freedom, indicates that the overall goodness of fit for the Heckman selection model is statistically significant at the probability of less than 1%. Given these findings, the Heckman two-step model was deemed

more appropriate than alternative approaches, as it effectively addresses both sample selection bias and the interdependence between participation and supply decisions. Thus, the study's methodological choice ensures robust and unbiased estimates of the determinants of white haricot bean market supply.

Finally, the Heckman selection model is appropriate for this data set. Below, in Table 15, are the results of the Heckman model (probit) in its first stage for the determinants influencing farmers' decisions to participate in the market. Nine of the fourteen factors included in the Heckman model were shown to have a substantial impact on the study area's households' decisions to participate in the market (Table 15). These were sex, frequency of extension contacts, family size, farm size, cooperative membership, livestock holding, ownership of transport, Access to credit, and non/off-farm income, which significantly influenced producers' decisions to participate in the white haricot bean market.

Sex of the household head: At the 1% level of significance, the household head's sex significantly and positively influences producers' decision to participate in the market. being a male-headed household would increase the probability of participating in the market by 15.3 %. The result is consistent with Haregitu (2019), who found that having a male household head positively impacted the decision to participate in the teff market.

Family size: Family size was found to have a positive and significant influence on the market participation decision of producers, at the 5% significance level. The marginal effects of this variable indicate that a one-member increase in adult equivalent in the family increased the probability of white haricot beans producers' market participation by 2.4 %. Because white haricot bean production requires much labor, households with large family sizes can recruit family members as a main labor source, reducing the amount of money needed to pay for labor. producers are encouraged to participate in the market and produce excess white haricot beans as a result. This result aligns with Kabeto (2014), and Teshome (2020), in Ethiopia, who found that the labor force promoted producers' participation in the red bean and haricot bean markets, respectively.

Non/off-farm income: As expected, the non/off-farm income was also positive and significantly influenced the market participation decision of producers, at a 1% significance

level. Smallholder farmers were more likely to engage in the white haricot bean market if they received off/non-farm income from off/non-farm employment. Because they can readily hire workers and buy inputs, white haricot bean producers with higher off/non-farm incomes might be able to engage more successfully than producers with lower non/off-farm incomes. Receiving non-farm income by engaging in non-farm/off-farm employment increases the chance of a household's market participation decision by 0.011%. This result is consistent with the findings of Adino *et al.* (2021), who found that the more off-farm income there is, the greater the probability of market participation, and also these results are in line with the studies of Alula *et al.* (2023), who found a positive and significant relationship between non/off-farm income and maize marketing.

Extension frequency contacts: At the 5% significance level, the number of extension contacts significantly and positively influences producers' decisions to participate in the market. This could be explained by the fact that more extension visits would offer current information on agricultural technologies that could boost production and, consequently, raise the marketable supply. With a one-day increase in extension contact of households, the probability of market participation decisions increased by 5.5 %. This result is consistent with Sisay and Aweka (2020), who found the additional extension contact had a positive and significant impact on producers' chance to participate in the haricot bean market, as well as Teshome's (2020), who found that additional extension contact had a positive and significant impact on producers' likelihood to participate in the haricot bean market.

Farm size: The result of the data showed that farm size was positive and statistically significant at a 10% level. White haricot beans are more likely to be produced on larger farms. The result indicates that for one additional hectare of land allocated to white haricot beans, the probability of the market participation decision of producers increased by 19%. The findings of Deresse *et al.* (2018), who discovered a strong positive relationship between land size and decision market participation in the teff market, are consistent with this outcome.

Cooperative Members: As anticipated, membership in a collaborative organization was significant at the 1% level and positively influenced the decision to enter the white haricot bean market. This suggests that joining a cooperative may improve access to market data, inputs, extension services, and/or technical advice crucial to production and marketing choices.

Therefore, being a member of a cooperative increases the probability of market participation by 55%. As a result, the likelihood of producer households that were involved in a farmers' cooperative was more likely to be a participant than be non-participant. This result agrees with Bahilu and Daniel (2020), who found that membership of an organization has a positive and significant effect on participation decisions on red beans.

Livestock (TLU): As anticipated, ownership of livestock was found to have a positive and significant influence on the market participation decision of producers at a 5% significance level. This is because farmers with more TLU can utilize them as a financial resource for production activities and as a source of draft power for tasks like traction and transportation. Having productive assets, like oxen, which are employed for direct production, enhances the household's planting area and raises the probability of producing a marketable surplus. As one TLU increased in livestock holding, the probability of the market participation decision increased by 1.97%. This outcome aligns with Moono's (2015), which indicated that the chance of producers participating in rice markets was positively and significantly influenced by livestock ownership.

Ownership of transport: Ownership of transport was found to have positively and significantly influenced the market participation decision of producers at a 5% significance level ($p = 0.03$). As households had one additional transportation, the probability of the market participation decision increased by 15.2%. This implies that producers are encouraged to produce in excess and engage in the market when they own the means of transportation to carry production inputs from the source and deliver outputs to the market. This result is in line with the findings of Shewaye *et al.* (2016), who found that ownership of means of transport had a positive and significant effect on the probability of producers participating in haricot bean markets.

Access to credit: Access to credit was found to be a positive and statistically significant influence on the market participation decisions of white haricot beans producers at a 5% significance level. Having access to credit for households increased the probability of market participation by 9.8 % (Table 15). This implies that producers sold more at markets when they could easily borrow money. It is simpler for producers to produce more white haricot beans when they can access credit. It enables them to purchase gardening supplies like fertilizer and

seeds. This result is in line with Kifle *et al.* (2022), who found a positive and significant relationship between access to credit and the market participation decision of teff.

Table 15: The first-step probit regression results of Heckman's two-step selection equation

Variable	Coefficient	Std. err.	z	P> z	Marginal Effect
Age	-0.0195203	0.02	-1.06	0.290	-0.0032372
Sex	0.6945268	0.26	2.73	0.008	0.1529756
Access to Market information	0.3985611	0.34	1.18	0.244	0.0839782
Access to credit	0.3993669	0.18	2.32	0.025	0.098079
Cooperative membership	1.655539	0.33	4.98	0.000	0.5472524
Own transportation	0.6156196	0.28	2.18	0.030	0.1519589
Livestock holding	0.0970039	0.04	2.28	0.023	0.019702
Distance to the nearest market	0.0095377	0.03	0.36	0.7020	0.0014421
Extension contact frequency	0.2402558	0.10	2.46	0.015	0.0548598
Farm experience	0.0201022	0.02	0.91	0.362	0.0026326
Family size	0.1031751	0.04	2.33	0.021	0.0240771
Education	-0.0152694	0.05	-0.33	0.748	-0.004535
Farm size	0.7817736	0.41	1.89	0.068	0.1920169
Quantity of harvested white beans	-0.0280058	0.08	-0.33	0.740	-0.0082022
Off/non-farm income	0.0000515	0.00	3.02	0.007	0.0000106
Cons	-5.245995	1.40	-3.86	0.000	

Number of observations = 352 Log likelihood = -150.42 LR chi2(14) = 164.39

Prob > chi2 = 0.00 Pseudo R2 = 0.35

Source: Own survey results, 2024.

4.5.2. Determinants of the extent of participation in the white haricot beans market

The second step in Heckman two step estimation procedures is used to identify determinants of number of white haricot beans supplied to the market and it includes those variables used in Heckman first step procedure except one or more exclusion restriction variables. This study used membership to agricultural cooperative as a selection variable as selection variable in participation equation which was found to affect white haricot beans market participation decision but has no significant effect on number of white haricot beans supplied to the market in order to predict inverse of the Mills' ratio correctly.

The results of second-step Heckman selection estimation for the number of white haricot beans supplied to the market are given in Table 16. The coefficient of Mills ratio (Lambda) in the Heckman second-step estimation is significant at 5% probability level. This indicates sample selection bias, which is the existence of some unobservable household characteristics

determining likelihood to participate in white haricot beans market and thereby affecting the number of white haricot beans supplied to the market. Wald $\chi^2(14) = 3800.12$ which is significant at 1% significant level, indicated the overall goodness of fit of the Heckman selection model. This shows that jointly the independent variables included in the selection model explain the extent of participation. Therefore, Heckman two step sample selection model was relevant model for this study. These variables are age, sex, farm experience, family size, livestock, education, access to market information, quantity of harvested, off/non-farm income, and distance to the nearest market. Age, sex, distance from the market, and off/non-farm income negatively and significantly influence the extent of market participation in white haricot beans. In contrast, the seven variables affect the extent of market participation positively and significantly.

Age of the household head: At the 1% significance level, the age of the household head had a significant and negative influence on the extent of market participation of producers. Older household heads may participate less in the market due to limited access to information and lower risk-taking, while younger heads sell more of their products because they have better access to market environments and information. Younger household heads could be attributed to greater familiarity with technologies, such as smartphones and online resources that offer market prices and demand patterns, than older household heads may be the cause of this. As one additional year increases in household age, the quantity of white haricot beans supplied to the market decreases by 0.032 quintals. The result is in line with Adino *et al.* (2021), who found that the age of the household head was statistically negatively significant in the extent of market participation among haricot bean producers.

Sex of the household head: As was hypothesized, the sex of the household head has a negative and statistically significant impact on the extent of market participation, which is statistically significant at the 1% significance level. Being a female-headed household would decrease the supply of white haricot beans to the market by 0.87 quintals. This may indicate difficulties female producers face, possibly due to social or economic causes. This result is consistent with Walelgn and Lemma (2019), who found that the volume of maize market supply is significantly and negatively affected by household sex.

Education level of the HH: Educational level was a positive and statistically significant influence on households' extent of market participation at a 5% significance level. For every additional year of formal education of the household head, the market supply of white haricot beans increases by 0.05 quintals. Producers produce more when they receive formal education or training within a given time frame. Education is essential for correctly implementing the guidance given by specialists in the field and development agents. This result agreed with the results of Selam (2020), who found that education level affected the marketed quantity supply of haricot beans positively.

Farm experience: Farm experience significantly and positively affects the extent of market participation of white haricot producers at a 10% significance level. More years of experience help farmers improve their understanding of production and marketing challenges. Experienced farmers can better match supply with market demand, knowing who needs the beans and when. With an additional year of farming experience in households, the quantity of white haricot beans supplied to the market increases by 0.018 quintals. This finding aligns with Adino *et al.* (2021), which demonstrated that the years of experience in household heads significantly influence the level of market participation among smallholder haricot bean producers.

Access to market information (MARKINFO): At the 1% significance level, access to market information had a positive and statistically significant effect on the extent of market participation of white haricot bean producers. Having access to market information increases the quantity of white haricot beans supplied to the market by 0.69 quintals. Improved market information reduces transaction costs, enhances participation, and mitigates issues like moral hazards and adverse selection. These results are consistent with those of Fentabil (2022), who found that access to market information will lead to increased productivity of haricot beans with a high marketable surplus.

Distance to the nearest market: As was hypothesized, distance to the nearest market had negative and significant effects on the extent of market participation of producers at the 5% significance level. This implies that when the household head's distance from the market increases by one kilometer, the quantity of white haricot beans they supply to the market decreases by 0.026 quintals. The implication is that the more producers get close to the market,

the more they can supply white haricot bean products to the market. Additionally, when farmers live nearest to the market, the amount of product supplied to the market increases, thereby increasing their income, and it is a better means of technology adoption to improve their produce further. This result is in line with Selam (2020), and Shewaye *et al.* (2016), who indicated that distance to the nearest market affected the number of haricot beans marketed significantly and negatively.

Quantity of white haricot beans harvested: As expected, this variable had a positive relationship with the extent of market participation of producers of white haricot beans, and it was found to be statistically significant at a 1% significance level. The model predicts that adding one quintal of product in households' production increases the number of white haricot beans they supply to the market by 0.15 quintals. This finding indicates that the marketed supply of white haricot beans from households in the study area is more influenced by the volume of white haricot beans produced. Farmers producing more white haricot beans tend to be market-oriented, as the increased output allows them to sell excess crops. This result is in line with Tashome (2020), who noted that in Ethiopia, the quantity of haricot beans harvested significantly positively influenced the amount of marketed supply of haricot beans.

Livestock holdings (TLU): The result shows a considerable positive relation at a 1% significance level between producers' extent of market participation and livestock holdings, as assessed in Tropical Livestock Units (TLU). In other words, households with more livestock holding exhibit higher levels of productivity, which leads to more farmers selling white haricot beans. Increased agricultural output is a result of having more livestock, especially in smallholder farming, when animals like oxen are used for planting. This implies that as one TLU increases in livestock holding, the quantity of white haricot beans supplied to the market increases by 0.12 quintals. This finding was corroborated by Ephrem (2018) and Selam (2020), who found a positive relation between the market supply and livestock holding in the context of haricot bean production.

Off/non-farm income (NONFRMI): The study found that off/non-farm income had a negative and significant influence on the extent of market participation of households at 1% significance level. When a producer of white haricot beans earns off/non-farming income, the number of producers supplying these beans to the market decreases by 0.0014 quintals. This could be

because growers with higher off/non-farm incomes would typically make more money from their off/non-farm sources rather than from selling white haricot beans. This result is consistent with Teshome (2020), who found that the income from non-farm income affects the quantity of haricot bean market supply significantly and negatively.

Family Size (FMLYSIZE): As was hypothesized, family size had a positive and statistically significant influence on the extent of market participation at a 5% significance level. When there is surplus labor, farmers can expand their land holdings, diversify their crop output, and participate in market exchanges. If a one-adult equivalent increases in households, the producers would be able to raise agricultural production and enhance their market-oriented activities in the supply of white haricot beans to the market by 0.05 quintals. Most smallholder farmers use family labor for farming activities; therefore, an increase in household size would lead to an increase in farm size cultivation, thereby increasing the amount of farm produce to sell. This result aligns with Hlatshwayo *et al.* (2021), who investigated smallholder producers' market participation in South Africa. They demonstrated that larger household sizes had a positive impact on farmers' extent of participation in agricultural markets.

Table 16: The second step, the OLS regression analysis results of Heckman's two-step

Variable	Coefficient	Std. err.	Z	P> z
Age	-0.0320533***	0.01	-3.54	0.000
Sex	-0.8749157***	0.12	-7.98	0.000
Distance to the nearest market	-0.0258746**	0.01	-2.03	0.042
Access to Market information	0.6868164***	0.20	3.48	0.000
Livestock holding	0.1240954***	0.02	6.09	0.000
Access to credit	0.1401266	0.09	1.60	0.110
Own transportation	0.487489	0.14	0.35	0.729
Extension contact frequency	0.0528767	0.05	1.07	0.284
Farm experience	0.0185263*	0.01	1.80	0.072
Family size	0.0489327**	0.02	2.17	0.030
Education level	0.0521377**	0.02	2.37	0.018
Farm size	0.1641441	0.22	0.74	0.462
Quantity of white haricot beans harvested	0.1529597***	0.04	3.89	0.000
Off/non-farm income	-0.0001448***	0.00	-15.95	0.000
_Cons	6.832701	0.88	7.76	0.000
lambda	0.4894624	0.19	2.61	0.010
rho=0.78953	Wald chi2(14) = 3800.12	Prob > chi2= 0.0000		

Note. *** = 1% significance level, ** = 5%, and * = 10% significance level

Source: Own survey data (2024).

5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Summary and Conclusion

This study aimed to analyze the market chain of white haricot beans in Habro District, West Hararghe Zone, Oromia Region, Ethiopia. White haricot beans are an important cash crop in the district, contributing significantly to the income of producers. Despite its potential, market participation and the extent of participation by producers are limited due to production and marketing challenges, as well as weak institutional support.

The specific objectives of the study were to identify the key market chain actors and their roles, analyze the structure, conduct, and performance of the white haricot bean market, and determine the factors influencing farmers' market participation and the extent of their involvement. To achieve these objectives, both primary and secondary data were collected. Primary data were gathered from 352 randomly selected white haricot bean farmers and 20 traders, while secondary data were sourced from relevant government and non-government organizations.

Descriptive statistics, including frequencies, means, percentages, and standard deviations, were used to examine socioeconomic and demographic characteristics. The Structure-Conduct-Performance (SCP) was employed to assess market structure, conduct, and performance. Additionally, the Heckman two-stage model was used to analyze determinants of market participation decisions and the extent of market participation.

The descriptive analysis revealed that from a total of 352 sample respondents of white haricot beans producers, most of them (65.1%) are male-headed households and the remaining (34.9%) are female-headed households. The average family size for both participants and non-participants was 6 people. Farmers' market experience averaged 18 years for participants and 18.48 years for non-participants. Participants owned an average of land size 0.83 ha, while non-participants had 0.76 ha.

Key market actors in the white haricot bean market chain included producers, wholesalers, rural collectors, primary cooperatives, unions, and consumers. The majority of the white haricot beans produced by the sampled farmers were sold to wholesalers (53%), followed by rural collectors (22%), primary cooperatives (11%), unions (9%), and directly to consumers (5%).

The SCP analysis indicated that the white haricot bean market in Habro is non-competitive, primarily due to barriers such as lack of capital, inadequate market transparency, and an oligopolistic structure. These factors result in high marketing margins, reflecting an inefficient market.

The Heckman model results showed that market participation decision is positively influenced by sex, farm size, livestock holding, extension contact, access to credit, cooperative membership, family size, transport ownership, and non-farm income. The extent of market participation was positively influenced by farming experience, livestock holding, family size, education, harvested quantity, and access to market information. Conversely, factors such as distance to the nearest market, age, sex, and non-farm income had a negative influence on the extent of market participation.

5.2 Recommendations

The study found several issues with the Habro district's white haricot bean market, such as inefficiency, unfairness, and restricted market access. The following suggestions are put forth to address these problems:

Cooperative support: By bolstering cooperatives, farmers will be able to pool resources and bargain for higher crop prices. Farmers will have more negotiating leverage and be able to obtain a just portion of market earnings if cooperative membership is encouraged.

Support for female households: Since female-headed households have more obstacles when it comes to market participation, policies should be created, and if already created applied correctly to assist them. Giving them financial support, training, and resource access will increase their market participation.

Extension services and education: Farmers' market participation can be enhanced by providing more frequent and high-quality extension services. Farmers can make decisions better if regular training sessions are organized and market-related guidance is given. Programs for adult education that emphasize production and marketing abilities will also enable farmers to participate in the market more successfully.

Increasing productivity: Policies should prioritize boosting production through better availability of high-quality inputs such as equipment, seeds, and fertilizer. Keeping these supplies accessible and affordable will increase farmers' productivity and market participation.

Improving rural infrastructure: Rural infrastructure, such as roads and transportation, needs significant improvement. Better infrastructure will reduce logistical barriers, making it easier for farmers to access markets and sell their produce.

Encouraging livestock ownership: Promoting livestock ownership for traction can increase market participation by enabling farmers to cultivate larger areas. Integrate livestock and crop farming by promoting mixed farming systems to diversify income sources and improve resilience.

Access to credit: Strengthening rural financial institutions and improving access to credit will allow farmers and traders to invest in production and marketing activities. Addressing collateral issues and providing timely credit is essential for increasing market participation.

Market Information: Improving access to market information is crucial for farmers. The government should invest in communication tools, such as mobile phones and the Internet, to provide real-time information on prices and demand, helping farmers make informed decisions and sell their produce at the best prices.

Promote Intergenerational Knowledge Transfer: Facilitate programs that encourage knowledge transfer between older and younger farmers, such as mentorship programs and community-based training sessions. Pair older, experienced farmers with younger ones. Older farmers share knowledge; younger farmers provide labor and adopt new tech.

Integrated Farm and Non-Farm Activities: encourage farmers to reinvest non-farm income into agricultural activities, such as purchasing inputs, improving infrastructure, or adopting new technologies. In conclusion, creating a more efficient and inclusive white haricot bean market in the Habro district requires a holistic approach. Strengthening cooperatives, improving infrastructure, providing education and extension services, and enhancing access to credit and market information will help increase farmers' participation and improve the market's overall performance.

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7. APPENDIX

Appendix table 1. Result from Heckman's two stage model

```

Heckman selection model -- two-step estimates      Number of obs      =      352
(regression model with sample selection)          Selected           =      220
                                                    Nonselected        =      132

                                                    Wald chi2(14)      =      3800.12
                                                    Prob > chi2        =      0.0000

```

	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
MARKWHBSUPPLY						
AGE	-.0319209	.009027	-3.54	0.000	-.0496134	-.0142284
SEX	-.8794231	.1249517	-7.04	0.000	-1.124324	-.6345223
NMARKDIST	-.0257948	.0127106	-2.03	0.042	-.0507071	-.0008825
MARKINFO	.6803702	.1971424	3.45	0.001	.2939782	1.066762
LIVEST	.1239392	.0203612	6.09	0.000	.0840319	.1638465
ACCOFCREDIT	.1397391	.0876613	1.59	0.111	-.0320739	.3115522
OWNTRANP	.047006	.1402659	0.34	0.738	-.2279102	.3219222
EXCTENCONTACT	.0519435	.0492551	1.05	0.292	-.0445948	.1484818
FARMEXP	.0183447	.0102713	1.79	0.074	-.0017867	.0384761
FMLYSIZE	.0485507	.0225163	2.16	0.031	.0044196	.0926817
EDUCT	.0523107	.0219864	2.38	0.017	.0092181	.0954032
FRMSIZE	.1754058	.2276641	0.77	0.441	-.2708077	.6216193
QUNTOFHARSTWHB	.1473947	.0424625	3.47	0.001	.0641698	.2306196
nonofffarmincome	-.0001455	9.09e-06	-16.01	0.000	-.0001633	-.0001276
_cons	6.887162	.8758269	7.86	0.000	5.170573	8.603751
MARKPARTDECI						
SEX	.6945268	.2603812	2.67	0.008	.1841891	1.204865
MARKINFO	.3985611	.3417564	1.17	0.244	-.2712692	1.068391
ACCOFCREDIT	.3993669	.1782258	2.24	0.025	.0500507	.7486831
COOPMEMB	1.66143	.3326413	4.99	0.000	1.009465	2.313395
OWNTRANP	.6142182	.2830867	2.17	0.030	.0593785	1.169058
LIVEST	.097006	.042639	2.28	0.023	.0134351	.1805768
NMARKDIST	.0102007	.026635	0.38	0.702	-.0420029	.0624044
EXCTENCONTACT	.2382165	.0983394	2.42	0.015	.0454748	.4309583
FARMEXP	.0196374	.0221003	0.89	0.374	-.0236784	.0629531
FMLYSIZE	.1024755	.0442639	2.32	0.021	.0157198	.1892312
EDUCT	-.0147082	.0458163	-0.32	0.748	-.1045064	.07509
AGE	-.019452	.0183665	-1.06	0.290	-.0554497	.0165458
FRMSIZE	.8531059	.4667228	1.83	0.068	-.0616539	1.767866
nonofffarmincome	.0000492	.0000184	2.68	0.007	.0000132	.0000852
QUNTOFHARSTWHB	-.0280058	.0843129	-0.33	0.740	-.1932561	.1372445
_cons	-5.245995	1.495261	-3.51	0.000	-8.176652	-2.315338
/mills						
lambda	.4814765	.1873044	2.57	0.010	.1143667	.8485863
rho	0.78723					
sigma	.61160832					

Appendix table 2. Likelihood ratio test of Heckman two- stage model

Heckman selection model
(regression model with sample selection)

Number of obs = 352
Selected = 220
Nonselected = 132

LR chi2(20) = 583.86
Prob > chi2 = 0.0000

Log likelihood = -326.7043

	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
MARKWHBSUPPLY						
SEX	-.9358199	.1128931	-8.29	0.000	-1.157086	-.7145535
MARKINFO	.5142614	.1497929	3.43	0.001	.2206728	.8078501
ACCOFCREDIT	.1223404	.0832867	1.47	0.142	-.0408986	.2855794
OWNTRANP	.0015104	.1308603	0.01	0.991	-.254971	.2579918
LIVEST	.1175897	.0191042	6.16	0.000	.0801461	.1550332
NMARKDIST	-.0271409	.0122111	-2.22	0.026	-.0510742	-.0032077
EXCTENCONTACT	.0346174	.0456604	0.76	0.448	-.0548752	.1241101
FARMEXP	.0169131	.0098243	1.72	0.085	-.0023421	.0361683
FMLYSIZE	.0416618	.0213118	1.95	0.051	-.0001085	.0834321
EDUCT	.052495	.0211815	2.48	0.013	.01098	.0940099
AGE	-.0299182	.0085895	-3.48	0.000	-.0467533	-.0130831
FRMSIZE	.1179815	.2155077	0.55	0.584	-.3044059	.5403689
QUNTOFHARSTWHB	.1452214	.0410412	3.54	0.000	.064782	.2256607
nonofffarmincome	-.0001498	8.12e-06	-18.44	0.000	-.0001657	-.0001338
_cons	7.443932	.7435366	10.01	0.000	5.986627	8.901237
MARKPARTDECI						
SEX	.8088129	.2725134	2.97	0.003	.2746964	1.342929
MARKINFO	.4900109	.3298133	1.49	0.137	-.1564113	1.136433
ACCOFCREDIT	.3788172	.1770779	2.14	0.032	.031751	.7258834
COOPMEMB	1.612711	.3154483	5.11	0.000	.9944441	2.230979
OWNTRANP	.710809	.2769292	2.57	0.010	.1680376	1.25358
LIVEST	.1032324	.0429231	2.41	0.016	.0191047	.1873602
NMARKDIST	.0075735	.0268078	0.28	0.778	-.0449687	.0601158
EXCTENCONTACT	.2503408	.0960821	2.61	0.009	.0620234	.4386583
FARMEXP	.0211092	.0222014	0.95	0.342	-.0224047	.0646231
FMLYSIZE	.0975946	.0444935	2.19	0.028	.010389	.1848003
EDUCT	-.0097245	.0460559	-0.21	0.833	-.0999924	.0805434
AGE	-.0234386	.0186167	-1.26	0.208	-.0599268	.0130495
FRMSIZE	.8836197	.4670009	1.89	0.058	-.0316853	1.798925
QUNTOFHARSTWHB	-.0081589	.0828553	-0.10	0.922	-.1705522	.1542344
nonofffarmincome	.0000596	.0000194	3.07	0.002	.0000215	.0000977
_cons	-5.76005	1.506939	-3.82	0.000	-8.713595	-2.806504
/athrho	.5666783	.2714582	2.09	0.037	.0346299	1.098727
/lnsigma	-.5623951	.0641578	-8.77	0.000	-.688142	-.4366482
rho	.5129156	.2000423			.0346161	.8000411
sigma	.5698426	.0365598			.5025089	.6461987
lambda	.2922812	.1273279			.042723	.5418393

LR test of indep. eqns. (rho = 0): chi2(1) = 4.39

Prob > chi2 = 0.0361

Appendix table 3. Link test for model specification

Source	SS	df	MS	Number of obs	=	352
Model	34.25812	2	17.12906	F(2, 349)	=	123.92
Residual	48.24188	349	.138228883	Prob > F	=	0.0000
				R-squared	=	0.4152
				Adj R-squared	=	0.4119
Total	82.5	351	.235042735	Root MSE	=	.37179

MARKPARTDECI	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
_hat	1.18501	.2934378	4.04	0.000	.6078815	1.762139
_hatsq	-.1692103	.2620035	-0.65	0.519	-.6845147	.3460941
_cons	-.0330932	.0678023	-0.49	0.626	-.1664457	.1002593

Appendix table 4. Tobit model results

Tobit regression	Number of obs	=	352
	Uncensored	=	220
Limits: Lower = 0	Left-censored	=	132
Upper = +inf	Right-censored	=	0
	LR chi2(15)	=	1010.24
	Prob > chi2	=	0.0000
Log likelihood = -216.80893	Pseudo R2	=	0.6997

MARKWHBSUPPLY	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
SEX	-.9031136	.1136801	-7.94	0.000	-1.126726	-.6795016
MARKINFO	.1275873	.1564242	0.82	0.415	-.1801035	.4352781
ACCOFCREDIT	.0502818	.0785901	0.64	0.523	-.1043071	.2048708
COOPMEMB	-.0674597	.1512347	-0.45	0.656	-.3649427	.2300233
OWNTRANP	.6443116	.1574137	4.09	0.000	.3346744	.9539488
LIVEST	.0848938	.0182502	4.65	0.000	.0489952	.1207924
NMARKDIST	-.0560189	.0112135	-5.00	0.000	-.0780762	-.0339615
EXCTENCONTACT	.1470227	.0439597	3.34	0.001	.0605527	.2334926
FARMEXP	.0626381	.0099001	6.33	0.000	.0431643	.0821118
FMLYSIZE	-.0071114	.0196035	-0.36	0.717	-.045672	.0314492
EDUCT	.0163521	.0191073	0.86	0.393	-.0212324	.0539367
AGE	-.0647945	.0088689	-7.31	0.000	-.08224	-.0473491
FRMSIZE	.0587295	.205429	0.29	0.775	-.3453552	.4628142
QUNTOFHARSTWHB	.1447554	.0445678	3.25	0.001	.0570892	.2324216
nonofffarmincome	-.0001635	7.87e-06	-20.79	0.000	-.000179	-.0001481
_cons	8.838557	.5983898	14.77	0.000	7.661507	10.01561
var(e.MARKWHBSUPPLY)	.3250168	.0318973			.2679584	.3942252

Appendix table 5. Results from Double hurdle model

Cragg hurdle regression

Number of obs = 352

LR chi2(15) = 1053.90

Prob > chi2 = 0.0000

Log likelihood = -75.566157

Pseudo R2 = 0.8746

MARKWHBSUPPLY	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
MARKWHBSUPPLY						
SEX	-.0089983	.071888	-0.13	0.900	-.1498962	.1318996
MARKINFO	-.1280812	.0973182	-1.32	0.188	-.3188214	.0626591
ACCOFCREDIT	-.009094	.0452013	-0.20	0.841	-.0976869	.0794989
COOPMEMB	.176798	.0935349	1.89	0.059	-.006527	.360123
OWNTRANP	.6112565	.0995005	6.14	0.000	.416239	.806274
LIVEST	.0171094	.0106431	1.61	0.108	-.0037508	.0379696
NMARKDIST	-.005393	.0066041	-0.82	0.414	-.0183368	.0075508
EXCTENCONTACT	-.0121841	.0271519	-0.45	0.654	-.0654008	.0410326
FARMEXP	-.002165	.006403	-0.34	0.735	-.0147148	.0103847
FMLYSIZE	-.0066733	.0111556	-0.60	0.550	-.0285378	.0151912
EDUCT	.0052965	.0107781	0.49	0.623	-.0158282	.0264211
AGE	.0025522	.0058973	0.43	0.665	-.0090062	.0141106
FRMSIZE	-.2226967	.1153438	-1.93	0.054	-.4487663	.0033729
QUNTOFHARSTWHB	.1536765	.0280217	5.48	0.000	.0987549	.2085981
nonofffarmincome	-.0001206	4.96e-06	-24.31	0.000	-.0001303	-.0001109
_cons	6.47259	.3585239	18.05	0.000	5.769896	7.175284
selection_ll						
MARKINFO	1.784172	1.484233	1.20	0.229	-1.12487	4.693214
ACCOFCREDIT	-.2491096	.4624221	-0.54	0.590	-1.15544	.6572209
COOPMEMB	-1.249574	1.456753	-0.86	0.391	-4.104758	1.60561
OWNTRANP	.776757	.4945415	1.57	0.116	-.1925266	1.746041
NMARKDIST	-.2708025	.0766969	-3.53	0.000	-.4211257	-.1204794
LIVEST	.1677022	.1374464	1.22	0.222	-.1016878	.4370923
EXCTENCONTACT	.8603189	.2137299	4.03	0.000	.4414159	1.279222
FMLYSIZE	.1184298	.1150607	1.03	0.303	-.1070851	.3439447
EDUCT	.3234076	.1449351	2.23	0.026	.0393401	.6074751
AGE	-.1331213	.0456635	-2.92	0.004	-.2226201	-.0436226
FRMSIZE	1.089842	1.182917	0.92	0.357	-1.228632	3.408317
QUNTOFHARSTWHB	.2017693	.2155037	0.94	0.349	-.2206102	.6241487
_cons	2.222169	2.670705	0.83	0.405	-3.012316	7.456655
lnsigma						
_cons	-1.179543	.0476731	-24.74	0.000	-1.27298	-1.086105
/sigma	.3074193	.0146556			.2799959	.3375286

Appendix table 6. VIF Test for Multicollinearity

Variable	VIF	1/VIF
NONFRMI	6.64	0.150508
MARKINFO	4.65	0.214985
COOPMEMB	4.56	0.219454
AGE	3.31	0.302137
OWNTRANP	2.47	0.405495
FRMSIZE	2.00	0.498836
EXCTENCONT~T	1.90	0.525942
NMARKDIST	1.88	0.531124
SEX	1.86	0.538034
EDUCT	1.65	0.605903
FARMEXP	1.42	0.702548
FMLYSIZE	1.05	0.949330
LIVEST	1.05	0.951998
ACCOFCREDIT	1.02	0.977364
Mean VIF	2.53	

Source: survey result (2024)

Appendix table 7. Conversion factors for livestock units (TLU)

Animals	Livestock Unit	Animals	Livestock Unit
Calf	0.25	Donkey (Young)	0.35
Weaned Calf	0.75	Sheep and Goat (Adult)	0.13
Cows and Oxen	1.00	Sheep and Goat (Young)	0.06
Donkey (Adult)	0.70	Chicken	0.013

Source: Storck *et al.* (1991)

I. PRODUCERS SURVEY QUESTIONNAIRE

The purpose of administering this questionnaire is to gather necessary and pertinent data that will be used as input for the MSc graduate research entitled “**Market Chain Analysis of White Haricot Bean in Habro District of West Hararghe Zone, Oromia National Regional State, Ethiopia**” at Haramaya University. Your participation in the interview is voluntary and the information you are going to give will be treated as secure and confidential. Hence, you are kindly requested to provide us with your genuine and correct answers to the sets of questions included here within the questionnaire.

Thank you in advance for your cooperation!

I. Background Information/Identification

1. Code number: _____
2. Name of the enumerator: _____
3. Date of interview: _____
4. Name of the Kebele: _____
5. Name of the Village: _____

II. Household Demographic Information and Livelihood

1. Name of the household head _____
2. Sex of the household head; 1= Male 0= Female
3. Age of the household head _____ years
4. Marital status of the household head; 1. Single 2. Married 3. Divorced 4. Widowed
5. Educational level (year of schooling) _____
6. Number of total family members _____
7. Total amount of hired labor for the production year (2023/24) _____
8. Cost of a unit of labor _____

III. Crop Production information

- 1) The total area of land allocated for *white haricot bean* production during the last cropping season in qindi (other): _____
- 2) What type of seeds of *white haricot beans* do you use? (√) 1. Local 2. Improved 3. Both
- 3) What type of *white haricot bean* production system do you adopt? 1. Sole cropping 2. Mixing with different haricot beans 3. Mixing with other crops 4. Others _____
- 4) When did you start *white haricot bean* farming (farming experience) _____ (years)
- 5) Production of *white haricot bean* and major crops in (2023/24)

	Type of Crops	Quantity produced	Quantity consumed	Stored for seed (kg)	Gift (kg)	Quantity sold In 2023	Price in 2023 per 100 kg
1	<i>teff</i>						
2	wheat						
3	Maize						
4	Sorghum						
5	Pulses						
6	Oil seeds						
7	khat						
8	Others						

- 6) Is the labor force available for the production of *white haricot bean*? 1. Yes=1 2. No=0

7) What is your source of labor for white haricot bean production? 1. Family labor 2. “debo”
3. Hired labor 4. All

8) What Amount of *white haricot beans* you produce in (2023/24)? _____ Qt/Kg.

9) What were your main objectives for *white haricot bean* production? 1. Mainly for sale
2. Both equally 3. Mainly for home 4. Other, specify _____

10) At which season did you produce *white haricot beans* in the (2023/24. production season? 1. Meher 2. Belg 3. Both

11) How much quantity of *white haricot bean* did you produced per timad or hectare? _____ Qt/Kg.

12) Do you have livestock? (✓) 1. Yes 2. No

13) If your answer for Q.12 is yes, livestock Number: _____ Oxen /bulls,
_____ Cows/heifers _____ Calves, _____ Goats , _____ Sheep ,
_____ Donkeys, Horses, _____ Camels , _____ Mules , _____ poultry,
_____ Bee hives _____ others _____

14) Main constraints faced in *white haricot bean* production during (2023/24) production season.

No.	Possible problem	1. Yes	2. No
1	Low productivity of white haricot bean		
2	Lack of improved seeds		
3	Fear of crop failure (insect, disease, drought, excess rain, frost)		
4	Shortage of land		
5	Lack of market information		
6	Shortage of input supply (fertilizers, chemicals, labour, oxen, etc)		
7	Lack of support activities		
8	Lack of market		
9	Low selling price		
10	Other, specify		

15. If your answer is **Yes**, what is/are the cause/s of the constraint/s?

16. What do you suggest to solve the constraint/s? _____

17. Livelihood source of the household? (*Multiple answer is possible*)

1. Crop production 2. Livestock rearing 3. Broth (crop and livestock) 4. Non-farm 5. Other (specify) _____ Total income: _____

18. Estimate of annual cash income from? 1. Sale of crop _____ Birr/year 2. Sale of livestock _____ Birr/year 3. Sale of livestock products (milk, butter, egg) _____ Birr/year 4. Off-farm income _____ Birr/year 5. Other sources _____ Birr /year (specify) _____ total income _____

19. Did you participate in non-farm income-generating activities in the (2023/24) cropping season? 1, Yes 2, No

20. If yes, type of work: 1. Petty-trading 2. Paid daily Labour 3. Handcraft

4. Civil servant 5. Firewood sale 6. Remittance 7. other (specify) _____

21. For what purpose do you use the income from off-farm activities?

1. To purchase household items
2. To purchase farm inputs
3. to settle debts
4. To buy food
5. others (specify) _____

22. How much do you earn from off-farm income in year? _____

IV. Access to credit, services and information

- 1) Do you have access to credit? 1. Yes =1 2. No=0
- 2) Have you received formal credit in 2016/17 E.C? 1. Yes =1 2. No=0
- 3) If yes, how much did you take? _____
- 4) For what purpose you used? 1. Farm inputs purchase. 2. Livestock purchase
3. Household consumption 4. Land rent. 5. Others (Specify) _____
- 5) From where did you get the credit service? 1. Cooperatives 2. Micro finance 3. NGO
4. Local money Lender 5. Saving and credit Association 6. Others (specify) _____
- 6) If Q# 1 is „no“, why? 1. High interest rate 2. you are self-sufficient 3. Lack of Collateral
4. Fear of inability to repay 5. No service 6. others specify _____
- 7) What was the precondition to get credit? 1. Membership 2. Personal guarantee
3. Land holding 4. Collateral 5. Partial payment 6. Others (specify) _____
- 8) What problem do you perceive in taking formal credit? 1. Inadequacy of supply
2. High interest rates 3. Restrictive procedures 4. Others (specify) _____

V. Cooperative Membership

- 1) Were you a member of any cooperative in the (2023/24) production season? 1. Yes 2. No
- 1) If your answer is **Yes**, what is the name of the cooperative?

- 2) What is the nature of the group? 1. Formal 2. Informal
- 3) What service(s) did you receive from the cooperative you belong to?
1. Savings 2. Marketing information
3. Credit 4. Coordinate purchase and sale 5. Training
7. Other, specify _____

VI. Extension Service

- 1) Did you have an extension access in (2023/24) ? 1. Yes =1 2. No=0
- 2) If yes, how often the extension agent contacted you specifically for *white haricot bean production* and marketing purpose? 1. Weekly 2. Once in two week 3. Monthly
4. Twice in the year 5. Once in a year 6. Any time I ask those 7. Others (specify) _____
- 3) What type of extension service did you get?
1. Technical advice 2. Price information
3. Input use 4. Credit use-making 5. Other _____

VII. Marketing aspect

- 1) What is the total amount of *white haricot bean* you sold in (2023/24)? _____ Qt, in (2016/17) E.C _____ Qt
- 2) To whom did you sold? 1. Direct to consumers 2. To wholesalers
3. To rural collectors 4. To urban assemblers 5. To retailers
- 3) What was the Price per kilo gram? 1. in 2022/23 _____ Birr/kg. 2. In (2023/24) E.C _____ Birr/kg

4) Total quantity sold and average selling price

Total quantity sold		Average selling price	
2015	2016	2015	2016

5) Do you have your own transportation means equines (donkey, horse, and mule)?

1. Yes=1 2. No=0.

6) If yes, how many equines do you have? _____

7) How many kilometers you need to travel to get market?

1. The nearest market for selling *white haricot bean* _____ Km (walking minutes)

2. The district market _____ Km

8) What do you think about last year price? 1. High, 2. low

9) Where do you sale/market place? 1. Within village 2. Outside village

3. Within district 4. Outside district

10) Did you know the market prices before you sold *white haricot bean* in (2023/24)?

1. Yes=1 2. No =0

11) If say no, who set price in the market? 1. Myself 2. Set by market 3. Buyers 4. Negotiation.

12) From which source did you get market information? 1. Co-farmers 2. Radio 3. TV

4. Telephone 5. Brokers 6. Extension agents 7. Other, specify _____

13) What type of information did you get? 1. Price information 3. Buyers' information

4. Marketplace information 5. Other, specify _____

14) When did you start *white haricot bean* market (market experience)
_____ (years)

VIII. Market structure, conduct, and performance-related questions

A. Market structure-related questions

1) Are there entry problems in *white haricot bean* market? 1, Yes 2, No2) Are there exit problems *white haricot bean* market? 1, Yes 2, No3) Are there dominant traders in *white haricot bean* market? 1, Yes 2, No

4) How many grain traders are there? 1, Too many, 2, Many, 3, average, 4, Few, 5, Very few

5) Do you have a supply problem of *white haricot bean*? 1, Yes 2, No6) Is there competition among *white haricot bean* traders? 1, Yes 2, No7) Is there a perfect information flow about *white haricot bean* market? 1, Yes 2, No8) Are you willing to pay for *white haricot bean* information? 1, Yes 2, No

9) Is there homogeneity of a product? 1, Yes 2, No

10) Do you have access to all-weather roads to *white haricot bean*? 1, Yes 2, No11) Do you have a demand/ market problem of *white haricot bean*? 1, Yes 2, No

B. Market conduct related questions

1) How was the price trend of *white haricot bean* in the past 4-5 years? 1. Increased 2. Decreased 3. No change.

2). Is there price variation based on demand & supply white haricot bean? 1, Yes 2, No

3). Who decides the price of *white haricot bean* in the market? 1. Farmers 2. Traders

3. Consumers 4. The market 5. Bargaining 6. Others _____

- 4). Is there grade and standard-based marketing/pricing *white haricot bean*? 1, Yes 2, No
- 5). Is there a truthful product *white haricot bean* claim in the market? 1, Yes 2, No
- 6). Is there collusion among traders of *white haricot bean*? 1, Yes 2, No
- 7). Are there unfair trade practices *white haricot bean* market? 1, Yes 2, No
- 8). Is there transparency in the marketing process of *white haricot bean*? 1, Yes 2, No
- 9). There are investments & reinvestments in the market of *white haricot bean*?
1, Yes 2, No
- 10). How much is your average transaction cost *white haricot bean* per quintal in the marketing process in Birr for different activities? Loading-----Unloading-----
---Packaging-----transportation-----Sorting ----- assembling -----
storage----- others specify -----
- 11). Is there perfection in measuring tools? 1. Yes, 2. No

C. Performance-related questions

- 1) who are the actors in *white haricot bean* market? _____
- 2) Is there a profit margin difference between market actors? 1. Yes, 2. No
- 3) If yes who gets better? -----
- 3). What is your net profit from a quintal in birr? _____
- 4). What is the degree of benefit from the trade of *white haricot bean*? 1, Very good 2, good
3, fair, 4, low, 5, very low
- 5). The monthly average quantity purchased white haricot beans in quintals _____.
- 6). The average monthly quantity of *white haricot beans* in quintals. _____

II. Questionnaire for traders on “market chain analysis of *white haricot bean* in Habro district, Oromia Regional state, Ethiopia” for MSc. Research.

Date _____

Name of Market _____

I. Socio-demographic characteristics of traders

- 1) Name of the trader _____
- 2) Age of the trader _____ Years old.
- 3) Sex of the trader? 1. Male 2. Female
- 4) Marital status of the trader? 1. Single 2. Married 3. Divorced 4. Widows
- 5) Total family size _____
- 6) Educational level of the trader (year of schooling) _____
- 7) Major businesses you engaged? 1. Wholesaler 2. Urban assembler 3. Rural collector
4. Retailer 5. processor
- 8) For how long have you been in this business of white haricot bean? _____ Years
- 9) With whom you trade *white haricot bean*? 1. Alone 2. With family 3. With partners
- 10) When did you do your business of white haricot bean? 1. Year-round 2. once in a week
3. When the purchasing price is low 4. During the holiday only 5. Others
(specify) _____

II. Capital

11) How much was your initial working capital when you started the business *white haricot bean*? _____ Birr

12) How much was the amount of your working capital in (2023/24) ? _____ Birr

13) What was the source of the working capital in? 1. Own 2. Loan 3. Gift

4. Share 5. Others (specify) _____

14) If it was a loan, from whom did you borrow? 1. Relative/family 2. Other traders

3. Friends 4. Private money lender 5. Banks

15) What was the reason behind the loan? 1. To build store 2. To purchase a car

3. For working capital 4. Others (specify) _____

III. Purchase practice

16) How much amount of *white haricot bean* did you purchase? In (2023/24) _____ qt.

17) How much was the purchased price? _____ Birr/kg

18) How much amount of *white haricot bean* did you sold? In (2023/24) _____ qt.

How much was your selling price? _____ Birr/kg

19) What was the main reason for your *white haricot bean* choice to purchase?

1. High supply 2. High demand 3. High selling price

4. Long storage life 5. Others (specify) _____

20) Who purchases *white haricot bean* for you? 1. Myself 2. Friends 3. Through brokers

4. Family members 5. Commission agent 6. Others _____

21) If you used brokers and commission men, what was the advantage of using them?

1. You could get enough quantity 3. Reduce transaction cost 5. Save your time

2. You could get quality *white haricot bean* 4. Purchased at low price 6. Other

(specify) _____

22) How did you attract your supplier? 1. By giving a better price relative to others 2. By

fair scaling (weighing) 3. Other (specify) _____

23) How did you attract your buyers? 1. By giving better price relative to others 2. By providing

Quality *white haricot bean* 3. By fair scaling 4. By giving credit

5. Other (specify) _____

24) Who were your major buyer of *white haricot bean*?

1. Wholesalers 3. Cooperative 5. Rural collector

2. cooperative union 4. Urban consumers 6. Gov't organizations 7. Others _____

25) Who were your major supplier of *white haricot bean*?

1. Wholesalers 2. Rural collectors 3. Retailers 4. Urban assemblers

5. Farmers 6. Gov't organizations 6. Cooperative 7. Others _____

25) On average, how many markets did you visit in a week? _____ Markets

26) How is your usual purchasing price compared to your competitors?

1. Higher 2. Lower 3. The same

27) If it was higher in Q. 26 what was the main reason?

1. To attract more suppliers 3. To get better quality *white haricot bean*

2. To buy more quantity 4. To kick out your competitor from the market

5. Others (specify) _____

28) Who set your purchasing price for *white haricot beans*?

1. Myself 2. The seller 3. By market 4. Negotiation with suppliers

29) When did you set your purchasing price of *white haricot bean*?

1. Early in the morning of the market day 3. At the time of purchase

2. One day before the market day 4. Other (specify) _____
- 30) Who decided on your selling price of *white haricot beans*?
1. Myself 2. Buyers 3. By negotiation 4. By the market
- 31) When did you set the selling price?
1. Early in the morning of the market day 3. At the time of selling
2. One day before the market day 4. Others (specify) _____
- 32) How was the supply of *white haricot beans in (2023/24)* compared to the previous year?
1. Increased 2. Decreased 3. No change.
- 33) What is the reason behind your response?
1. _____
2. _____
- 34) What is your mode of buying and selling strategy?
1. In cash 2. In credit 3. In combination with both cash and credit.
- 35) How was the price of *white haricot beans in (2023/24)* compared to the previous year?
1. Increased 2. Decreased 3. No change.
- 36) What is the reason behind your response?
1. _____
2. _____
- 37) What was the major problem to enter the *white haricot bean trade*?
1. License 2. Lack of starting capital 3. Government policy 4. Trading experience
5. Other (specify) _____
- 38) Are there restrictions imposed on unlicensed traders? 1. Yes 2. No
- 39) What are the main criteria to be licensed *white haricot bean traders*? 1. Initial capital
2. Interest 3. *White haricot bean trading* experience 4. Others (specify) _____
- 40) How do you see the procedure to get the license? 1. Complicated 2. Easy
- 41) How much amount Birr is required to get the license? _____ Birr.

IV. Marketing Services

- 42) Did you pay tax for the *white haricot bean* you purchased and sold? 1. Yes 2. No
- 43) if yes how many you pay per year? _____
- 44) Indicate your average cost incurred in *white haricot bean trading* activities (2023/24) ?

Marketing cost component	Cost per quintal
Sack price (packaging materials)	
Loading unloading	
Processing	
Transportation	
Storage	
Permanent and temporary workers	
Tax	
Wage for permanent employee	
Personal travel	
Total cost	

- 45) How did you get information on supply, demand & price of grains in other markets?
- From: 1. Other traders 3. Cooperatives 5. Radio
2. Brokers 4. Newspaper 6. Telephone 7. Others (specify) _____
46. What mode of transportation did you use from collection point to store?

- 1. Head/back load 3. Trucking/Vehicle
- 2. Pack animals 4. Cart 5. Others /specify _____ -
- 47. What problem do you have during trading?
