Does Quality Difference in Chickpea Impact on the Value Chain and Food Security Status of Households? Evidences from Becho District, Oromia Regional State, Ethiopia

By

Tewodros Gebremeskel Debebe (**GSR/7470/09)**

MSc Thesis Submitted to

Center for Food Security Studies, College of Development Studies,

Addis Ababa University

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Food Security and Development Studies

Addis Ababa, Ethiopia

June, 2018

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DECLARATION

I, Tewodros Gebremeskel, declare and affirm with my signature below that this thesis is my own original work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this thesis.

Sources of information other than my own have been acknowledged and a reference list has been attached.

This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Science in Food Security and Development Studies.

I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Brief quotations from this thesis may be used without special permission provided the accurate and complete acknowledgement of the source is made.

Full Name: Tewodros Gebremeskel Debebe Signature----------

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ACKNOWLEDGEMENT

Foremost, I glorify and adore the Almighty God, for the opportunity, wisdom and encouragement He has provided me all through the courses to this end of the successful completion of my MSc. program.

Words are hardly enough to acknowledge my cordial advisor Dr. Solomon Tsehay for his endurance, and understanding to support me in this process of the completion. I truly and deeply acknowledge his unreserved commitment, all rounded knowledge.

I truly acknowledge the knowledge and experiences I shared with the entire lecturers of the Center for Food Security Studies of College of Development Studies. My thoughtful gratitude goes to Dr. Messay, whose role in my academic arena is immense. I never forget his advice, encouragement, fatherhood heart.

Compassion International Ethiopia is worthy to be mentioned and appreciated for the opportunity given to me to attend my MSc. In particular, the entire leadership is commendable to be acknowledged.

My profound appreciation goes to the staff of Becho district Agriculture Office for their assistance and support for this success end, I am utmost grateful to Mr. Birhanu who has been closely supporting day and night during the data cleaning, encoding and entering.

Finally, I appreciate my sweetheart wife Adiam Asfaha for truly partnering, sharing of my burden, and providing me unreserved all rounded support. I love you very much, dear. As I have taken the golden time my children that I could share with them, I can never forget my children Caleb, Barkot and Barsenet. I am also indebted to my friends Bereket Akele, Wondimu Ejigayehu and Yonas Melese for their diverse supports. Conclusively again, I thank GOD for His being there always for me. Thank you all for being there as well.

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LIST OF ACRONYMS/ABBREVIATIONS

a.s.l	Above Sea Level
ATE	The Average Treatment Effect
ATT	The Average Treatment Effect on Treated
CIA	Conditional Independent Assumption
CSA	Central Statistics Agency
FAO	Food and Agriculture Organization (United Nations)
ECX	Ethiopian Commodity Exchange
ERCA	Ethiopian Revenues and Customs Authority
FCS	Food Consumption Score
GCC	Global Commodity Chain
Ha	Hectare
HFIAS	Household Food Insecurity Access Scale
HH	Household
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IMF	International Monitory Fund
Info	Information
IPMS	Improving Production and Market Success
Kg	kilogram
KBM	Kernel Based Matching
NNM	Nearest Neighbor Matching
PSM	Propensity Score Matching
PWRA	Inverse-probability-weighted-regression-adjustment- Estimation
Qts	Quintals
STATA	Statistics and Data Package Software
TLU	Total Livestock Unit
VC	Value Chain
WFP	World Food Program
yr	Year

ABSTRACT

Quality of production has its own impact on Chickpea value chain which ultimately affects the food insecurity status of producers. Such effect has its own impact on the production decision of producers. This study examined the marketing value chain of different quality chickpeas, the production decision and the food insecurity status of producers. The analysis was based on 286 randomly selected households from Becho District in South West Showa Zone of Oromia Regional State of Ethiopia. In addition, 1 rural assemble, 26 wholesalers and 6 local collectors in Tulu Bolo, Qobo, and Awash Bune, and two farmers unions in Tulu Bolo and Asgori, a wholesaler and ECX were interviewed to identify chickpeas value chain actors, their respective roles in the pricing of a chickpea, marketing channels, and marketing structure and to draw up value chain map of the study area. The propensity Score Matching (PSM) along with probit was applied for examining the impact of quality chickpea production on the income obtained from chickpea production. The result shows that quality chickpea production had increased the average household income by about 6,979 birr per year using Kernel Matching with 2.36 % significance level. Household food insecurity access scale and food consumption score analysis using the ordered logit regression and logit regressions were applied to determine the food insecurity status among the households in the study area. The logit regression of food consumption score with a good-of-fit Pseudo R^2 of 22.98% of result shows that the major quality chickpea producers (i.e. 57.58%) were found to be food secure while 70.78% of the poor-quality chickpea producers were more food secure at 1% significant level. The logit regression of food consumption score also indicated that the result of food insecurity of household food consumption decreased after matching. The ordered logit regression model with Prob > chi^2 at 1% significant level results showed that majority (62.12%) of quality chickpea producers were food secured. Thus, the research implicates that quality chickpea production should be promoted in the area to combat food insecurity and to increase the income of households. The value chain analysis indicated that quality chickpea commodity has a critical role in attracting markets and in boosting the household income of the farming households.

Keywords: **Chickpeas, Value Chain, Market Analysis, Food Insecurity, Farming Households, Ethiopia.**

CHAPTER ONE: INTRODUCTION

1.1. Background

Chickpea crop is a high-value and the most nutritious food grain which grows in the cool semi-arid areas of the tropics, subtropics as well as the temperate areas. In the world, it is grown at 10.3 million hectares and the average annual production amounts to 7.9 million tons. Kabuli and Dessie are the most known and only types of chickpea that are grown in the world. Dessie predominately grows near to the equator while Kabuli requires the more temperate climates. Of the two types, Kabuli is the most preferred high-value crop for marketing with high prices both in the local and international arena (Bekele et al, 2007).

Ethiopia is endowed with diverse agro-ecology that permits different farming systems, and crops are major components of the farming systems in the country. The role of pulses is crucial in Ethiopian economy and ranked third in the export of agricultural commodity next to coffee and oilseeds. Among the top exportable pulses, chickpeas are the top export pulses accounting for 90% of export volumes and 85% of export earnings (ERCA, 2013). The report of FAO in 2005 indicated that Ethiopia earned 304 US$ per ton from the export of 16.99 tons of chickpea from the year 2001 to 2003 (Bekele et al, 2007). According to IFPRI (2010), chickpea crop is among the major staple food crops with greater gene bank conservation and breeding potential in the country, and also the production potential of 2.9 metric tons per hectare if accompanied by the appropriate inputs. Pulses including chickpeas contribute to smallholder income, as a higher-value crop than cereals, to diet, as a cost-effective source of protein and to offer natural soil maintenances through nitrogen-fixing.

The diverse biophysical and agro-climate conditions in Ethiopia are very suitable to grow chickpea across the highlands and semi-arid regions of the country. Chickpea in the country is used as a source of food and economic values for many poor households. Since chickpea crop has an ability to survive drought stress and scarcity of water, it is grown by the end of the main rainy seasons using residual soil moisture. This multifaceted crop enables the farmers to grow it as a second crop and earn income from it and also improves the food security of the farmers. It also enriches the nutrient of the soil through its nitrogen fixed ability. This makes the crop pro-poor and highly ecologically friendly for growing in many areas that suffer from soil nutrient depletion (Bekele et al, 2007).

CSA (2014) stated that chickpea is among important commodities accounting for more than 15% of Ethiopian legumes with an area of some 239000 ha and with about one million households engaged in its production. The agricultural development policy of Ethiopia is very supportive to marketable agricultural commodities and inclusive of smallholder producers and commercialization of small-scale production. The policy provides due attention to those agricultural commodities which have global markets for exportable high-value crops with all the challenges of high marketing costs such as high transaction costs, poor market infrastructure, low marketable surplus and poor quality products (Bekele and Hailemariam, 2007).

One of the major chickpea growing areas of the country is Becho district. The farming system in Becho district is characterized by the integrated mixed crop-livestock production system, where the production and productivity of one could not be separated from the other one. Chickpea is one of the major crops grown in the district, mainly by small farming households usually under rain-fed conditions.

1.2. Problem Statement

Major emphasis has been given to pulse production in the 2030 Agenda to ensure food and nutrition security, poverty alleviation and sustainability (FAO, 2016). With over 200,000 hectares under cultivation and 4 million quintals in annual production (CSA, 2013), Ethiopia is the largest producer of chickpea in Africa, and the sixth largest producer in the world (FAO, 2010). If accompanied by the appropriate inputs use, the demonstrated potential in Ethiopia is 2.9 tons per hectare, but the current average chickpea yields are 1.2 metric tons per hectare (IFRPI, 2010). Bekele et al (2007) also indicated that Ethiopia is the largest producer of chickpea in Africa and produces about 180 thousand tonnes.

However, the quality of chickpea is not to the standard and the high potential of chickpea production has not been fully exploited for improving the income of the rural poor. The productivity of the corp has remained dormant for several years since smallholder farmers do have the access to high-yielding varieties with market-preferred varieties on a large scale. The quality produce of chickpea by smallholder farmers do not meet the standard requirements of international trade which in turn affect the farmers and actors to be less effective in the production of quality chickpea and markets. The constraints of essental inputs and output

markets and information are the challenges of the smallholder farmers to produce the expected quality and volume to the market(Bekele et al, 2007).

Becho district is renowned for its chickpea production. But there is heterogeneity in terms of quality chickpea production given the fact that both Dessie which is perceived as low quality and Kabuli which is regarded as high quality have been intensively produced. Such incidence exposes the farmers to fall under different marketing value chains and the gain from chickpea tend to be varied across households that ultimately affect the food insecurity status and income of households. This implies that the quality of production affects the value chain of chickpea (Bekele and Hailemariam, 2007).

Despite the policy interest to expand chickpea production for exports, there is lack of empirical evidence on the structure, conduct and performance of the chickpea marketing systems in the country (IFPRI, 2010). The price difference between the different qualities of chickpea has its own impact on food security status of households. Researchers dwelled on the efficiency of chickpea and challenges of chickpea production (IFPRI, 2010; Bekele et al, 2007). Though few researchers conducted in a separate manner, limited efforts have been made to a link between the quality production of chickpea, its values chain and food insecurity in the study district and in the country as well (Lijalem, Tebkew, and Asnake, 2016). This research, therefore, tries to illuminate light on the impact of quality production chickpea on the food security status and income of farming households. On top of that, the study extends its horizon to sort out factors that drive producers to produce quality chickpea.

1.3. Objectives

1.3.1. General Objective

The overriding objective of the research is to analyze chickpeas value chain and production decision and food insecurity status of producers in Becho district in South West Showa zone of Oromia regional state of Ethiopia

1.3.2. Specific Objectives

The specific objectives of this study are:

- To identify chickpeas value chain actors, their respective roles in the pricing of a chickpea, marketing channels, marketing structure and to draw up value chain map of the study area;
- To examine the impact of producing quality chickpea on food insecurity and income of farming households; and
- To identify factors which influence the production decision of quality chickpea producers.

1.4. The Significance of the Study

In this research, Chickpeas Value Chain, household income, and food in/security analysis will have the following significances:

- It will have an academic importance in improving the methodology
- It will contribute to the formulation of policy issues
- It will have importance in showing what should be done and what type of intervention is required to improve food security situation of the people in Becho district.

1.5. The Scope of the Study

This study scoped only to one district, the respondents of four [1]*Kebeles* in the district. The data of the study were based on a cross-sectional survey. The subject of this study was farming households who are producing Kabuli and Dessie types of chickpeas in the four selected *kebeles* in Becho district. The impact of quality of chickpea production on food security and income were examined under the scope of this study. In the study of the value chain, the structure of the marketing system and production was analyzed in the study area up to Addis Ababa following the marketing channels. Right from the farmer households' gate prices, a study focused on the primary, secondary and tertiary markets of chickpeas. The chickpea marketing channels and actors were the subject of the study.

[1] Kebele is the lowest political administrative unit in the current Ethiopian Democratic Republic Government structure.

1.6. Limitations of the Study

The researcher encountered a number of challenges during data collection. The language barriers and inaccessibility of the areas were the major ones. Some respondents were not also accessible because they were engaged farmers in a training conducted during the data collection. Time, cost and location factors were the other major difficulties in completion of research.

There is a possibility of some errors such as the privacy, biases, speculation, and culture of the respondents to a limited extent could affect the quality of the information obtained through baseline survey questionnaires. In order to overcome the limitations, the researcher did all the efforts to complete the research with sincere efforts.

1.7. Organization of the Thesis

Chapter one i.e. Introduction part includes background, statement of the problem, objectives, significance of the study, the scope and limitation of the study, and organization of the thesis. Chapter two Theoretical Literature Review, Empirical Evidences, chickpea production and value chain challenges in Ethiopian context, and Conceptual Framework. Chapter Three is a research method section which comprises Description of the Study Area, Sampling Technique, Sampling Size Determination, Types and Sources of Data Analysis, Tools and Techniques of Data, Method of Analysis and Data and Description of Response and Explanatory Variables. Chapter four addresses result and discussion which in particular includes demographic, socio-economic and institutional analysis, descriptive results, and propensity score matching result, estimating determinants of food insecurity status and value chain of the chickpea commodity. Finally, chapter five presents the conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1. Value Chain Theoretical Literature Review

Business activities and the field of international trade provide a basis for the evolvement of the concept of the value chain. An insight into various theories of international and national trade was borne of emerging and subsequent ideas of classical theories of trade, modern theory of trade and new theories of trade. The economist Adam Smiths, David Ricardo, Eli Heckscher and Bertil Ohlin were the prominent figure in developing the concept of balance of payments or balance of trade, Absolute Cost Advantage Theory, Comparative Cost Advantage Theory, and Modern Theory of International Trade. Making use of the classical theories of international trade, modern theories by the economist Eli Heckscher in 1919 came to scene with a critic, but a better theory of international trade (Patel, 2017).

In 1970's, a new trade theory positioned a recognition in specifically dealing with product specialization to enhance economies of scale increase. In this theory, the idea of the role of the government necessitated as a compliment to the modern theories of international trade (Wangwe, 1993). Later with refined theories of the earliest, a well-known economist Michael Poters came up with a competitive advantage of nations. In Poter's framework, the value chain was tailored as a tool to determine the current or potential source of firms of competitive advantage and to distinguish the effect of primary and secondary activities on the final value of a product (Kaplinsky and Morris, 2011).

In 1980's, the concept of supply chain management (SCM) obtained a prominent place in multidisciplinary perspectives. The contemporary session titles contained the words "supply chain" in 1995 enhanced the dissemination of the concept. Though the term signifies differences in various contexts, the operational terms of supply chain management encompass the flow of materials and products. It also signifies a network of organizations in the different processes and activities that produce value in the form of products and services (Habib, 2011).

With the growing division of labor and the global dispersion of the production of components, systemic competitiveness has implicated to the importance of value chain analysis in this era of rapid globalization. Efficiency in production is only a necessary condition for successfully penetrating global markets and sustained income growth requires an understanding of dynamic

factors within the whole value chain. Small-scale markets allow for little specialization and it's become profitable to employ workers to allow each of them to specialize in a specific area (Morris, Staritz, and Plank, 2016).

The concept of value chain goes beyond getting access to markets and selling of products. All the necessary infrastructures and resources are required to be successful for the value chains. According to Jacques (2011), physical, human, knowledge, technology, and infrastructure are basic factors that enable or constrain value chain upgrading. Morris, Staritz, and Plank (2016) indicated that value chain analysis has an important role in ensuring the analysis considering the whole cycle of production, including the governing connectedness to final markets. The analysis treats the efficiency of the production link in the chain and those factors which determine the participation of particular groups of producers in the final markets.

Value chain analysis plots the flow of goods and services up and down the chain, and between different chains (Morris, Staritz, and Plank, 2016). According to Hellin and Meijer (2006), value chains can be mapped and analyzed using value chain analysis (VCA) which can include qualitative and/or quantitative tools, for there are no fixed rules on which research approach is preferred than a qualitative approach. Apart from qualitative and/or quantitative tools, the market map is a conceptual and practical tool that helps to identify policy issues that may be hindering or enhancing the functioning of the chain and also the institutions and organizations providing the services that the different chain actors need in order to make better-informed decisions.

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A value chain covers a full range of activities signifies a product or service which include producers, inputs suppliers, operation, processors, retailers, and buyers from conception through

the different phases of production, delivery to final consumers, and final disposal after use (Morris, Staritz and Plank, 2016; Dilip,2016). According to Jon (2006), a simplified value chain illustrated: Seed suppliers → Farmers → Traders → Processors → Exporters/importers → Retailers → Consumers.

2.2.Theoretical Framework of Food Security

Food security was defined as "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life." (FAO, 1996). The concept of food security has obtained a global concern since the event of World War One. In the early 1930s, the information on the importance of food for health and the world food problem was introduced into the international political arena. A survey conducted by the Health Division of the League of Nations recognized the existence of global hunger and malnutrition in the poor countries. Since then, the Health Division of the League of Nations provided a prominent position to the food issues for a sustainable solution. Following the occurrence of the acute world food crisis in the early 1970s, The United Nations General Assembly approved the creation of the World Food Council to express the concern towards the extreme food shortages in many developing countries (Simon, 2017).

In 1974, highly unstable food supplies and prices on the world market put the majority of people of the developing countries in the food crisis. This led to a concern to crucial consideration in ensuring international access to physical food supplies to recipient countries through donor organizations and agencies. In the 1980s, a remarkable progress and success were obtained through the introduction of the green revolution which helped to increase food production. In a way, it was, however, known that food insecurity situation is not necessarily the result of the catastrophic shortfall in food production, but the lack of purchasing power of the people. Hence, the physical and economic access to food supply incorporated in the concept of food security (Weingärtner, 2004).

In the 1980s, a scholar called Amartya Sen presented how the lack of purchasing power and food entitlement would impact the food security situation of households/individuals. In spite of the unprecedented population growth, the world has abundance of food but many poor countries and

hundreds of millions of poor people do not share due to having no purchasing power and entitlement. Later, Simon Maxwell made known to a necessity of a shift of food security issues from national attention to household and individual level. For them, the issue is not only how to increase production but how to generate income to purchase the sufficient quantity of food needed to satisfy their nutritional requirements. The fight against hunger should focus on agricultural and rural development and on improving the capacity of the people suffering from food insecurity to overcome poverty (Alcock, 2009).

Though over hundred different definitions were coined to define food security, the most familiar and commonly accepted one was approved by World Food Summit in 1996. It was defined as a situation " when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an activity and healthy life". Later in 2009, World Food Summit confirmed that this definition is inclusive of the consideration of four pillars of food security such as availability, access, utilization, and stability. Even the nutritional dimension is an integral part of the definition. Poverty is regarded as the major obstacle to achieving food security at the household and in order to improve the food security situation an intervention to poverty eradication is very essential (Ecker and Breisinger, 2012).

At the country level, several factors determine the situation of food security. Within a neoclassical framework, the concept of food security is realized when a certain market price, food supply, and demand are adequate to meet food requirements sustainably. The volume of food production domestically both for sale on the market and household consumption determines the food production and the prevailing food market price. The aggregate food supply combines food production for the domestic market and exports, modified by stock changes and food imports. The effective market demand and home consumption from subsistence production also affect food demand. A situation of insufficient income and purchasing power is created when there is a demand deficit (Sassi, 2018).

2.3.Empirical Literature Review

Value chain analysis is the process of breaking a chain into its constituent parts for the purpose of understanding the structure and functioning of a given commodity. The analysis consists of

identifying chain actors at each stage to discern the functions and relationships, determine the chain governance/leadership, facilitate chain formation/strengthening, identify value-adding activities, assign costs and add value to each of those activities (Addisu et al, 2017).

Competitiveness of smallholder producers and commercialization of small-scale production depends on the development of viable and remunerative market linkages. Competitiveness in global markets is particularly important for exportable (tradable) high-value crops and livestock products. Some of the major factors that limit competition and lead to market imperfections are related to high marketing costs resulting from high transaction costs and poor market infrastructure, low marketable surplus and poor quality products that do not meet market preferences (Bekele and Hailemariam, 2007).

Commodity Value chain from producers to consumers contributes to the growth of marketing channels for agro-food products. It helps the underprivileged producers to benefit the existing of the value chain in specific agricultural commodities. A study showed that the participation of women on the economic aspects is essential in chain dynamics in agricultural product and labor markets. The finding indicates that an appropriate global commodity chain (GCC) approach should consider women in the interaction in all stages of commodity value chain (Nakazibwe and Pelupessy, 2014).

A research conducted to analyze the chickpea marketing chain of Ada'a-Liben District for the advancement of emerging market opportunities and capacity building performance evaluation of the chickpea production. In order to understand the structure and performance of chickpea marketing chain, a number of alternative approaches such as extensive consultations with private and public sectors were contacted for generating qualitative and quantitative data. For triangulating the information through alternative approaches, a group discussion and key informant interviews were also conducted in the selected areas of the district. During the study, each group of assemblers, retailers, wholesalers, processors, and exporters in a market were contacted to improve the accuracy of data. The finding of the study indicated that chickpea marketing system in Ethiopia is highly underdeveloped and poorly organized. The domestic market accounts for over 80% of the total chickpea volume traded annually. The market

variability, low volume of production, poor quality and poor price competitiveness highly affects the export market condition of the country in the global market system (Bekele et al, 2007).

In Ethiopia, the export performance of pulses including chickpea in the year 2008 and 2009 consecutive years showed a decline. This mainly happened for a reason that there was a decline in international demand, poor seed quality of local production, huge domestic demand, and unstable market. In order to overcome the challenges, the study recommended farmers to use improved varieties of pulse crops along appropriate agronomic practices enlarged with the promotion of farmers' access to pulse markets with the premium price of quality. The study specifically proposed the increase of cleaning and grading for exporters, promotion of the availability of market information, low transportation cost, and public international market intelligence as solutions to overcome challenges of pulse exports (Dawit et al, 2010; Menale et al, 2009).

The marketing system of chickpea in the country is very complex and production of grains reach to end users through several channels. The chickpea marketing structure is speculated with the bulk of unprocessed grain transaction, limited value addition, high transport cost and limited storage facilities. The major chickpea marketing outlets which link producers with end users are identified as rural retailers, assembler to the district retailers, assemblers to the urban retailer, assembler to the processors, the assemblers to the supermarkets, the assemblers to the exporter, district wholesalers to the exporter, the farmers unions to the exporter, and finally, the farmers' union to the processor. The length of the value chain and the involvement of actors depend on the distance between assemblers and the final outlet to the end user. The consideration of historical area, yield and price trends and policy interest to expand agricultural commercialization determines the production and future outlooks of chickpea in Ethiopia (Menale et al, 2009).

Jordan, Grove, and Backebery (2014) indicated that the influence of the incentive structure on the behavior of smallholder farmers plays a decisive role in participating commercial agri-food chains. For a successful participation in competitive agri-food chains, the behavior of the smallholder farmers and relevant role-players should be changed to the better match of the requirements. Mainstreaming of integrated value chain allows for a comprehensive analysis of the incentive structure embedded in the social, physical and institutional environment within

which the farmers operate. The introduction of the appropriate coordination strategy among the farmers and their buyers enhances the relationship and minimize transaction cost.

A successful participation of smallholder farmers largely determines their incomes from agricultural production. Lack of information on prices and technologies, high transaction costs due to distant local market areas and lack of access to credit hamper the advancement of smallholder farmers in the markets. The finding indicated that smallholder farmers preferably obtain information on chickpea variety preference and adoption from their neighbors, family members, government extension and cooperative (Asfaw et al, 2010; Menale et al, 2009).

The performance of pulse value chain in Ethiopia is not away from several challenges. The impediments are exhibited at three broad stages, namely production, aggregation and marketing, and commercialization towards exports. Some of the indicated challenges of the value chain are low on-farm productivity, inefficient marketing system, and inconsistent export supply. A finding shows that the farm tests on experimental plots in Ethiopia have provided a potential of producing 2.9 to 3.5 tons of chickpea per hectare in spite of the average yield is 1.2 hectare. This implies that there is a productivity gap of production capacity. The gaps mainly attribute to limited or no use of chemical fertilizers, very limited availability of improved seeds and insufficient/lack of use of conventional agronomic practices (Chilot, Rashid, and Befekadu, 2010).

Analysis of the value chains of various staple foods in Ethiopia shows that the quantity flows to the market is not more than 22% of total production. It is evidenced that the proportion of agricultural product is retained on-farm for seed and subsistence consumption. The marketed quantity flows from producers to consumers through various marketing channels, and the key market players are rural assemblers, wholesale traders, food processors, exporters, and retailers. About 12% of pulse crops are annually exported, and most of the marketable quantity is handled through the producers' → wholesaler → exporter →export market channel. Analysis of the distribution of the value added across the entire value chain of each commodity also shows that a large part of the value added is attributed to producers (Chemonics International Inc., 2010).

A developing country value chain analysis comprises value addition, horizontal and vertical chain-network structure and governance mechanisms elements. The value chain upgrading is

characterized by market access restrictions, weak infrastructure, lacking resources and institutional voids. The finding indicates that the developing countries pay little attention to the business environment in which chain actors operate. The production value chain addition, governance with other actors in the value chain and choosing different market channels for commodity products contributes to the motivation of value chain actors. A need to examine the role of non-value chain actors is also essential for the improvement of the value chain in the pro-poor market development (Trienekens, 2011).

A multi-stage sampling technique was used to obtain data from 133 smallholder farmers in order to examine the market participation of smallholder haricot bean producers in Meskan district in Ethiopia. Heckman two-stage models revealed that the value of haricot bean produced, access to market information, farm size, education level, access to credit, membership to an organization and distance to the nearest market significantly affected the market participation decision of haricot bean producers. Among the significant variables which affect market participation decision, membership to an organization and distance to market showed a negative effect. The extent of market participation among haricot bean producers was significantly affected by farm size, the value of haricot bean produced, access to input supply and access to credit (Yaynabeba and Tewodros, 2013).

A research conducted to assess the determinants of smallholder pulse producer's market orientation in southern Ethiopia. During the assessment, a total of 183 smallholder farmers were interviewed using structured schedule. The households who produce chickpea accounts for 26.8% of the total interviewed smallholder farmers. About 69.5% of total chickpea produce was sold indicating that chickpea is an even more important cash crop. The Tobit estimation result shows that household head education level, access to credit and land per capita positively influenced chickpea market orientation. Human capital, resource endowment and access to market information and access to institutional factors determine smallholder pulse producers' market orientation. The research implies that it is essential to support the smallholder farmers to credit access, human capital development and women empowerment for promoting market orientation (Tewodros, 2014).

A research investigating the value chain of 'teff' in Becho and Dawo districts identified and categorized the value chain actors. A multistage sampling procedure was used to assess relevant data from 150 'teff' producers and about 54 traders in the study. The finding indicated double taxation, the absence of infrastructure, capital shortage, access to credit, farmer reluctance to sell, lack of demand, the absence of storage facility and absence of government support are some of the constraints to the production and selling of 'teff'. A need to create trust among value chain actors, strong extension intervention on upgrading the value chain, and giving training for smallholder farmers on upgrading value chain is critical to promote 'teff' value chain in the targeted districts (Efa et al, 2016).

Teferi and Getamesay (2017) conducted a research on the market chain for cereal and pulse crops in order to measure profit of rural farming households in North Shewa Zone of Oromia Regional State. A total of 393 sample farming households, 20 merchants, 10 government employees and Union worker respondents were involved in the study. A descriptive analysis and logistic regression econometric model were used to analyze the date. The finding showed that market chain positively affects the profitability of the respondents. The procurement of agricultural inputs and selling of the products to the cooperative contributes to relatively high profits to the producers. The research confirmed that market chain enables farming households to improve profitability.

A study conducted by Abu and Soom (2016) revealed that lack of access to credits, inadequate land availability, and poverty, infertility of the soil, lack of non-farm income generating activities, storage, and processing problems are some of the constraint factors influencing the achievement of food security in the study area. In order to enhance the food security situation of the respondents in this study, the researcher recommended an access of credit facilities, a policy of agricultural in promoting farmers access to land, informal education through extension services on nutritional awareness and an improvement of household farm productivity.

Ahmed et al (2017) in their study revealed that increase in food price, crop diseases, lack of irrigation water and increase in health expenses are major factors which determine the household food security situations of the 576 households conducted through face-to-face interviews using structured interviews in Punjab, Pakistan. Further, the results of logistic regression show that

family size, monthly income, food prices, health expenses and debt are main factors influencing the food security status of rural households. The role of market accessibility factors (road distance and transportation cost) has a significant role in enhancing food security at household level. The findings suggested that creating off-farm employment opportunities, improved transportation facilities, and road infrastructure is a solution for local food security.

2.4.Chickpea Production in Ethiopia

In Ethiopia, the two commonly growing chickpea varieties are Kabuli and Desi, and in particularly Desi is the most dominant one. Quality in chickpea production has an important role and potential in terms of market orientation and competitiveness among smallholders. However, a research evidenced that the availability of high yielding varieties with market preferred traits have not fully reached to the farmers, and hence smallholders are limited by low productivity and poor quality of traditional varieties (Bekele and Hailemariam, 2007).

One of the key questions asked in chickpea markets is how prices vary along the value chain and the role that seasonality, quantity and quality factors affect commodity prices. A quality production and supply of chickpea with desirable market traits enables smallholder farmers to penetrate a high-value niche market (Jones, Freeman and Monaco, 2002). Low-quality chickpea production cannot be presented in competitive markets with the required rewarding prices and farmers growing low-quality products cannot attain the required grades and standards and achieve the necessary economies of scale in competitive markets (Bekele and Hailemariam, 2007).

Several factors such as seed pricing, the texture of the soil, pesticides availability, and production capability marketing development have the potential impact on the quality and economic viability of chickpea production and productivity. A research pointed out factors like improved technology availability, relative profitability, domestic and international policy environment and adequate rainfall are some of the factors that influence the production and future prospect for chickpea (Bekele and Hailemariam, 2007).

Apart from poor market infrastructure and low marketable surplus, poor quality product in chickpea does not meet market preferences (Bekele and Hailemariam, 2007). Along the market and value chain, processors and traders are constrained by low-quality grain, inadequate supply,

and high cleaning costs whereas market intermediaries in the supply chain face high assembly costs, high market risk, and cash flow problems. These factors deprive farmers of the underlying incentives to produce and supply quality and differentiated products with desirable market traits in addition to their inability to penetrate high-value niche market (Jones, Freeman and Monaco, 2002). Small-scale farmers growing low-quality products are unlikely to exploit market opportunities as they cannot attain the required grades and standards and achieve the necessary economies of scale in competitive markets.

In the value chain analysis, chickpea does not have a formal and standard quality measurement or indicators. However, smallholders and actors in the value chain use traditional ways. Correspondingly, Bekele and Hailemariam (2007) stated that traders at all market levels grade chickpeas in light of its grain color, grain size, the presence of foreign matter and, broken and shriveled seeds.

According to Gugerty (2010), market-oriented agricultural production can be a mechanism to increase smallholder farmer welfare, rural market performance, and contribute to overall economic growth. Smallholders are typically both producers and consumers, and given that local food markets may not function efficiently, the impacts of commercialization on food availability for smallholders must be considered. FAO (2003) stated that the emergence of sustained local private sector involvement, internal markets have often been overwhelmed by larger companies dominant in global value chains. In discussing prospects for diversification, for example, value chains are likely to impact strongly upon the prospects for smallholder entry. There may, however, be the possibility for smallholders to become integrated into the chains of larger exporters.

Chickpea, locally known as *Shimbura*, is one of the major pulse crops grown in Ethiopia. Chickpea, a major pulse crop, plays a key role in providing protein to the diet of the population and in improving the soil fertility. The chickpea seed is a good source of carbohydrates and proteins, which collectively constitute 80% of the total dry seed weight (Aliyi, 2017).

The national chickpea improvement program in its discourse of endeavor to improve the productivity, quality and adaptability evaluated over 15000 genetic materials and came up with some 20 varieties. Chickpea in Ethiopia is now shifted from a simple precursor crop to a

principal component of the cropping system that significantly contributed to poverty reduction. Business opportunities through organized informal seed system with the value of more than 2000 USD / ha are worth mentioning of the income generating power the crop. The country has improved chickpea technologies for about 40% of the production (Asnake, 2014).

2.5. Chickpea Value Chain Challenges and Barriers in Ethiopia

Chickpea production is exposed to different abiotic and biotic constraints which penalize seed yields. The major bottlenecks limiting chickpea production and causing wide yield gap globally include biotic (Pod borer, Fusarium wilt, and Ascochyta blight) and abiotic (drought, heat, cold and salinity) stresses (Aliyi, 2017).

The challenges of chickpea value chain lie in production, aggregation and trading, and exports. Low on-farm productivity Smallholder productivity constrained by limited use of improved inputs, small fragmented plots, marginal soils, limited use of improved varieties, and inadequate farm management practices Inefficient marketing system Limited effectiveness of marketing due to involvement of many actors, leading to excessive handling and weak demand signals, and inadequate financing and transport Inconsistent export supply Limited relationship between exporters and importing countries, unstable and erratic demand from importing countries leading to limited number of contracts between exporters and producers (IFPRI, 2010).

The crop provides an important source of dietary protein and minerals for the rural poor, especially those who cannot produce or cannot afford costly livestock products as a source of essential proteins.

The consumption of chickpea is also increasing among the urban population mainly because of the growing recognition of its health benefits and affordable source of proteins. In the export market, chickpea contributes a significant portion of the total value of pulse exports. For example, chickpea constituted about 48% of the pulse export volumes in 2002. During this period of time, the exported volume accounts for about 27% of the total quantity of chickpea production while the balance remains for the domestic market (Bekele and Hailemariam, 2007).

2.6.Conceptual Framework

Literature review on quality chickpea production indicated that the production of the quality chickpea help to improve the household income, enhance the value chain[2] and enable the producers to secure foode at household level if they produce in a sustainable manner. The conceptual framework used in this study illustrates the associations of factors which affect the quality chickpea production.

The factors which affect the production of quality chickpea production are demographic factors (i.e. Sex of the HH head, Age of the HH head, Marital Status of HH head, Total Family Size, Formal Education of the HH head and Agriculture/farming experience), economic factors (i.e. Livestock Assets, Dependency Ratio, HH farmland size, Total Productivity and Access to Loan) and institutional factors (i.e. Market Distance, Farmers Training, Access to Loan, Input Market Information, Sale Market Information, Development Agent Contact and Mode of Transport).

[2] **Value chain** involves a unified system which shows a well-integrated function to maximize the welfare of all actors involved from production up to consumption (Chilot, Rashid and Befekadu, 2010)

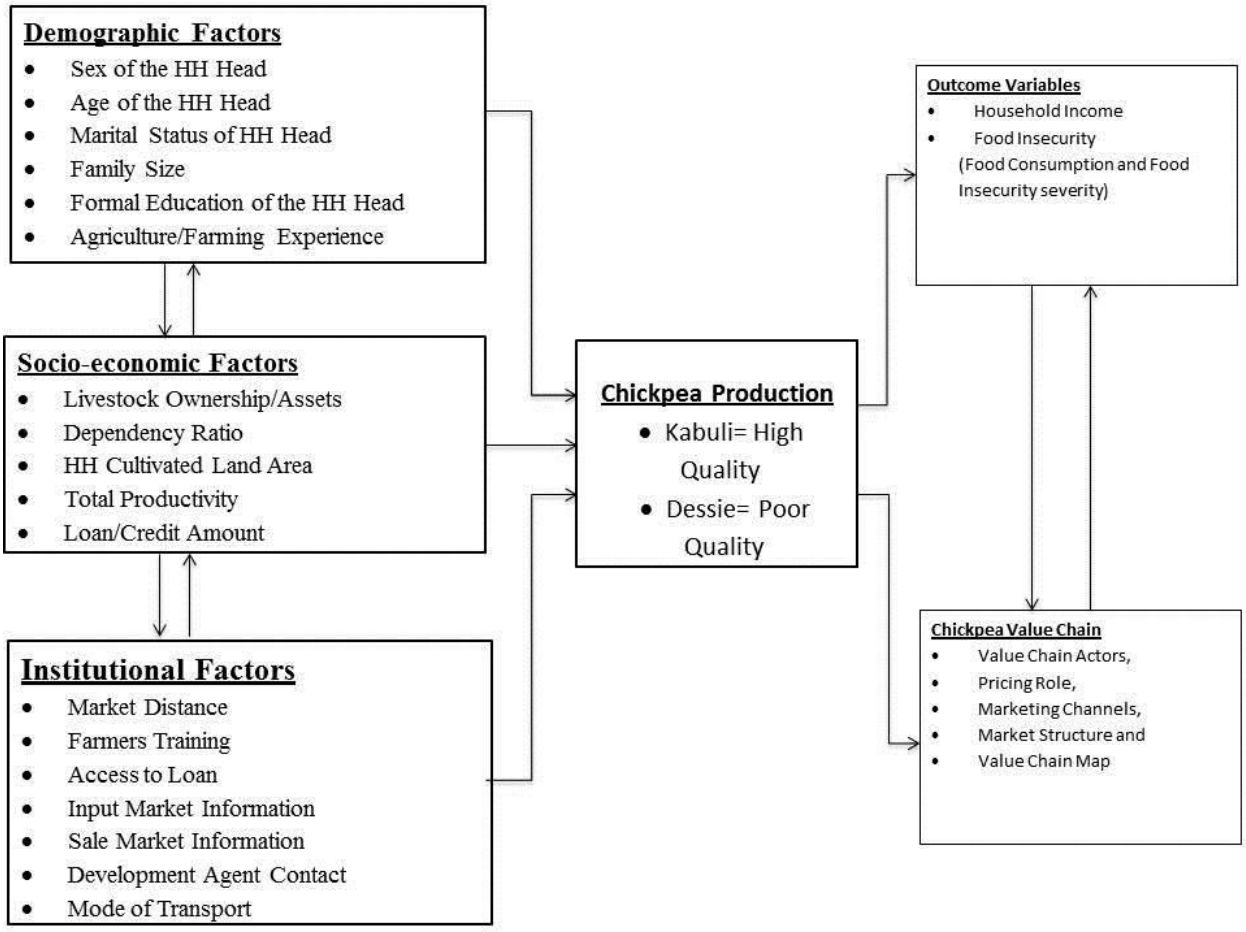


Figure 1: Own Conceptual Framework Based on the Literature

CAPTER THREE: RESEARCH METHODS

3.1. Description of the Study Area

Becho is one of the districts in Southwest Shewa Zone in Oromia Regional State in Ethiopia. It is located 35 km away from zonal capital, Weliso and 80 km from Addis Ababa the capital city of the country. It is bordered on the south by Kokir, on the west by Walisona Goro, on the northwest by Dawo, on the north by Elu, and on the east by Tole. The district has 19 rural kebeles and 2 urban kebeles, and Tulu Bolo is an administrative center of the district (Oromia BoFED, 2009; Engidawork, 2015).

The district's altitude ranges between 2100 and 2600 m a.s.l. With insignificant pockets of *Dega* (3%), nearly all areas of the district fall under *Woina-Dega* (97%) agro-climatic condition. It receives an annual rainfall 900-1100 mm, and the month June to September is the main and extended rainy seasons. The temperature of the districts ranges between 12 and 26oc and the driest seasons occur from the month October to May. There are many rivers in the zone including the Awash, Wdocha, Wealcha, Bibin, Mojo, Koce, Golole, Gojirila and Lemen. The topography is dominantly a flat one which consists of plateau, hills and plains and hence inundated seasonally (Oromia BoFED, 2009; Engidawork, 2015).

The agro ecology of the district is predominately midlands or *Woina-Dega* though there are also a few highland or *Dega* areas. It has estimated total area of about 446.8 km2 or 44,680 hectares (ha) of which about 29,928 ha is cultivated land and 1,731 ha is a grazing land, among the others. Scattered bushes and scrubs are the main vegetation coverage. A mixed farming system is the main livelihood strategy in the area. In the district, chickpea is the third major crop next to 'teff' and wheat. The most labor-intensive agricultural activities are land preparation, weeding and harvesting. The analysis of climate change is particularly important for chickpea, which is very sensitive to high temperature, climate variability and drought stress, especially at flowering and grain filling stages. The district amount and temporal distribution of rainfall and other factors are suitable for the growing of chickpea. Becho district is a major potential site for chickpea production which is grown on residual moisture in selected areas (Oromia BoFED, 2009; Engidawork, 2015).

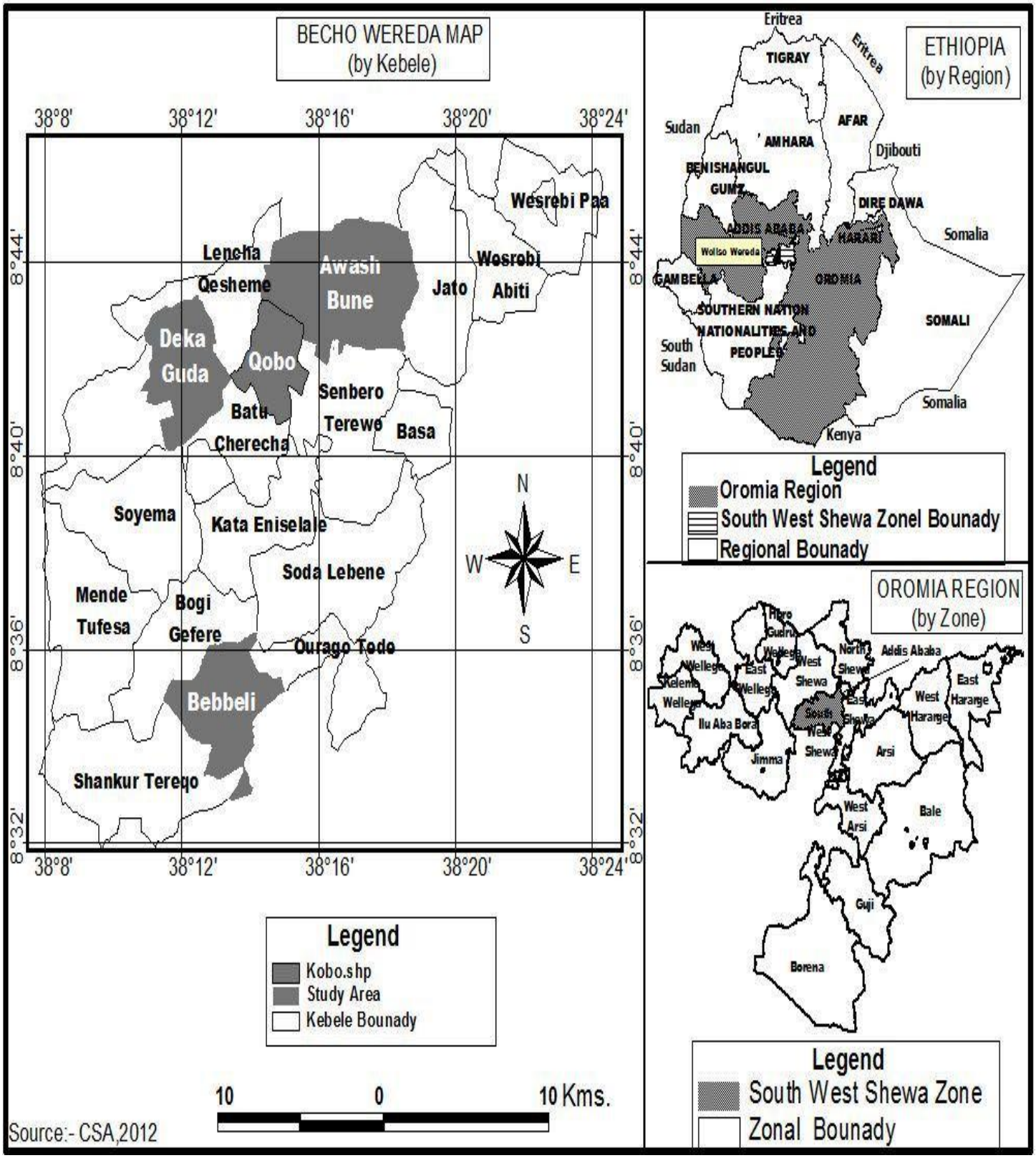


Figure 2: The study areas Becho district in the regional and national setting

3.2. Research Design

3.2.1. Sampling Technique

In this research, multi-stage sampling techniques were used. Becho district was purposively selected because of its potential for the production of chickpea in the country. In likewise, four *kebeles* such as Awash Bune, Bebbeli, Deka Guda and Qobo were selected from the total 19 rural kebeles and 2 town *kebeles* of the district with a purposive sampling technique. These four *kebeles* from the districts are potential areas in chickpea production and most farmers produce chickpea as a third crop. In addition, the district agriculture extension bureau has identified these *kebeles* as study areas for chickpea.

After the total sample size of this study is determined using the published table of Yemane (1967) sampling techniques, a proportional sample population was withdrawn from each the chickpea producing population list of the targeted Kebeles.

On the other hand, a purposive sampling method was employed in order to determine actors in the chickpea value chain in the target area and along the value chain. This enabled the researcher to strategically select respondents and study in-depth the chickpea marketing system information with an optimal insight of the issues under the study.

3.2.2. Sample Size Determination

According to the information obtained from Becho District Agricultural Extension Bureau, the total number of farming households in the four sample *Kebeles* is 2392. Out of which, almost 60% of the farming households have the practices of planting chickpea crop on their farm. Thus, chickpea producing farming households were targeted as a total population for extracting sample population of this study. The number of sample farming households for the household questionnaire was then determined to be about 286 (i.e. 19.9 % of the total chickpea crop farming households in the four target Kebeles) farming households with ±5% precision level and 95% confidence interval according to the published table 1 which provide the sample size (Yamane, 1967) (see Appendix 9). Finally, a proportion of sample farming households were taken from each *Kebele*.

Table 1 Sample size of the research

Sample *Kebeles*	Total Farm Households	Chickpea Producers (60%)	Sample Households
Awash Bune	1023	613	120
Bebeli	530	318	64
Deka Guda	516	310	62
Qobo	323	194	40
Total	2392	1435	286

The analysis of this study is made based on the household sample size and sample actors of chickpea in the value chain. As per the sample size of the study, a total of 286 household baseline questionnaires were distributed and collected from the field. In addition, 30 chickpeas value chain actors, individual retailers and wholesalers in Tulu Bolo, Qobo and Awash Buni towns; two unions in Tulu Bolo and Asgori towns; and wholesalers, retailers and Ethiopian Commodity Exchange (ECX) in Addis Ababa were interviewed and summarized in the chapter.

3.3. Types and Sources of Data

For this research purpose, a cross-sectional primary data type was used to analyze socio-economic status, the chickpea value chain and food in/security situation of the respondents. The primary data was collected to cover every aspect of the study.

In value chain analysis, the structure and information of marketing system of chickpea were assessed from primary data. The information can comprise of production cost and profitability, marketing costs, marketing margins, marketing channels, chickpea value chain actors, value chain major functions, the relationship in value chain channels, etc. In addition, a primary data was used to assess the food security status of both quality chickpea producing and non-quality chickpea producing farming households using survey questionnaires. Finally, food security status of the respondents was also triangulated using Household Food Insecurity Access Scale (HFIAS) and Food Consumption Score (FCS).

3.4. Tools and Techniques of Data Collection

A combination of qualitative and quantitative approaches was used to address the research questions. A qualitative approach was used to examine the structure and process of chickpea

value chain. The research employed structured and semi-structured household questionnaire survey, key informant Interview and field observation tools in primary data collection.

- Structured and semi-structured questionnaire surveys were used to collect information about food security status of the respondents and marketing system of the chickpea value chain.
- Key Informant Interview was conducted with chickpea producers, actors in the primary, secondary and tertiary chickpea value chain markets.
- Field Observation was executed to authenticate and enhance the information obtained through primary and secondary data.

3.5. Method of Data Analysis

3.5.1. Chickpea Value Chain Analysis

The collected data were edited to detect errors and omissions and thereafter coded prior to analysis by using Statistical Package for Social Sciences (STATA) 13.0. Then, the data were analyzed using qualitative, quantitative and mapping methods. Qualitative information from interview questions and observation was narrated. The quantitative data were analyzed using both descriptive statistical tools (mean, standard deviation, and percentage). The descriptive statistics showed a clear picture of the socio-economic situation of the respondents and helped to identify and ranked major input, production and marketing constraints of chickpea. Moreover, mapping of the value chain of chickpea was done to identify the key actors, the structure and the roles of the actors in the marketing channel.

3.5.2. Propensity Score Matching (PSM)

A series of descriptive analysis with t-test and chi-square was first employed to examine comparative analysis of treatment (Quality Chickpea Production) and control (None Quality chickpea production). For the reasons that the response variable is binary in nature and more advanced in to account for non-constant error variances in more advanced econometric settings, a Probit regression model was applied to measure the average impacts of quality chickpea producers (Albright, 2015).

The quality of chickpea type (Kabuli and Dessi) was applied to assess the difference in quality production. Our main variable of interest (Pi) is a dichotomous variable for quality chickpea producers. The production of quality chickpea is likely not randomly distributed among chickpea producing farming households; hence a large set of observable quality production and production participation characteristics, Xi was included in the study. Various covariates, Xi, were determined referring to various theories and literature. The covariates were age of the household head, education of the household head, dependency ratio, family size, livestock ownership, chickpea cultivated area, total farmland size, experiences of agriculture, distance of the local markets as being measured from farming households, amount of credit obtained from local microfinance, and a contact with development agents.

Then, the propensity score matching (PSM) was applied to control potential selection bias and estimate an average treatment effect of quality chickpea production (Rosenbaum and Rubin, 1983). PSM will reduce the selection bias through employing counterfactuals that control all other factors but treatment. The essential mechanism of PSM is to find control groups that are similar to the treated in all relevant pre-treatment characteristics.

In order to compare the mean difference between households which engaged in the production of quality chickpea with those households which did not, propensity score matching was used. The basic idea behind propensity score matching (PSM) is to match households which have similar characteristics in terms of other covariates except for their status of involvement in the production of quality chickpea. PSM constructs a statistical comparison group that is based on a model of the probability of participating in the treatment T conditional on observed characteristics ***x***, or the propensity score is given by:

$$P(x) = pr(T = 1/x) \quad \text{..... (1)}$$

First, a logit model is estimated with the binary treatment variable (Quality chickpea production status of the farming households) as selection variable, conditional on the baseline characteristics of both the treatment and the control group. From this, propensity scores, i.e., the conditional probability of assignment to a treatment given their baseline characteristics, are predicted. First, a logit model was used for the aforementioned covariates. Second, two balanced groups were created based on their estimated propensity scores for final comparison. This enabled to measure

the average difference in the outcome variables (food security and income) between households in the two groups.

Following Caliendo and Kopeinig (2008), let W_i be a binary treatment variable that equals one if farming households participate and zero otherwise. The potential outcomes of the participants are represented by (W_i) for each household i. The average treatment effect on the treated (ATT) is expressed as:

$$\tau ATT = E(\tau \mid W = 1) = E[Y(1) \mid W = 1] - E(Y(0) \mid W = 1] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where E[Y (1) |W = 1] is the expected outcome value for treated farming households; E[Y (0) |W= 1] is the expected outcome value for participating farmers if they are not participating. E[Y (0) |W = 1] is the counterfactual and not-observed, as we need a proper substitute to estimate ATT. In this case, PSM helps to construct the counterfactual from the non- participating farmers. In doing so, we will invoke the conditional independence assumption (CIA) and the common support assumption to control the selection bias problem (Caliendo and Kopeinig, 2008). The non-confoundedness assumption (i.e., CIA) ensures that selection into treatment is only based on observable covariates, which is a strong assumption.

The common support condition ensures that farming households with similar observable covariates have a positive probability of being both participant and non-participant (Caliendo and Kopeinig, 2008). We check this assumption using balancing properties and a density distribution histogram. If CIA holds and there is overlap between the participant and non-participant groups, the PSM estimator for τ ATT is given as:

$$\tau PSM = Ep(x)| W=1\{E[\, Y(1) \mid W = 1, p(x)\,] - E[\, Y(0) \mid W = 0, p(x)\,]\} \ldots\ldots\ldots\ldots\ldots..(3)$$

Where p(x) was a predicted propensity score from the logit model. Two methods were used to match similar participant/treated and non-participant farming households. The nearest neighbor matching (NNM), and kernel-based matching (KBM) were applied as the main ATT estimation methods. As matching estimators are often prone to selection bias, the inverse-probability-weighted-regression- adjustment estimator (IPWRA) used to further check the robustness of treatment effect estimates. IPWRA provides efficient estimates by allowing the modeling of both

the outcome and the treatment equations ((Becker and Ichino, 2002; Caliendo and Kopeinig, 2008). This will allows us to control for selection bias at both the treatment and outcome stages.

3.6. The Linkage between Food Security and Chickpea Quality Production

The study deployed [3]Food Consumption Score (FCS) and [4]Household Food Insecurity Access Scale (HFIAS) techniques to analyze the food insecurity situation of the respondents in the four sampled *kebeles*.

The FCS is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups. The score was calculated using the weighted frequency of consumption of nine food groups consumed by a household during the seven days before the survey. The value 35 was calculated from an expected daily consumption of food based on the nutrient density analysis (Berardo, 2008).

Table 2 Food consumption score profiles

Food Consumption Score	Profiles
0-21	Poor
21.5 - 42	Borderline
> 42	Acceptable

In addition, the food security status of the sample farming households was assessed from the field using structured survey questionnaire. For this purpose, the Household Food Insecurity Access Scale (HFIAS) questions were used to assess the food insecurity situation of the sample population. An HFIAS category variable was calculated for each household by assigning a code for the food insecurity (access) category in which it falls (Coates et al, 2007). The prevalence of different levels of household food insecurity (access) was calculated to categorize the households into four groups such as food secure, moderately food insecure, mildly food insecure, and severely food insecure. Then, the two survey results (FSC and HFIAS) have been compared to analysis the outcomes of quality chickpea production in relation to food security status of the

[3] The Food Consumption Score (FCS) is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups (WFP, 2008).

4 Household Food Insecurity Access Scale (HFIAS): is a food insecurity technique which is used in the study area to estimate the prevalence of food insecurity of farming households.

sample households. HFIAS shows the severity of the food security situation while FCS takes into account three dimensions of food consumption: dietary diversity, food frequency, and relative nutritional importance (Berardo, 2008).

Accordingly, the former uses a logit and the latter uses an order logit regression models to identify factors that contribute to the food insecurity status of households. For such end, the production of quality chickpea was considered as independent variables in the first regression and its effect was analyzed using propensity score matching.

Above all, the factors that determine the participation of households in the production of chickpea were examined using logit model. This implies that there are three distinct models which are estimated in this study. The first model finds out factors that affect food insecurity status of households using balance model which divides households into two: food secured and insecure. Hence, a logit model was applied.

According to Gujarati (2004), the models were presented by the following equation:

$$p_i = E(Y = 1/Xi) = \frac{1}{1 + e^{-(\beta 1 + \beta 2Xi)}} \quad \text{(1)}$$

where equation 1 is logistic distribution equation. Let consider Zi = β1+β2Xi or replaced by zi in the first equation, then we obtained equation 2

$$p_i = \frac{1}{1 + e^{-Zi}} = \frac{e^z}{1+e^z} \quad \text{(2)}$$

Z_i is between - ∞ and + ∞, and P_i is between 1 and 0. Where P_i shows the probability that household is food secured, *X*i is the explanatory variables, *i* is the possibility of a food secured and in secured (where pi equal to one the probability that households food secured and 1-pi the probability that household is food insecure.

1- P_i then, the possibility of food insecure can be explained as in equation 3 as follows:

$$1 - Pi = \frac{1}{1 + e^{Zi}} \quad \text{(3)}$$

Equation 4 is obtained by dividing by probability of food insecure

$$\frac{Pi}{1 - Pi} = \frac{1 + e^{Zi}}{1 + e^{-Zi}} = e^{Zi} \quad \text{(4)}$$

When the natural logarithm of both sides of the equation is written, equation 5 is obtained:

$$Li = \ln\left(\frac{Pi}{1-Pi}\right) = Zi = \beta 1 + \beta 2Xi \quad (5)$$

Thus, a non-linear logistic regression model is liberalized based on both its parameters and variables. "*L*" is called "logit" and this model is called logit model. When there are more than one independent variable, (X_1, X_2... X_K), the equation becomes:

$$Pi = \in (Y = \frac{1}{Xi} = \frac{1}{1 + e^{-(\beta 1 + \beta 2X1 + \beta 3X2 + \cdots + \beta kXk)}}) \quad (6)$$

If the disturbance term ui is considered the general logit model becomes

$$z_i = \beta 0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_n x_n + u_i \quad (7)$$

Using HIFIAS, households have been categorized as food secure, moderately food insecure, mildly food insecure, and severely food insecure. The response variable has four values.

$$y = \begin{cases} 1 = \lfloor if\ food\ secured \\ 2 = \lfloor if\ moderately\ food\ insecured \\ 3 = \lfloor if\ mildely\ food\ insecured \\ 4 = \lfloor if severely\ food\ insecured \end{cases}$$

This initiates to use order logit. The presentation of the model is given below:

An ordered logit model for an ordinal response Yi with C categories is defined by a set of C-1 equations where the cumulative probabilities $g_{ci} = \Pr(Y_i \leq y_i | x_{i,})$ are related to a linear predictor β0'xi = β0+β1x1i+β2x2i+… through the logit function:

$$logit\ (g_{ci} = \log(g_{ci}/1 - g_{ci})) = \alpha_c - \beta' X_i, \quad C = 1, 2, \ldots, C-1 \quad (1)$$

The parameters α_c called thresholds or cut points are in increasing order($\propto_1 < \propto_2 < \cdots < \propto_{c-1}$). It is not possible to simultaneously estimate the overall intercept β_o and all the C-1 thresholds: in fact, adding an arbitrary constant to the overall intercept β_o can be counteracted by adding the same constant to each threshold α_c. The identification problem is usually solved by either omitting the overall constant from the linear predictor (i.e. β_o= 0) or fixing the first threshold to zero (i.e. α_c= 0).

The vector of the slopes β is not indexed by the category index C, thus the effects of the covariates are constant across response categories. This feature is calling the parallel regression

assumption: indeed, plotting logit (g_{cr}) against a covariate yields C-1 parallel lines (or parallel curves in case of a non-linear specification, e.g. polynomial regression). In model (1) the minus before β implies that increasing a covariate with a positive slope is associated with a shift towards the right-end of the response scale, namely a rise of the probabilities of the higher categories.

From the equation (1), the cumulative probability for category C is

$$g_{ci} = \exp(\alpha_c - \beta' X_i)/(1 + \exp(\alpha_c - \beta' X_i)) = 1/(1 + \exp(-\alpha_c + \beta' X_i)) \_\_\_\_\_ (2)$$

The ordered logit model is also known as the proportional odds model because the parallel regression assumption implies the proportionality of the odds of not exceeding the C–th category odds $\alpha = g_{ci}/(1 - g_{ci})$ in fact, the ratio of these odds for two units, say i and j, is $odds_{ci}/odds_{cj} = \exp[\beta'(X_j + X_i)]$, which does not depend on C and thus it is constant across response categories.

The ordered logit model is a member of the wider class of cumulative ordinal models, where the logit function is replaced by a general link function. The most common link functions are logit, probit, and complementary log-log. The last name indicates that the probabilities of the categories are obtained by difference: $p_{ci} = g_{ci} - g_{(c-1)i}$ (Greydanus, 2013).

3.7. Description of Response and Explanatory Variables

3.7.1. Response Variables

Quality chickpea production is the response variable of this study. The categorical response variable of quality chickpea represents Kabuli (1) and Dessie (0). The household income of chickpea producers, food security status and household consumption of sampled farming households were the outcome variables of this study. In addition, the value chain is the other outcome of this study.

3.7.2. Explanatory Variables

Age of household head (yr.): in this study age is a continuous explanatory variable, indicating the age of the household head. The younger age of the farming households shows a positive correlation with the openness of the new improved varieties than older and retiring older farming

households (Paul and Mausch, 2017). The younger the age of the farming households increases the adoption of improved varieties of crops.

Sex of household head (Sex): This is a dummy explanatory variable, indicating the sex of the household head. A value of 1 represents if the household head is male otherwise 0. A research finding indicates that male-headed households are more adopters of improved crop varieties than female-headed households (Legesse et al, 2005). Therefore, the male status of household head is positively correlated with adoption of improved chickpea seed.

Family Size: this is a continuous explanatory variable measured by the number of members in farming household. The size of the farming household members is related to labor resources and is hence the engagement in agricultural activities. It is, therefore, sensible to expect that a household with large household members can produce the more marketable output of crops or store it for household consumption (Randela, Alemu, and Groenewald, 2008).

Educational Level of Household Head: This is a categorical variable which takes the value on the bases of formal education level. If the farming household head is not attending formal education, it is categorized as 0. The education of farming household head positively influences chickpea market orientation since education is important to engage potential farming households into improved varieties of chickpea for the purpose of generating more income (Tewodros, 2014).

Marital Status of Household Head: this is a dummy explanatory variable, indicating the marital status of the farming household head. Married (1), widowed (2), divorced (3), never married (4), and cohabiting (5). It is expected that married farming households have more stability in household income and increase productivity through buying and cultivation of improved varieties of crops.

Inputs Market Information: It is a dummy variable that takes value 1 if the farming households have the access to inputs market information and 0 for those who do not have. Market participation positively influence when the farming households have information about inputs with the support of subsidized prices for their production of improved chickpea and other crops (Riazet, 2017).

Sales Market Information: It is a dummy variable that takes value 1 if the farming households have the access to sales market information and 0 for those who do not have. Market participation positively influence when the farming households have information about inputs with the support of subsidized prices for their production of improved chickpea and other crops (Riazet, 2017).

Mode of Transport (Donkey/Horse Cart and Vehicle): is a dummy variable which has a direct impact on market access for obtaining inputs and sales.

Dependency Ratio: is a continuous variable which explains the ratio of the family members in a range of productive age category versus to the dependent family members of farming households. The farming households having with more dependents are likely to have a lower level of buying or selling the power of improved crops to or from the market since it has a positive correlation with the position of the economic capacity and income of the farming households (Randela, Alemu, and Groenewald, 2008). The expected sign of dependency ration is negative when the number of dependents in the farming household increases.

Area of Total Cultivated Land (ha): It is a continuous variable of the total land holding of farming household. This variable is measured in hectares. The bigger the size of the farm the greater the proportion of land allocated for improved crop varieties (Afework and Lemma, 2015). The expected sign is positive and the variable is continuous recording the number of hectares of the farm.

Distance to the Nearest Market (km): It is a continuous variable which indicates the response of the farming households in terms of km. As farming households are far away from the nearest village market, it is expected to have less access to and use of improved varieties of crops (Afework and Lemma, 2015). As a given farming household far away from the centers of local markets, the likelihood of using improved varieties of chickpea decreases.

Experience in Agriculture (yr.): is a continuous variable which shows the total number of years the farming households have in agriculture practices. The more farming households have the experiences in agriculture they are expected to influence in the adoption of improved chickpea varieties which in turn is signal positively (Afework and Lemma, 2015).

Participation in Farmers Training: It is dummy variable and it takes a value of 1 if the woman training on climate change adaptation and, 0 otherwise. Access to general training is expected to influence the use of improved crop varieties.

Development Agent Support: This is a continuous variable, which indicates the number of visits conducted by development agents on a regular base. The visits of development agents play crucial roles for farming households in terms of providing advice and information. The frequency of the contact with the development agents has a positive contribution to the access and cultivation of improved crop varieties. Therefore, it is assumed that development agents' support has positive impacts on the improved chickpea production (Riazet, 2017).

Credit/Loan of the Households: it is a continuous variable. Access to credit gives farming households a relief from financial constraints. The access to credit services enables to reduce the impacts of negative consequences on the production of crops. The access to credit services significantly and positively influences the farming households using improved crop varieties or not (Deressa et al. (2009).

Total Livestock Ownership: It is a continuous variable to refer to the total number of animals possessed by the household measured in tropical livestock unit (TLU). Livestock is considered as the productive assets of farming households which are used as a security against crop failure. This can be attributed to increasing wealth and income base of farm households which makes more money available in the households and willing to purchase improved seeds for cultivation (Tesfaye and Alemu, 2001; Randela, Alemu, and Groenewald, 2008). Hence this variable is expected to have a positive impact on the adaption of improved varieties of crops.

3.7.3. Statistical and Specification Test

Model Comparisons Various multivariable linear regression models (1) using least squares approach were fitted under each of the scenarios representing the correlation matrix and dataset replications using the generated datasets with response variable y and predictors x1 , x2 , and x3 : 0 11 2 2 3 3 y xxx =+ + + + ββ β β ε…….....(1) where β0 , β1 , β2 , and β3 are the regression coefficients and the error term ε is normally distributed with mean 0 and variance 2 2 σε σ (N(0,)) ∼ . Multicollinearity was assessed using variance inflation factor (VIF) [14], which measures the inflation in the variances of the parameter estimates due to

multicollinearity potentially caused by the correlated predictors. In each scenario for correlation matrix the average estimates of regression coefficient, standard errors, t-test statistics, p-values, and VIF over the 1000 simulations were calculated (Vatcheva, Lee, McCormick, and Rahbar, 2016).

CHAPTER FOUR: RESULT AND DISCUSSION

This chapter discusses the results of the descriptive and econometric analysis. A summary of the explanatory variables that potentially influence the quality production of chickpea were computed by either t-test or chi-square. A value chain analysis was conducted and a value chain map was drawn in order to assess the roles of actors in the pricing of chickpea commodity, marketing channels, and marketing structure.

A propensity score matching (PSM) model was used to examine the impact of quality chickpea production on the income obtained from the production of crops. Then, the household food insecurity severity and household food consumption status were assessed through Household Food Insecurity Access Scale (HFIAS) and Food Consumption Score (FCS), respectively. Finally, ordered logit and logit regressions econometric analysis was performed to examine the impact of producing quality chickpea and the determinant factors on food insecurity severity and household food consumption status, respectively.

4.1. Demographic Characteristics of the Respondents

According to the study result, 83.22% of the sample households respondents were male and the remaining 16.78% were females. Out of the total 286 respondents, the majority (83.57%) of the total 286 respondents is married while the rest of them are widowed, divorced, never married or cohabited. The study shows that the respondents have a maximum of diploma certification in a formal education.

Table 3 Demographic characteristics of the respondents (a)

Descriptions		**Number of Respondents**	**%**
Sex of the HH head (male =1)	Male	238	83.22
	Female	48	16.78
	Total	286	100
Marital Status of the HH head	Married	239	83.57
	Widowed	24	8.39
	Divorced	11	3.85
	Never Married	5	1.75
	Cohabiting	7	2.45
	Total	286	100
Education level of the HH Head	0	160	55.94

(13= Diploma)	1	5	1.75
	2	8	2.80
	3	10	3.50
	4	5	1.75
	5	15	5.24
	6	25	8.74
	7	12	4.20
	8	10	3.50
	9	6	2.10
	10	18	6.29
	11	3	1.05
	12	8	2.80
	13	1	0.35
	Total	286	100

Source own survey result 2018

The demographic characteristics of the study revealed that the average age of the respondents was 47.12 with a minimum of 16 and 85 maximum age range. The average family size of the respondents was 7.14 family sizes with a maximum of 16. The respondents have 27.88 average years of the experience in agriculture and 70 years were the maximum years of the experiences of the respondents.

Table 4 Demographic characteristics of the respondents (b)

Variables	**Mean**	**Std. Dev.**	**Min**	**Max**
Age of the Household Head (yr.)	47.12	12.13	16	85
Family Size	7.14	2.8	1	16
Experience in Agriculture (yr.)	27.88	12.56	0	70

Source own survey result 2018

4.2. Socio-economic Characteristics of the Respondents

Of the average 3.02 ha total land sizes, the study revealed that the respondents cultivate on average 2.65 ha fields with 0.5 and 8.65 of minimum and maximum hectare field size, respectively. The study indicated that the average value of dependency ratio/ percentage of working age population of the sampled population is 0.42 with the average family size of 7.14.

The respondents replied that on average they have a 13.12 quintals [5]productivity of crops per hectare with a maximum of 86 quintals, which is below the national productivity of major crops (i.e. 21.5 quintals / hectare) (IMF, 2018). The respondents of this study have on average 26.06 livestock assets with a minimum and maximum value of 20.29 and 45.69, respectively.

Table 5 Socio-economic characteristics of the respondents

Variables	**Mean**	**Std. Dev.**	**Min**	**Max**
Total Land Size	3.02	1.48	.5	9.65
Area of Total Cultivated Land (ha)	2.65	1.38	.5	8.65
Dependency Ratio	0.42	0.22	0	1
Total Productivity	1311.63	877.29	0	8600
Livestock Ownership/Assets	26.06	3.17	20.29	45.69

Source own survey result 2018

4.3. Institutional Characteristics of the Respondents

The respondents took on average 2,459.20 birr with the sealing amount of 14, 000 birr on credit for various on-farm, off-farm and non-farm activities from the local microfinance institutes. The maximum distance from the residence of the respondents to the main local market in Tulu Bolo town is 17 km and the respondents are away from the nearest market by on average 6.88 km. The respondents participated and took on average 1.55 times various farmers training organized by the local government, non-governmental organizations and various actors in the study year with a maximum of 4. The respondents were able to obtain on average 3.56 times development agent technique support per year in various agriculture-related issues.

[5] Crop Productivity is measured as the sum of the total value of production divided by the total size (in hectares) of land managed.

Table 6 Institutional characteristics of the respondents (a)

Variables	Mean	Std. Dev.	Min	Max
Credit/Loan of the Households	2459.20	3250.67	0	14000
Development Agent Support	3.56	2.91	0	12
Participation in Farmers Training	1.15	.77	0	4
Distance to the Nearest Market (km)	6.88	3.42	0	17

Source own survey result 2018

The study indicated that majority of the respondents (i.e. 91.26%) had input market information to purchase fertilizers and chemicals for cultivations of chickpea and other farm crops while the rest responded that they did not have the information on input market. Likewise, 92.31% respondents had information about the sale market information to sell their agricultural produce. Of the total sample population, 84.62% of the respondents used donkey/cart mode of transportation to bring their agricultural production to the main market.

Table 7 Institutional Characteristics of the Respondents (b)

Descriptions		Number of Respondents	%
Input Market Information	No	25	8.74
	Yes	261	91.26
	Total	286	100
Sale Market Information	No	22	7.69
	Yes	264	92.31
	Total	286	100
Mode of Transport	Donkey/Horse Cart	242	84.62
	Vehicle	37	12.94
	Others	7	2.44

Source own survey result 2018

4.4. Detecting the Degree of Multicollinearity

Multicollinearity arises when at least two highly correlated predictors are assessed simultaneously in a regression model. Multicollinearity detection was made in regression analysis to know whether or not the coefficients are uniquely identified in the model. If there is multicollinearity among the explanatory variables, the statistical inferences made about the data may not be reliable. Multicollinearity does not affect the overall the predictions of the model, but it detects the instability and biasness standard errors. This leads to very unstable p-values for

assessing the statistical significance of predictors and ultimately causes unrealistic and untenable interpretations (Vatcheva, Lee, McCormick, and Rahbar, 2016).

In this study, the most common variance inflation factors (VIF) and the inverse of VIF (1/VIF) called Tolerance (TOL) were used to verify multicollinearity among the explanatory variables. According to the test result, multicollinearity was not a serious problem both among the continuous and dummy/categorical variables (see Appendix 6 and 7).

4.5. Descriptive Results

Salient variables which are associated with chickpea quality producers are characterized and examined using t-test and chi-square. Demographic, socio-economic and institutional variables such as age, dependency ratio, farmland size, formal education, family size, market distance, loan/credit amount, contacts with agricultural development agent, field days participation/training, livestock ownership/asset, and experiences in agriculture were analyzed using of t-test.

Table 8 Descriptive summary of selected continuous variables used in estimation

Explanatory Variables	**Mean value Quality produce**	**Mean value Non-Quality produce**	**P-value**
Age of Household Head (yr.)	46.79	47.40	0.6650
Family Size	6.60	7.60	0.9987
Dependency Ratio	0.43	0.41	0.2189
Area of Total Cultivated Land (ha)	2.92	2.43	0.0014***
Distance to the Nearest Market (km)	6.56	7.14	0.0135**
Experience in Agriculture (yr.)	27.34	28.34	0.7478
Participation in Farmers Training	1.11	1.19	0.8338
Livestock Ownership/Asset	26.02	26.09	0.4294
Development Agent Support	3.97	3.21	0.0135**
Credit/Loan of the Households	2051.52	2808.65	0.9753
Total Productivity	1356.73	1272.97	0.7891

Source own survey result 2018
*** Significant at 1% level, ** significant at 5% level,* significant at 10% level

The results of the t-test indicated that there is a statistical difference in the average value of the area of total cultivated land (ha) at 1%, significance level, respectively. As it is shown in table 8, the average size of the cultivation land of quality chickpea producers is 2.92 while the cultivation land of the counterfactual group is 2.43. Most of the farming households have own farmland for the cultivation of crops. The average cultivation land size of the sampled farming households in the study areas is above the national figure of 0.15 hectares (CSA and World Bank, 2013).

Accordingly, the distance of the nearest market from the farming households is significant at 5% of significance level. The average distance of the quality chickpea producers from the nearest market is 6.56 km while the households producing poor quality chickpea are found on average at 7.14 km away from the local market Tulu bolo. In the same manner, the statistical difference in the average value of development agent support is at 5% significance level. The study indicated that the farming households obtained on average 3.21 and 3.97 frequency of visits for quality chickpea and poor quality chickpea production, respectively.

The dummy variables such as sex of the household head, marital status of the household head, input market information, sale market information and mode of transportation were examined using chi-square. As table 9 shows, the sex of household head and input market information of quality chickpea producing farming households and the counterfactual group is statistically different at 5% level of significance. The statistical difference to the access of sale market information between quality chickpea producing farming households and the counterfactual group is at 10 % level of significance.

The result shows that 88.64% of the head of quality producing farming households are male while only the remaining 11.36% are females. Likewise, the proportion of 78.57 % and 21.43% of the head of non-quality producing farming households are males and females, respectively. Legesse, Senait, Asnake, Demissie, Gaur, Gowda and Bantilan (2005) proved that male household heads are more adopters of improved chickpea variety than females.

Out of the total 132 respondents of quality chickpea producing farming households, only 12.88% and 10.71% have the access to input and sale market information, respectively. Similarly, the percentile of non-quality chickpea producing farming households who do not have access to input and sale market information are only 5.19% and 4.52%, respectively.

Table 9 Descriptive summary of selected dummy variables used in the estimation

Variables	Description	Quality producer	Non-Quality producer	P-value
Sex of the HH Head	Male	117 (88.64%)	121 (78.57 %)	0.023**
	Female	15 (11.36%)	33 (21.43%)	
Marital status of the HH	Married	116 (87.88%)	123 (79.87%)	
Head	Widowed	8 (6.06%)	16 (10.39%)	
	Divorced	4 (3.03%)	7 (4.55%)	0.411
	Never Married	1 (0.76%)	4 (2.60%)	
	Cohabiting	3 (2.27%)	4(2.60%)	
Input Market Information	No	17 (12.88%)	8 (5.19%)	0.022**
	Yes	115 (87.12%)	146 (94.81%)	
Sale Market Information	No	12(10.71%)	7(4.52%)	0.052*
	Yes	100(89.29%)	148(95.48%)	
Mode of Transport	Donkey/Horse Cart	95(84.82%)	140(90.32%)	0.172
	Vehicle	17(15.18%)	15(9.68%)	
	Others	0(0.0%)	0(0.0%)	

Source own survey result 2018
** significant at 5% level, * significant at 10% level

The result implies that major of quality chickpea producing farming households did not have sufficient access to input and sale market information. However, the farming households of quality producers had more access than poor quality producers. Riazet (2017) proves that market participation positively influence when the farming households have information about inputs with the support of subsidized prices for their production of improved chickpea and other crops.

4.6. Propensity Score Matching (PSM) Result

Propensity score matching was used in order to compare the mean difference between households which engaged in the production of quality chickpea with those households which did not. Covariates other than the outcome variables were used to compute the probability of participation in quality chickpea production using Probit (p-score). Based on this, farming

households which had the same characteristics in both groups (engaged in quality chickpea production and which did not) were matched with the nearest neighbor matching and kernel techniques which are the two most widely methods of matching. The ATT (average treatment on the treated) of household income between treated and control groups were then estimated.

The response variable quality chickpea producers were matched with the similar characteristics in terms of age of the household head, sex of the household head, marital status, market sale information, household farmland size, contact with development agents, and frequency of farmers training confounding variables. The response variable was estimated with seven aforementioned covariates using propensity score matching.

Table 10 Propensity score matching results of quality chickpea impacts on HH income

Variable	Sample	Treated	Controls	Difference	T-Stat
Household Income	Unmatched	37516.3182	34640.0649	2876.25325	1.16
	ATT	37516.3182	30537.197	6979.121213	2.36

Source own survey result 2018

The result reveals that producing of quality chickpea commodity had the impact to boost the household income of the producers when compared with the counterfactual group of Dessie chickpea producers. Congruently, Verkaart et al. (2016) evidenced the similar results that the production of improved chickpea significantly increases household income and the access to improved chickpea appears a promising pathway for rural development in Ethiopia's chickpea growing regions. Table 10 shows that the household income of quality chickpea producers had increased by 6,979.12 birr per annum after the farming households were matched. The t-test showed that mean difference on covariates after matching is statistically significant at 2.36 values after matching. The result entails that such difference is because of quality chickpea produce.

Table 11 PSM t-test for the estimation between treated and control group

Confounding Variables	Sample	Mean		% bias	% reduct |bias|	P>| t |
		Treated	Control			
Household Head Age	U	46.788	47.403	-5.1		0.670
	M	46.788	45.697	9.0	-77.5	0.452

Household Family Size	U	6.5985	7.5974	-36.1		0.003***
	M	6.5985	6.7727	-6.3	82.6	0.624
Livestock Ownership/Asset	U	26.022	26.089	-2.1		0.859
	M	26.022	26.56	-17.0	-701.9	0.308
Household Head Sex	U	1.1136	1.2143	-27.3		0.023**
	M	1.1136	1.1061	2.1	92.5	0.845
Experience in Agriculture (yr.)	U	27.341	28.338	-8.0		0.504
	M	27.341	26.576	6.1	23.2	0.620
Access to Farmers Training	U	1.1061	1.1948	-11.4		0.332
	M	1.1061	1.1439	-4.9	57.3	0.703
Input Market Information	U	.87121	.94805	-26.9		0.022**
	M	.87121	.85606	5.3	80.3	0.721
Dependency Ratio	U	.42923	.40940	9.2		0.438
	M	.42923	.43477	-2.6	72.0	0.833

Number of observations	= 286
Likelihood Ratio (8)	= 20.34
Probability > chi2	= 0.0091
Pseudo R2	= 0.0515
Log likelihood	= -187.22476

Source own survey result 2018

*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level

Table 11 shows a t-test on the hypothesis that the mean value of each variable in the treatment group and the counterfactual group was done before and after matching. The p-value of the exogenous variables such as household family size, household head sex, and input market information is below 0.1, and hence are significant at 10% probability level. With the exception of Household Head Age and Livestock Ownership/Asset, the difference between the two groups of the exogenous variables was eliminated and the "bias" was large before matching.

Thus, the result shows that the control group similar enough to the treatment group was generated for the ATT estimation through the propensity score nearest-neighbour matching. The graph (i.e. Figure 3) shows the assumption of common support holds an overlap of the propensity scores of the quality chickpea producers and non-producers. It depicts that there is an adequate common support between the control and the treated group with the same characteristics of after matching.

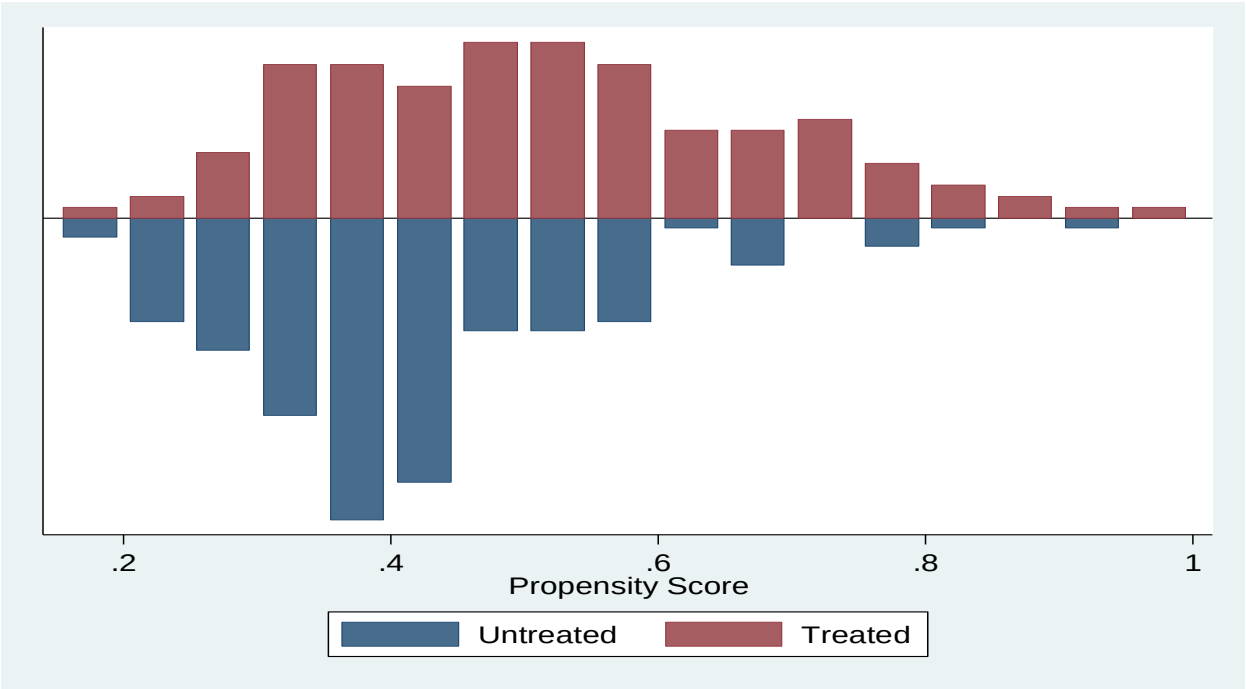


Figure 3: Propensity score distribution and common support for propensity score estimation of chickpea

In order to test the robustness of the matching technique, Rubins' B and Rubin's R were imputed. Rubin (2001) recommends that B should be less than 25 and that R should be between 0.5 and 2 for the samples to be considered sufficiently balanced (see Appendix 3 and 4). The results reveal that the matching used here goes in conformity with these tests.

4.7. Estimating determinants of Food In/Security Status

Cash crops have significant contribution in improving food security of the farming households in the developing countries. The surplus production is a source of income to improve the access to food. Hence, farming households choose cash crops are an integral part of strategies to improve food security at farm household level in developing countries. The production of cash crops also accelerate the build-up of institutions that enable further commercialization with cash crops provides farm households with means to save and invest in a more productive farm, and cash crops may have a catalytic effects on agricultural innovations as they add value and productivity in rural areas (Thom et al, 2014).

Since Household Food Insecurity Access Scale (HFIAS) is more than two categories and the valued of each category have a meaningful sequential order where the value is indeed "higher" than the previous, ordered logit model was used to test the likelihood ratio of food insecurity access of farming households. A Logit model was also used for analyzing food consumption score of farming households, for food consumption score is binary (dummy) which takes values 0 for food insecure or 1 for food secured farming households.

4.7.1. Household Food Insecurity Access Scale Analysis of Sample Farming Households

In the study, the analysis of food insecurity status using ordered logit model was executed to check the food insecurity status of sample farming households. The ordered logit analysis was made using socio-economic, demographic and institutional factors that could affect the food security status of the farming households. An ordered logit model of estimation used to figure out factors having a certain sort of relationship to the food insecurity status of farming households. As table 12 shows the ordered logit model of Prob > chi2 is a good fit since it is below < 0.05 (i.e. 0.0000). This shows that all the coefficients in the model are different than zero and the explanatory variables adequately estimated the propensity scores (Reddy and Endale, 2015).

As table 12 shows, the p-value of these four variables is below 0.05 or above Z score of 1.96. The output for the ordered logit equation shows that four variables significantly influenced and determined the probability of the food insecurity status in the study area. These variables are household farmland size, credit/loan of the household, input market information and distance to the nearest market.

Table 12 Determinants of food insecurity status of farming household

HFIAS	**Coef.**	**Robust Std. Err.**	**z**	**P>|z|**
Age of the Household Head	-.0026373	.0140629	-0.19	0.851
Sex of the Household Head	-.3999093	.330837	-1.21	0.227
Marital Status of the Household Head	-.051469	.1641022	-0.31	0.754
Household Farmland Size	-.3445424	.1444802	-2.38	0.017**
Household Income	-3.69e-06	6.42e-06	-0.57	0.566

Credit/loan of the household	.0000772	.0000381	2.02	0.043**
Development Agent Support	-.030425	.0614999	-0.49	0.621
Participation in Farmers Training	-.1518509	.1921812	-0.79	0.429
Experience in Agriculture	.0256615	.0131884	1.95	0.052*
Input Market Information	1.19316	.5975064	2.00	0.046**
Distance to the nearest market	.195185	.0433296	4.50	0.000***
Mode of Transportation	.3281493	.2043649	1.61	0.108
Dependency Ratio	.1741721	.650013	0.27	0.789
Total Productivity	-.0007096	.0003712	-1.91	0.056*
Livestock Ownership/Assets	-.0619189	.0496443	- 1.25	0.212
Chickpea	-.4251038	.2746367	-1.55	0.122
/cut1	-.8182118	1.46384		
/cut2	.5830797	1.462992		
/cut3	3.288511	1.498638		

Log likelihood = -280.19857
Number of obs = 286
LR chi2(16) = 61.85
Prob > chi2 = 0.0000
Pseudo R2 = 0.1311

Source own survey result 2018
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level

For a one unit increase in the predictor variables of household farmland size, the expected value of the outcome variable of food insecurity status of the farming households' changes by 0.34 coefficient decreases. In contrast, one unit increase in credit/loan of the household, input market information and distance to the nearest market, the outcome variable of food insecurity decreases by 0.000, 1.19 and 0.19 coefficient increases. The p-value of household farmland size, credit/loan of the household and input market information is 5% significance level while the distance to the nearest market is at 1% significance level.

The second objective of the study was to compare household food security between quality chickpea producers and non-producer farming households. Household food security was assessed and the results are present in table 12. The categorical household food security status was based on the household food insecurity access scale (HFIAS) developed by the food and

nutrition technical assistance (Terri et al, 2011). The scale provides a continuous measure of household food insecurity which can be categorized into four levels of household food insecurity (access) prevalence.

As the result shows in table 12, out of total sampled households in the study area 143 were found to be food secured farming households while the remaining half were food insecure. The majority (62.12%) of quality producing farming households were food secure while the rest 14.39, 21.97% and 1.52% of quality producing farming households were mild, moderately and severely food insecure, respectively. The Chi-square test indicates that there is a significant difference in food security status between quality chickpea producers and non-quality chickpea producers at 1% level of significance. This implies that quality producing farming households are more food secures than non-quality producing farming households.

Table 13 Farming households' food insecurity condition

Household Food Security Status	Quality produce (N= 132)		Non-Quality produce (N=154)		Total		P-value
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	
Food Secure	82	62.12	61	39.61	143	50.00	
Mildly Food Insecure	19	14.39	52	33.77	71	24.83	
Moderately food Insecure	29	21.97	35	22.73	64	22.38	
Severely Food Insecure	2	1.52	6	3.90	8	2.80	
Total	**132**	**100**	**154**	**100**	**286**	**100**	**0.000*** **

Source own survey result 2018 *** significant at 1% level

4.7.2. Household Food Consumption Score Analysis of Sample Farming Households

The binary outcome variable i.e. household food consumption score was estimated using logit regression model to analyze the food security status of farming households in the study area. In the logit model used for estimation of propensity scores, the likelihood ratio tests for food consumption score of farming household are LR chi2 (20) = 54.26, Prob > chi2 = 0.0001 and Pseudo R2 = 0.2298. These indicate that the included explanatory variables adequately estimated the propensity scores. The Pseudo R Square i.e. 22.98% implies that the model is a goodness-of-

fit test to carry out the regression analysis, and the independent variables have adequately estimated the propensity scores.

With this model, the determinant factors of the food security of households were estimated to examine variables which have the relationship with food security status of the farming households. As it can be shown in table 14, four variables i.e. credit/loan of the household, distance to the nearest market, total productivity and dominant farming activity significantly influenced and determined the probability of the food security status in the study area. According to the model output, the variables of credit/loan of the household, total productivity and dominant farming activity are statistically significant at 5% probability level indicating the presence of selectivity bias while the significance level of the variable distance to the nearest market is at 1%. With the exception of the variable of distance to the nearest market, the determinant variables are likely to be negatively associated with the outcome variable food security status.

Table 14 Determinant factors of food consumption score of farming households

FCS	**Coef.**	**Robust Std. Err.**	**z**	**P>|z|**
Age of the Household Head	.0002732	.0180818	0.02	0.988
Sex of the Household Head	.2435709	.4463552	0.55	0.585
Marital Status of the Household Head	.0113369	.2064797	0.05	0.956
Family Size	-.0338983	.0664845	-0.51	0.610
Area of total cultivated Land	1.30089	.7265021	1.79	0.073
Total Land Size	-.7992101	.6995763	-1.14	0.253
Household Income	7.61e-07	7.81e-06	0.10	0.922
Credit/loan of the household	-.000104	.0000442	-2.35	0.019**
Development Agent Support	.0289858	.0580883	0.50	0.618
Participation in Farmers Training	-.0524202	.199314	-0.26	0.793
Experience in Agriculture	-.0221355	.0167524	-1.32	0.186
Dominant Farming Activities	-.2983994	.1290915	-2.31	0.021**
Input Market Information	-1.029511	1.245379	-0.83	0.408
Sale Market Information	-.5151113	1.31251	-0.39	0.695
Distance to the nearest market	-.2248459	.0593544	-3.79	0.000***
Mode of Transportation	-.1659678	.2122015	-0.78	0.434

Dependency Ratio	-.0874623	.7596693	-0.12	0.908
Total Productivity	.0007405	.0003677	2.01	0.044**
Livestock Ownership/Assets	.1191596	.0685513	1.74	0.082
Chickpea Production	.4980989	.2976452	1.67	0.094
Log likelihood = -152.6384				
Number of observation = 286				
LR chi2(20) = 54.26				
Prob > chi2 = 0.0001				
Pseudo R2 = 0.2298				

Source own survey result 2018 E.C.
*** Significant at less than 1% probability level; ** Significant at less than 5% probability level; * Significant at less than 10% probability level

The data on food consumption of 286 farming households were collected for analyzing the variety and frequency of food groups consumed over 7 days recall period. Table 15 shows the results of food security status using food consumption score for both quality chickpea produced and non-produced farming households. Even though these thresholds are standardized, there is always room for adjustments based on evidence (FAO, 2008). For the simplification of logit regression analysis, the food consumption score was cut-off into two categories of Acceptable Food Consumption (>42), and Poor and Borderline Food Consumption and poor (< = 42). The threshold splits the farming households either food secure or insecure. By using the Food consumption score cut-off, the results showed that quality chickpea producers with the acceptable food consumption score were 57.58 % while 42.42 % of quality chickpea producers were under poor and borderline of the food consumption score. Likewise, the total non-quality chickpea producers with acceptable food consumption score were 70.78% while 29.22% of the farming households were under the poor and borderline food Consumption score.

Table 15 Farming households' food consumption score

Household Food Security Status	**Quality Produce (N= 132)**		**Non-Quality Produce (N=154)**		**Total**		**P-value**
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	
Acceptable food Consumption **(**>42)	76	57.58	109	70.78	185	64.69	
Poor and Borderline Food	56	42.42	45	29.22	101	35.31	

Consumption (<=42)							
Total	**132**	**100**	**154**	**100**	**286**	**100**	**0.020****

Source own survey result 2018

** Significant at 5% level

According to the Food Consumption Score, quality chickpea producing farming households with poor consumption and borderline consumption is treated as food insecure while the farming households who produce non-quality chickpea (i.e. Dessie) were food secured with acceptable food consumption category. The study shows that the mean marketed amount of Kabuli chickpea was 117.65 kg in 2009/10 E.C production years while Dessi type of chickpea was 64.57 kg in 2009/10 E.C.

With the same token, the non-quality chickpea producers consumed on average 265.33 kg which was more than those quality producers who consumed Kabuli chickpea (i.e. 202.81). This implies that the non-quality producing farming households tend to use the production of Dessie for household consumption while quality producing farming households is more marketing Kabuli chickpea. As indicated in the table, there is significant mean food consumption score difference between quality producers and the non-quality producers at 5% level of significance. Bekele et al (2007) related the reason with the food security status of the farming households who do produce poor quality chickpea (i.e. Dessie) as a result of the tendency of consuming Dessie chickpea at the household level.

4.8. Value Chain of Chickpea

It is a vivid fact that the benefits of the farming households could be maximized if the value chain is well examined so that the intervention could be maximized. In this research, the impact of quality chickpea production on the value chain of chickpea commodity was examined using a qualitative data obtained through interview. A value chain comprising of actors, their respective roles in the pricing of a chickpea commodity, marketing channels, and marketing structure were analyzed and finally, a value chain map of chickpea commodity of the study area was drawn.

The average distance of the sample farming households' suburban location from the nearby marketplace is 6.9 km. About 84% of the farming households use donkey/horse carts and animal back for transporting the chickpea and other crops to the local market in Tulu Bolo town. The

sampled farming households produced on average 326.5 kg Kabuli chickpea crop in 2009/2010 harvesting seasons. Out of which, they brought out for marketing about 38% of them and on average they sold out it with 2,171.69 birr with a maximum birr 2, 200.00. Kabuli chickpea is more marketable than Dessie type though the production is very minimal.

The interviewed 6 rural collectors responded that they mostly collect chickpea commodity from the rural female farmers who bring 2 to 3 kg chickpea to the market at a time. With the earnings, they purchase factory products for household consumption. In likewise, a total of 23 interviewed wholesalers replied that they purchase chickpea from the male farming households up to 60 kg at a time. The farm gate prices of Kabuli chickpea ranges from 14 birr to 18 birr while Dessie is sold from 11 to 16 birr. On average, the wholesalers purchase a kg of Kabuli with 13 birr, ranging from 12 to 18 birr. When the wholesalers sell chickpea, they obtain on average 14.9 birr per kg with a range of 13 to 20 birr. This implies that they obtain at least 2 birr from a kg of Kabuli. Apart from the quality, the season of production and selling of Kabuli determines the pricing. During the production, the price of Kabuli chickpea would be lower and highest during the off-season. The wholesalers purchase Dessie chickpea with 13 birr per kg average price and sell averagely with 14 birr per kg.

Table 16 shows that the wholesalers cost for the pricing of transportation, loading/unloading, house rent fee and commission-agents fee before delivering the chickpea crops to the wholesalers in Addis Ababa.

Table 16 transportation, loading, house rent fee and commission agent fee

S. NO		Mean	Std. Dev.	Min	Max
1	Transportation	27.58	8.65	5	40
2	Loading/unloading	8.19	3.74	0	10
3	House rent fee	32.26	127.51	0	600
4	Commissions Agent fee	7.90	4.04	0	10

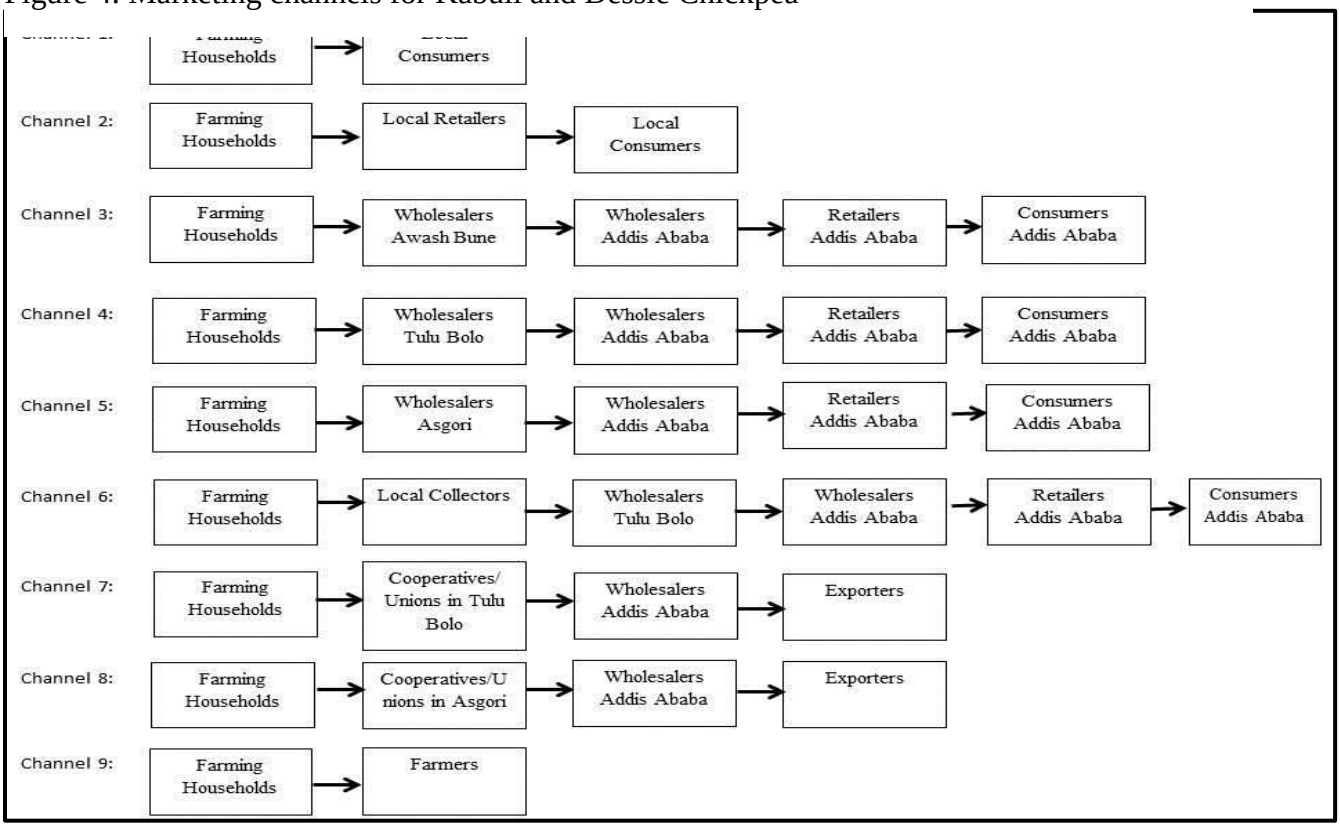
Source own survey result 2018

A number of various actors were involved through nine value chain channels. The value chain for the local markets reached to the final consumers in rural towns namely in Tulu Bolo, Qobo and Asgori through the local retailers, wholesalers, cooperatives/farmers unions, and farmers. The consumers, farmers, retailers and wholesalers in Tulu Bolo, Asgori, Awash Bune and Addis

Ababa purchase chickpea depending on the financial capacity and purpose of the usage. Most consumers in Tulu Bolo town are dwellers who do not have farmland in the rural areas whereas the dwellers that have farmland in rural areas mostly use their own productions for household consumptions.

Source: own sketched from the survey result, 2018

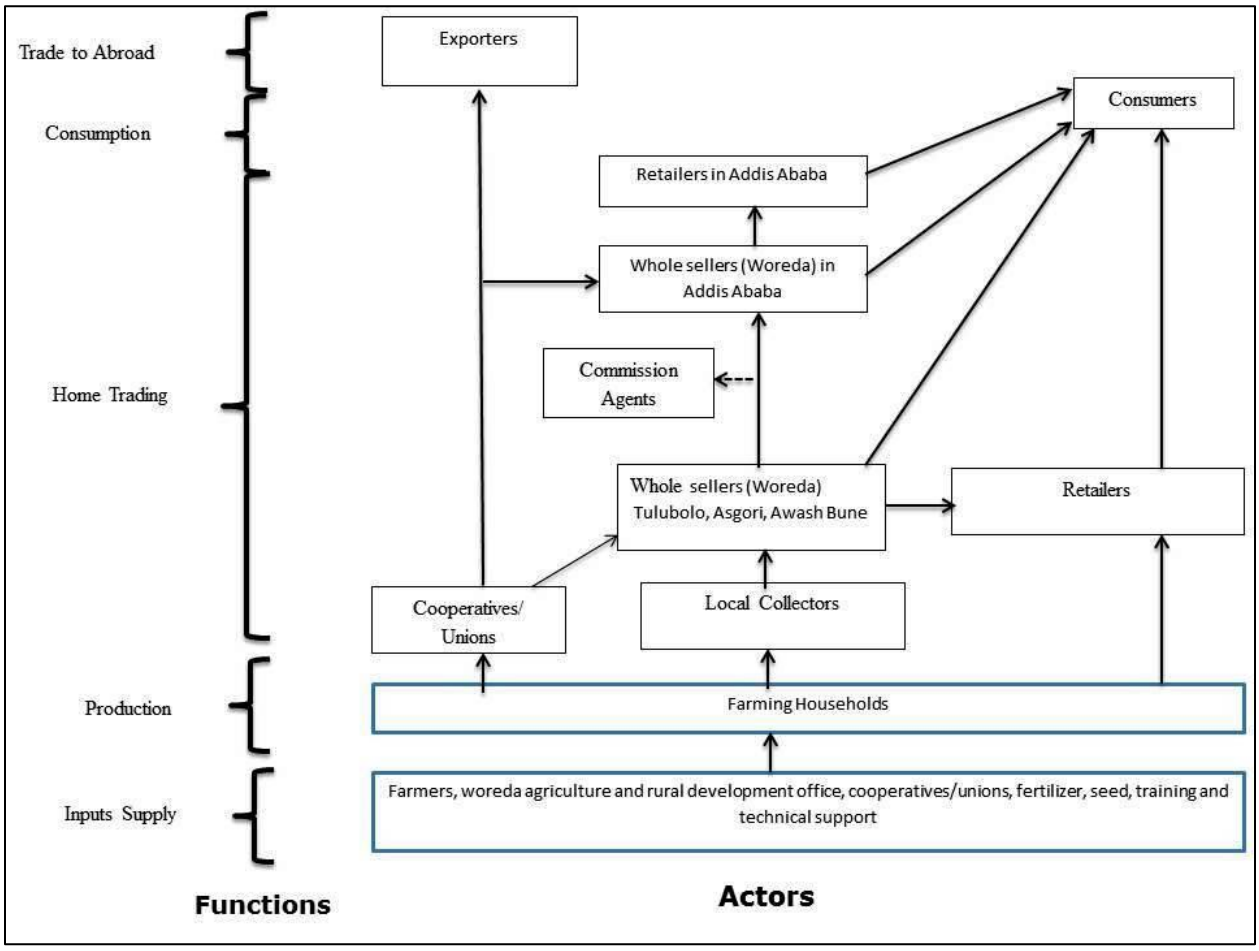
Figure 4: Marketing channels for Kabuli and Dessie Chickpea



The farming households in the district obtain inputs and improved varieties of Kabuli from the cooperatives through farmers' unions and primary cooperatives and also deliver their products to those cooperatives/ farmers unions in Asgori and Tulu Bolo. The farmers unions export Kabuli chickpea to wholesalers at *Merkato* and Ethiopian Commodity Exchange (ECX) in Addis Ababa. The wholesalers at *Merkato* retail chickpea to medium wholesalers organized as a cooperative and retailing to the consumers. Then, these wholesalers again retail the chickpea with other crops to the retailers and consumers/end users. In most cases, Kabuli chickpea is ended to exporting agents like ECX while most of the production of Dessie chickpea is ended by the consumers. As using farming households of the district as a focal point, major marketing channels which were identified in the study district to Addis Ababa are well depicted in Figure 5.

4.8.1. Market Structure and Functions of Different Participants

The major chickpea marketing outlets which link producers with the consumers were identified as rural retailers, *Kebele* and district assemblers, and wholesalers and to the consumers in Tulu Bolo and Asgori towns. Then, the wholesalers in Tulu Bolo and Asgori towns are linked to the wholesalers in Addis Ababa and these wholesalers are in turn connected to the medium wholesalers, to the retailers and finally to the consumers. In the other dimensions, the farmers' unions are connected to ECX for exporting chickpea commodities, in particular, Kabuli (Figure 6). The length of the value chain and the involvement of actors are determined by the distance between the actors right from the initial stage to the final outlet to the consumers.



Source: own drawn based on the survey result, 2018
Figure 5 Chickpea Value Chain Map

The District Agriculture Office supplies fertilizers and improved seeds to chickpea farming households on demand through farmers unions. The development agents also provide technical

support to them in the areas of cultivation techniques, improved seed varieties, and the use of fertilizers. Regarding fertilizer, the majority (97%) of the farming households in the study area use only organic fertilizer (manure and compost) while few of them use inorganic fertilizer for chickpea production. For the production of Dessie chickpea, most farming households use local verities whereas the improved seed of Kabuli chickpea type is purchased or obtained from cooperatives, district agriculture office or local seed dealers in the area. Small-scale farming households are the key plays in chickpea production. They involve in the chickpea value chain as producers and sellers at a primary level of land preparation to post-harvesting handling and marketing. The peak months of the production of chickpea in the area are months of December and January. The production of chickpea is stored in a traditional way of doing as they do for other crops and store in the compound using poor storage system.

Value is added to the product as it passes through the chain by value-adding activities, which creates this benefit. The "added" part means the difference between the total revenue created by the product and the costs of the materials, labor, and other inputs used to produce it, which can then be captured by the actors. Grain collectors collect chickpea from the farming households in three market particular days of the week in Tulu Bolo. Saturday is a major market day for selling and purchasing of chickpea. A number of grain assemblers and few wholesalers from the secondary markets operate in the collection of grain from the smallholder farmers. Kabuli chickpea is the most commercial crop while most of the production of Dessi chickpea is either consumed at home or is sold in the local market for consumption. Both female and male farming households bring the production of chickpea to the local market. The local market in Tutu Bolo town is the most known place for marketing chickpea. Of the three market days, Saturday, in particular, is the day for marketing chickpea to the whole sellers, local collectors, retailers, and consumers.

Depending on the proximity, farming households also bring their produce to the wholesalers who are found in Awash Bune and Asgori. Most dominantly, the farming households use donkey or horse cart as a mode of transport to bring their chickpea produce to the local market. Most chickpea farming households bring their produce to the wholesalers in Tulu Bolo. The wholesalers are locally called [6] "Wofchobet" since they collect and also provide services of

[6] A local name given to a millhouse where crops are grinded and powdered

milling crops. The maximum amount each farming household delivers to wholesalers 60 kg per a time. Female farming households also bring the produce to local collectors, but the amount is mostly 2 to 3 kgs so that they may obtain money to purchase factory products for household consumption. The local collectors then deliver the chickpea produce to the wholesalers. Farming households who are members of cooperatives/unions deliver their produce to the cooperatives/union in Awash Bune, Asgori, and Tulu Bolo. The wholesalers' temporary store chickpea produce and transport to Addis Ababa wholesalers through the facilitation of a number of commission agents whose identities are not as such visible.

The market is characterized by small volumes, high transactions costs, lack of grading and quality control systems, and severe lack of market information, especially for export demand and prices. As a result, Ethiopia is a price-taker vulnerable to over-supply in international markets where the Ethiopian crop has not developed full reputation for quality (Bekele, et al, 2007). Along with the renewed focus on market-led agricultural development and the ongoing effort to increase export of tradable commodities, the better market opportunities and higher prices seem to have increased the attention for Kabuli types. The traditional Dessi varieties are mainly traded locally because international markets prefer larger seeded Kabuli varieties. The average yields are low, but higher than those in the rest of Africa, perhaps due to the good soils and growing conditions for the crop in the highlands of Ethiopia (Shiferaw et al. 2004).

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

The objective of this study was to examine the impact of producing quality chickpea on food insecurity and chickpea crop income of farming households. A descriptive analysis indicated that the explanatory variables such as area of total cultivated land, distance to the nearest market, development agents, sex of the household head, and inputs market information are statistically associated with quality chickpea production at a significant level of 1%, 5% and 10%.

The propensity score matching showed the household income of quality chickpea producers had increased by 6, 979.12 birr per annum after the farming households were matched. The t-test showed that this difference on seven covariates is statistically significant at 2.36 after matching. The P-value of the exogenous variables such as household family size, the sex of the household head and input market information are significant at 10% probability level. The results revealed that the matching used for this study goes in conformity with Robins' B and R robustness test. The farming households who are producing Kabuli chickpea (the quality one) obtain more income than those who produce Dessi chickpea (the non-quality one). The farmers perceive Kabuli chickpea more marketable in terms of quality and farm gate pricing. Dessi chickpea is perceived as the poorer quality and mostly consumed at household level. Chickpea quality production (Kabuli) has a significant role in boosting income obtained from chickpea production and in reducing the severity of food insecurity situation of the farming households in the study areas.

For food insecurity analysis, both ordered logit and logit regression models were used to examine the likelihood ratio of food insecurity for HFIAS and FCS food insecurity analysis techniques. The models were found to good-fit with for the analysis of predicator variables on the food insecurity status of the farming households. In the analysis of HFIAS, variables such as household farmland size, credit/loan of the households, input market information, market distance to the nearest town, and total productivity significantly influenced and determined the probability of the food insecurity in the study areas. The analysis of HFIAS food insecurity techniques indicated that about 143 respondents of the total sampled population were food secured and 62.12% of them accounted for quality chickpea producing farming households.

Likewise, the explanatory variables of the FCS of sampled population were estimated using logit regression model with a goodness-of-fit Pseudo R^2 of 22.98%. The determinant factors of the FCS were credit/loan of the households, total productivity, dominant farming activity, and distance to the nearest market at 5% and 1% significant levels. The results of FCS analysis showed that out of the total quality chickpea producers, only 57.58% were at the level of acceptable food consumption score while the rest were under poor and borderline. On the other hand, more 70.78% of the total non-quality chickpea producers were at acceptable level of food consumption score. There is significant mean food consumption score difference between quality producers and the non-quality producers at 5% level of significance. The analysis indicated that the majority of Dessie Chickpea producers tend to use crop for household consumption. The consumption of chickpea at household level is the other dimensions in which the farming households are being assisted to maintain the food security at household level. The consumption of Dessie chickpea production increases the consumption at household level and improves the household food security status of the farming households.

The quality production of chickpea is a more commercialize crop for generating income for the households, which calls upon the participation in value chain for obtaining foreign exchange at country level. A number of various actors were involved through nine value chain channels. The value chain for the local markets reached to the final consumers in rural towns namely in Tulu Bolo, Qobo and Asgori through the local retailers, wholesalers, cooperatives/farmers unions, and farmers. The consumers, farmers, retailers and wholesalers in Tulu Bolo, Asgori, Awash Bune and Addis Ababa purchase chickpea depending on the financial capacity and purpose of the usage. The major chickpea marketing outlets which link producers with the consumers were identified as rural retailers, *Kebele* and district assemblers, and wholesalers and to the consumers in Tulu Bolo and Asgori towns. The value of the chickpea commodity increases its value as it passes through the channels right away from the farm gate. The market is characterized by small volumes, high transactions costs, lack of grading and quality control systems, and severe lack of market information, especially for export demand and prices.

5.2. Recommendations

Ethiopia is endowed with diverse agro-ecology that permits different farming systems, and crops are major components of the farming systems in the country. Chickpea is one of the multifaceted

crops which grow in Ethiopia for the purpose of household consumption and marketing. Among the top exportable pulses, chickpeas are the top export pulses and contribute to smallholder income, as a higher-value crop than cereals, to diet, as a cost-effective source of protein and to offer natural soil maintenances through nitrogen-fixing. The soil and the temperature in Oromia and Amhara Regional States are favorable for the growth of the crop. Dessie chickpea type predominately grows whereas the high valued crop type Kabuli chickpea is not given much attention due to various factors. If the policy makers, practitioners and institutions give due attentions, the productivity and production of the crop will increase ever before in terms of quality and quantity. The role of the crops would be immense at micro and macro level.

Therefore, the following measures are recommended:

Policy makers at all levels: recognition of small farming households and their contribution to the economic development would contribute to the growth of exportable crop commodity productivity and value chain.

Institutions and Practitioners: Providing the small farming households with access to training, expertise support, credit, market and inputs for cultivation of improved varieties would enhance the productivity and quality of cash crops in particular chickpea.

Institutions: Institutional supports and linkage with the value chain would attract entrepreneurs and exporters, which in turn rewards the small farming households to be motivated and produce more with the required quality of the crop commodity.

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APPENDIX 1 HOUSEHOLD SURVEY QUESTIONNAIRE

Confidentiality and Consent

[Interviewer: Please read the following paragraph to the respondent]

Dear Respondent,

Good morning/good afternoon. Thank you for your interest in talking with me today. I am _____. The purpose of my visit is to ask you some questions related to chickpea production, the food security situation in your household and value chain of chickpea in the *district*.

Your name will not be written on this form, and will never be used in connection with any of the information you tell me. You do not have to answer any of the questions that you do not feel comfortable with, and you may end this talk at any time you want to. However, your honest answers to these questions will help us better understand the situation of the chickpea production, food security condition of people in your household and value chain of chickpea in the *district*. We would greatly appreciate your help in responding to the interview. The interview will take ----- minutes. Would you be willing to participate?

Agree_____ Disagree _____

Thank you in Advance!

Name and Signature of Interviewer:

Name _____ Signature _____Date_____

Supervisor's/Editor's Remark:

_____

Supervisor's/Editor's Name and Signature

_____

Identification number (code) ---------- (to be filled by supervisor)

Name of enumerator: ----------

Sample Kebele: ---------- in Becho *District.*

SECTION I. DEMOGRAPHICAND SOCIOECONOMIC CHARACTERISTICS OF RESPONDENTS (QUESTIONS FOR FARMING HOUSEHOLDS)

1. Age of the household head _____(years)

2. How long have you lived in this village? _____(years)
3. Sex of the household head (respondent) 1 = Male ☐ 2= Female ☐
4. What is the current marital status of the household head?
   1=Currently married ☐ 4=Never married ☐
   2=Widowed ☐ 5=Cohabiting ☐
   3=Divorced ☐
5. What is the family size of your household? (Those who are alive)?

Age	M	F	Total
<15			
15-64			
>64			

6. How many household members of the productive age (15-64) do support for the living of the last 12 months? _____number of people
7. Educational Level of the household head and partner

Education Level	Household Head	Partner
1 = Unable to read and write		
2= Non-formal Education/Adult Education		
3= Formal Education (please indicate the highest grade level you attended)		

8. Yearly income of the household _____ (birr)
9. The sources of yearly income for your household
   1=Crop farming (incl. Gardening) ------ birr 6=Sales of eucalyptus trees---- birr
   2=Livestock production ----------birr 7=Support from relatives/individuals-----birr
   3=Petty trade----------birr 8=Support from organizations----- birr
   4=Daily laborer----------birr 9=Employed in a government/NGOs-----birr
   5=Charcoal and fire wood selling----------birr 10=Others-------- birr
10. Relationship of the Respondent to the Head of the Household
   1= Head ☐ 4= Relative ☐
   2= Spouse ☐ 5= Other (please specify)----------
   3= Child ☐
11. Religion of the respondent
   1= Orthodox ☐ 4= Catholic ☐
   2= Muslim ☐ 5= Waqqefeta ☐
   3= Protestant ☐ 6=Other----------

SECTION II. FARM RESOURCES (QUESTIONS FOR FARMING HOUSEHOLDS)

12. Land type, ownership, size, sloppiness, fertility status

Land Type	Land Size (ha)	Land Ownership (please indicate the ownership with land size number and corresponding size in ha) (1=owned, 2= rented in, 3= rented out, 4= shared in, 5= shared out, 6=others)	Sloppiness of the land (1=plain, 2= Hilly, 3= Steep)	Fertility Status (1=fertile, 2= Moderately fertile, 3= Less fertile, 4=infertile
1=Cultivated Land				

2=forest and wood land				
3=Grazing land				
4=Woodlot				
5=Home compound				
6=Other uses				

13. What is the total size of the land?----------ha
14. What is the size of the irrigated land for cultivation? ----------ha
15. Farm Assets

1=Tractor ----------#
2=Power tiller ----------#
3=Bullock cart ----------#
4=Pump set ----------#
5=Ploughs ----------#
6=Cultivator ----------#
7=Seed drill ----------#
8=Harrow ----------#
9=Sprayer/duster ----------#
10=Sickle ----------#
11=Spade ----------#
12=Others, if any (specify) ----------#

16. The source of Loan/Credit

1=Bank--------(birr)----------Interest	3=Neighbors ------(birr)--------Interest
2=Money lender --------(birr)-------Interest	4= Microfinance ------(birr)--------Interest
5=Any other ------(birr)--------Interest	

17. Number of contacts with agricultural extension agents(DA) per cropping year---------#
18. Number of field days participation for the last 12 months/cropping season----------#
19. Sources of weather variability information accesses ----------

1=TV	3=Agriculture Office
2= Development Agents (DAs)	4= Meteorology
5=Any other	

20. Types of social activities registered and participating (youth club, women association, farmers associations, etc.)----------
21. Crop Production by the household in 2009/2010 cropping year

Types of Crops	Total area cultivated (ha)		Seed types (kg)	fertilizer (kg)	land size (ha)	Amount of Production (kg)	Selling price per kg
	Irrigated	Non-Irrigated					
'Teff'							
Barley							
Wheat							
Maize							
Sorghum							
Chickpea							
Lentil							
Pea							
Faba bean							
Haricot bean							

Vegetables (Kale, Tomato, Carrot, Onion, Potatoes, Green pepper, Pepper chili, Garlic)							
Others (mention)							

22. The possession of the livestock of the household

Types of livestock	Number
Oxen	
Cow	
Heifers	
Horse	
Mule	
Donkey	
Sheep	
Goat	
Poultry	
Beehive	
Others----------	

23. Experience in Agriculture ----------years

24. The most dominant farming activities of the household carrying out for living.

1=Crop production ☐ 2=Livestock Rearing ☐ 3=Mixed Farming ☐

25. Farming Practices (climate smart agricultural practices)

1=Sowing different crops types ☐
2= Shifting to off-farm and non-farm activities ☐
3=Shifting sowing seasons from the regular way ☐
4= Use IYBAR BBM (Broad based Mold) ☐
5=Highly use water and soil conservation structure ☐
6= Use water percolating system ☐
7= Sowing drought resistance crops ☐
8=Use irrigation scheme ☐
9=Use fertilizers ☐
10= Sowing of varieties of crops ☐

26. Weather Variability of the districts based on the perception

Types of weather variability	Trend			
	1= decreasing	2= Increasing	3= no change	4= I do not know
Rainfall				
Temperature				

27. Farming Practices to cope with and adapt the weather change 1 = Male ☐ 2= Female ☐

SECTION III. CHICKPEA PRODUCTION, CONCEPTIOIN AND MARKETING (QUESTIONS FOR FARMING HOUSEHOLDS) (2009/10 EC)

28. Input Costs for the production of chickpea

Types of Costs	**Quantity (kg/liter)**	**Unit Price (birr)**
Seed		

Fertilizer(DAP)		
Bio-Fertilizer		
Pesticides		
herbicides		
Other----------		

29. The source of Market Information Prior to offer for input and sale

Items	Source of Information (1=News Paper, 2=T.V, 3=Radio, 4=ECEX, 5=Officials, 6=Commission agent, 7=Neighbors and friends)
Inputs	
Sale	

30. The quality of chickpea production

1= grade 1 ☐ 2= grade 2 ☐ 3= grade 3 ☐

31. Volume of Chickpea Production

Types of Chickpea	Volume of Production (kg and birr)				
	Total production (ha)	Yield per ha	Selling Price per kg (2010)	Cost of inputs production per ha	Share of sold in %
Kabuli					
Dessie					

32. Chickpea production constraints (circle all possible constraints)

1= Road Inaccessibility/Lack of Transportation	2= Inadequate rainfall/high rainfall variability/irrigation
3= Pests/ Human Pests/crop diseases	4= Unavailability and/or late supply of seed and fertilizer
5= Poor soils/ Low soil fertility	6= Lack/Insufficient of Improved seeds and fertilizers
7= Shortage of draft power/labor	8= Lack of capital to buy seed and/or fertilizer
9= Lack of demonstration and training	10= Lack of knowledge about seed treatment, insect, pest
11= Others (mention)	

33. Credit taken for the production of chickpea

Source	Purpose	Amount (birr)	Interest (%)
Bank			
Money lender			
Credit Association/Microfinance Institutes			
Individual/Neighbors			
Any other----------			

34. The household residential location away from the nearby market place ----------km

35. Mode of Transportation

1= donkey /horse cart ☐ 3= vehicle ☐

2= human carriage ☐ 4= others ----------

36. Marketing Channels of the household for selling chickpea production

Marketing Channels	Kg sold	Farm Gate Price (birr)/kg
1= Producer- Rural Consumer		
2= Producer- Rural Retailer		

3= Producer- Rural assemblers		
4= Producer- District Consumer		
5= Producer-District Whole Seller		
6= Producer-District assemblers		
7= Producer-Commission agent		
8= Producer- Processor		
6=Others (specify)		

37. Reasons for the sale of produce in a particular marketing channel

1=Provide credit facility ☐	6=Spot payment ☐
2=Proximity ☐	7=Remunerative price ☐
3= Less charges for the service ☐	8=Reduction in number of intermediaries ☐
4= Service rendered by them ☐	9= Less physical loss ☐
5=Getting storage and transport facility by them ☐	

38. Chickpea Producing Seasons (Mark ✓)

Types of chickpea	Months	Jan	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Kabuli	Peak												
	Lick												
Dessie	Peak												
	Low												

39. Chickpea Selling Seasons (Mark ✓)

Types of chickpea	Months	Jan	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Kabuli	Peak												
	low												
Dessie	Peak												
	Low												

40. Marketing Costs of Chickpea of the year 2009/10

Types of Chickpea	Production (kg)		Time of Sale	Place of Market	Price per kg
	Home Consumption	Marketed Surplus Quantity			
Kabuli					
Dessie					

Types of Costs	Amount	Unit Price (birr)
Bagging of transportation		
Transportation		
Labor Expenses		
Weighing charges		
Commission Agent's fee		
Sales tax / VAT		
Others (specify)		
Total Cost		

41. The most important constraints (problems) do you face in marketing of chickpeas

Constraints types	Rank
1=High marketing cost	
2=Nonpayment/ untimely payment	
3=Defective and faulty weighting	
4=Low price for the produce at the time of harvest	
5=Lack of transportation	
6=Lack of adequate storage facilities	
7=Lack of adequate processing units	

SECTION IV. HOUSEHOLD FOOD IN/SECURITY ACCESS SCALE (HFIAS) MEASUREMENT TOOL

NO	QUESTION	RESPONSE OPTIONS
1	In the past four weeks, did you worry that your household would not have enough food?	1= Yes 2 = No
1a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
2	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	1= Yes 2 = No
2a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	1= Yes 2 = No
3a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	1= Yes 2 = No
4a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not	1= Yes 2 = No

	enough food?	
5a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	1= Yes 2 = No
6a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	1= Yes 2 = No
7a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	1= Yes 2 = No
8a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	1= Yes 2 = No
9a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)

SECTION V. FOOD CONSUMPTION SCORE /DATA (FCS)

I would like to ask you about all the different foods that your household members have eaten in the **last 7 days**. Could you please tell me **how many days** in the past week your household has eaten the following foods? (For each food, ask what the primary source of each food item eaten that week was, as well as the second main source of food, if any)

Food item	DAYS eaten in past week (0-7 days)	Sources of food (see Food item codes below)	
		Primary	Secondary
#.1 – Maize			
#.2 – Rice			
#.3 – Bread/wheat			
#.4 – Tubers			

#.5 – Groundnuts and Pulses			
#.6 – Fish (eaten as a main food)			
#.7 – Fish powder (used for flavor only)			
#.8 – Red meat (sheep/goat/beef)			
#.9 – White meat (poultry)			
#.10 – Vegetable oil, fats			
#.11 – Eggs			
#.12 – Milk and dairy products (main food)			
#.13 – Milk in tea in small amounts			
#.14 – Vegetables (including leaves)			
#.15 – Fruits			
#.16 – Sweets, sugar			

Food Score Codes

Purchase =1	Own production =2	Traded goods/services, barter =3	Borrowed = 4
Received as gift= 5	Food aid =6	Other (specify) =7	

Thank you!

APPENDIX 2 INTERVIEW QUESTIONS

Confidentiality and Consent

[Interviewer: Please read the following paragraph to the respondent]

Dear Respondent,

Good morning/good afternoon. Thank you for your interest in talking with me today. I am _____. The purpose of my visit is to ask you some questions related to chickpea production and value chain of chickpea in the district, ----------,----------,----------.

Your name will not be written on this form, and will never be used in connection with any of the information you tell me. You do not have to answer any of the questions that you do not feel comfortable with, and you may end this talk at any time you want to. However, your honest answers to these questions will help us better understand the situation of the chickpea production and value chain of chickpea in the *district,* ----------, ----------, ----------. We would greatly appreciate your help in responding to the interview. The interview will take ----- minutes. Would you be willing to participate?

Agree_____ Disagree _____

Thank you in Advance!

Name and Signature of Interviewer:

Name _____ Signature _____Date_____

Supervisor's/Editor's Remark:

_____

_____

_____

Supervisor's/Editor's Name and Signature

_____

Identification number (code) ---------- (to be filled by supervisor)

Types of Actor (circle)

1=Rural Assembler	2=Rural Retailer
3=Rural Consumer	4=Tertiary Processor
5=Commission agent	6=Whole retailer
7=Whole seller	8=Union/Cooperative
9=Supermarkets	10=Grain Exporter

11= Others (specify)----------

Address ----------

Type of processing (specify) ----------

Years involved in the market or processing----------

Sample----------

Interview Questions

1. Age of the trader _____ (years)
2. Sex of the Trader 1 = Male ☐ 2= Female ☐
3. Educational Level of the trader
   1=Unable to read and write ☐
   2=Non-formal Education/Adult education ☐
   3=Formal Education (indicate the highest grade level you attended)----------
4. Year of experiences in chickpea trading----------(years)
5. Source of Market Information

Items	Source of Information (1=News Paper, 2=T.V, 3=Radio, 4=ECEX, 5=Officials, 6=Commission agent, 7=Neighbors and friends)

Inputs	
Sale	

6. Marketing margins for the various *chickpea* traders

Volume and Costs	Types of chickpea	
	Kabuli	Dessie
Volume (kg) of Purchased Chickpea in 2009/2010		
Purchasing Unit Price (birr)		
Volume (kg) of Traded in 2009/2010		
Selling Unit Price (birr)		
Packing Cost (birr)		
Transportation Cost (birr)		
Loading and Unloading cost (birr)		
Storage Cost (birr)		
Commission agent charges (%)		
License fee (birr)		
Weighing Charges (birr/Qtl)		
Other costs (specify)----------		

7. Trading/Transaction Season of the traders

Months	Types of Chickpea (Put a ✓)		Season of trading/transaction (Put a ✓)			
	Kabuli	Dessie	Purchasing		Selling	
			Peak	Low	Peak	Low
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						

8. Determinants of chickpea Prices

1= Education of the trader ☐ 2= Experiences on grade trading ☐
3= Access to information ☐ 4= Transaction frequency ☐
5= Quality ☐ 6= Time of sale ☐
7= Time of purchase ☐ 8= the selling prices of chickpea ☐
9= Access to transportation ☐ 10= Access to market ☐
11= others (mention)----------

9. Weakness/constraints of traders in chickpea marketing (Kabuli and Dessie)

1= Unreliable/shortage supply ☐ 2= Shortage of operating capital ☐

3= Lack of market information ☐ 4= Price instability ☐
5= Low product quality ☐ 6= Time of sale ☐
7= others (mention)----------

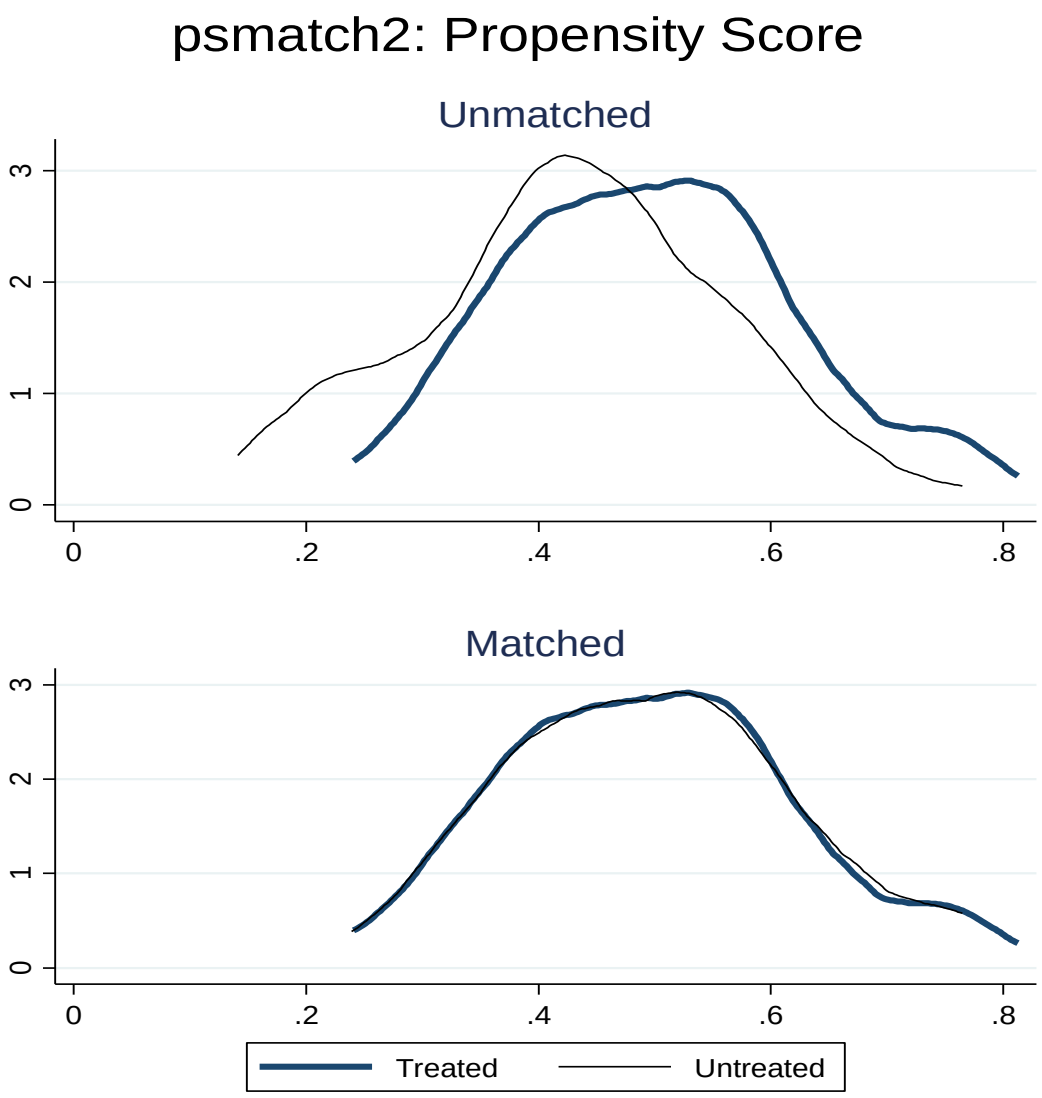
10. How much the price varies for different quality grain (birr/Qtl)?

1=Best quality (Grade A) _____birr/Qtl	2= Medium quality (Grade B) _____ birr/Qtl
3=Poor quality (Grade C) _____ birr/Qtl	

11. Suggestions for improving value chain of chickpea

Thank you for taking time with me and responding

APPENDIX 3 KERNEL DENSITY ESTIMATE PSM MODEL



APPENDIX 4 ROBUST AND MODEL GOOF FIT OF PSM

```
. psmatch2 chickpee HHage HHfamilysize TLU HHsex AgricultExperienceyr FarmersTraining depe
> ndencyratio InputMarketInfo , outcome( HHyrIncome )

Probit regression                                 Number of obs   =        286
                                                  LR chi2(8)      =      20.34
                                                  Prob > chi2     =     0.0091
Log likelihood = -187.22476                       Pseudo R2       =     0.0515
```

chickpee	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHage	.0066866	.0088606	0.75	0.450	-.0106799	.024053
HHfamilysize	-.0894541	.0300609	-2.98	0.003	-.1483723	-.0305359
TLU	.0152543	.0259999	0.59	0.557	-.0357046	.0662132
HHsex	-.4859338	.2162015	-2.25	0.025	-.9096809	-.0621866
AgricultExperienceyr	-.0043509	.0083903	-0.52	0.604	-.0207956	.0120937
FarmersTraining	-.0830043	.0991021	-0.84	0.402	-.2772408	.1112322
dependencyratio	.2503049	.3850776	0.65	0.516	-.5044334	1.005043
InputMarketInfo	-.4451579	.2823351	-1.58	0.115	-.9985246	.1082088
_cons	.9076819	.8109295	1.12	0.263	-.6817108	2.497075

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HHyrIncome	Unmatched	37516.3182	34640.0649	2876.25325	2472.01519	1.16
	ATT	37516.3182	30537.197	6979.12121	2959.01261	2.36

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	154	154
Treated	132	132
Total	286	286

. pstest,graph both

Variable	Unmatched / Matched	Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|	V(T)/ V(C)
HHage	U	46.788	47.403	-5.1		-0.43	0.670	0.97
	M	46.788	47.227	-3.6	28.5	-0.27	0.784	0.75
HHsex	U	1.1136	1.2143	-27.3		-2.28	0.023	0.60*
	M	1.1136	1.1136	0.0	100.0	0.00	1.000	1.00
HHfamilysize	U	6.5985	7.5974	-36.1		-3.04	0.003	0.94
	M	6.5985	6.197	14.5	59.8	1.18	0.240	0.94
FarmersTraining	U	1.1061	1.1948	-11.4		-0.97	0.332	1.35
	M	1.1061	1.1212	-2.0	82.9	-0.16	0.870	1.56*
TLU	U	26.022	26.089	-2.1		-0.18	0.859	0.73
	M	26.022	25.976	1.5	31.2	0.11	0.912	0.59*
HHloanamount	U	2051.5	2808.7	-23.5		-1.97	0.049	0.77
	M	2051.5	2051.5	0.0	100.0	0.00	1.000	1.02
AgricultExperienceyr	U	27.341	28.338	-8.0		-0.67	0.504	0.82
	M	27.341	27.947	-4.8	39.2	-0.37	0.712	0.66*
DomiFaAc	U	1.5758	1.9286	-30.0		-2.56	0.011	1.71*
	M	1.5758	1.7576	-15.5	48.5	-1.27	0.204	1.84*
SaleMarketInfo	U	.87121	.96753	-35.8		-3.09	0.002	.
	M	.87121	.88636	-5.6	84.3	-0.38	0.707	.
dependencyratio	U	.42923	.4094	9.2		0.78	0.438	1.08
	M	.42923	.44118	-5.5	39.8	-0.46	0.644	1.22

* if variance ratio outside [0.71; 1.41] for U and [0.71; 1.41] for M

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.082	32.28	0.000	18.9	17.5	68.5*	1.09	22
Matched	0.011	3.97	0.949	5.3	4.2	24.6	0.80	44

* if B>25%, R outside [0.5; 2]

. pstest _pscore, density both

. psgraph

APPENDIX 5 OLS ESTIMATE RESULT MULTICOLLINEARITY TEST VIF

Source	SS	df	MS
Model	2.6520e+10	19	1.3958e+09
Residual	9.7420e+10	266	366242200
Total	1.2394e+11	285	434880243

Number of obs	286
F(19, 266)	3.81
Prob > F	0.0000
R-squared	0.2140
Adj R-squared	0.1578
Root MSE	19137

HHyrIncome	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
chickpee	5338.589	2482.502	2.15	0.032	450.7347	10226.44
HHage	-71.43702	134.7103	-0.53	0.596	-336.6711	193.797
HHsex	-1066.507	3462.636	-0.31	0.758	-7884.168	5751.153
HHMaritalS	2904.828	1503.656	1.93	0.054	-55.75511	5865.411
HHfamilysize	1299.204	476.7674	2.73	0.007	360.4865	2237.922
HHformaleduc	291.7416	343.3616	0.85	0.396	-384.3108	967.794
HHfarmlandsize	793.6028	1028.879	0.77	0.441	-1232.18	2819.385
HHloanamount	.0481263	.365843	0.13	0.895	-.6721901	.7684426
DAcontact	-21.79069	479.4207	-0.05	0.964	-965.7328	922.1514
FarmersTraining	2578.473	1618.615	1.59	0.112	-608.4545	5765.4
AgricultExperienceyr	-29.50513	127.0426	-0.23	0.817	-279.6421	220.6319
DomiFaAc	2153.268	1050.12	2.05	0.041	85.66356	4220.873
InputMarketInfo	-4034.426	8853.461	-0.46	0.649	-21466.2	13397.35
SaleMarketInfo	3953.603	9454.438	0.42	0.676	-14661.45	22568.66
MarketDistance	687.2882	406.6725	1.69	0.092	-113.4184	1487.995
ModeofTransport	2742.56	1830.338	1.50	0.135	-861.2342	6346.354
dependencyratio	-10882.55	5913.415	-1.84	0.067	-22525.6	760.5051
totalProductivity	1.184136	1.34543	0.88	0.380	-1.464912	3.833184
TLU	1244.974	438.4351	2.84	0.005	381.729	2108.218
_cons	-21477.87	13024.48	-1.65	0.100	-47122.07	4166.328

APPENDIX 6 MULTICOLLINEARITY TEST VIF

```
. vif
```

Variable	VIF	1/VIF
SaleMarket~o	4.96	0.201761
InputMarke~o	4.88	0.204799
HHage	2.08	0.481353
AgricultEx~r	1.98	0.504816
HHfarmland~e	1.57	0.638177
DAcontact	1.52	0.659948
TLU	1.51	0.664445
MarketDist~e	1.50	0.665851
HHfamilysize	1.40	0.716837
HHformaleduc	1.37	0.729650
ModeofTran~t	1.33	0.752001
HHsex	1.31	0.764720
dependency~o	1.26	0.794717
HHMaritalS	1.22	0.820984
FarmersTra~g	1.21	0.826042
chickpee	1.20	0.836104
DomiFaAc	1.18	0.844427
HHloanamount	1.10	0.908662
totalProdu~y	1.08	0.922386
Mean VIF	1.77	

APPENDIX 7 CONVERSION FACTORS TO ESTIMATE TLU

Livestock Categories	**TLU**
Oxen	1
Cow	0.8
Heifer	0.5
Horses	0.8
Mule	0.5
Donkey	0.5
Sheep/Goat	0.1
Poultry	0.01

Source: Njuki, et al. (2011)

APPENDIX 8 DEPENDENCY RATIO

Dependency ratio is a ratio of total household size divided by the number of individuals working to support the household. It is an age-population ratio of those typically not in the labor force (i.e. the dependent part age 0-14 and 65+) divided by the labor force (i.e. the productive part ages between 15 and 64).

APPENDIX 9 SAMPLING SIZE DETERMINATION TABLE OF YAMANE (1967)

Table 1. Sample Size for ±3%, ±5%, ±7%, and ±10% Precision Levels where Confidence Level Is 95% and P=.5.

Size of Population	Sample Size (n) for Precision (e) of:			
	±3%	±5%	±7%	±10%
500	a	222	145	83
600	a	240	152	86
700	a	255	158	88
800	a	267	163	89
900	a	277	166	90
1,000	a	286	169	91
2,000	714	333	185	95
3,000	811	353	191	97
4,000	870	364	194	98
5,000	909	370	196	98
6,000	938	375	197	98
7,000	959	378	198	99
8,000	976	381	199	99
9,000	989	383	200	99
10,000	1,000	385	200	99
15,000	1,034	390	201	99
20,000	1,053	392	204	100
25,000	1,064	394	204	100
50,000	1,087	397	204	100
100,000	1,099	398	204	100
>100,000	1,111	400	204	100

a = Assumption of normal population is poor (Yamane, 1967). The entire population should be sampled.

Source: Yamane. (1967)