2019-01-02

SOCIO-ECONOMIC DETERMINANTS OF DIRECT HYBRID MAIZE SEED DEMAND AND MARKETING SYSTEM PERFORMANCE IN MECHA WORDA, ETHIOPIA

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Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Agriculture in Agricultural Economics

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SEPTEMBER, 2018

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As member of the Board of Examiners of the Master of Sciences (M.Sc.) thesis open defense examination, we have read and evaluated this thesis prepared by Mr. **Mushira Sisay** entitled **"Socio-Economic Determinants of Direct Hybrid Maize Seed Demand and Marketing System Performance in Mecha *Woreda,* Ethiopia**". We hereby certify that, the thesis is accepted for fulfilling the requirements for the award of the degree of Master of Sciences (M.Sc.) in Agriculture (Agricultural Economics).

Board of Examiners

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Name of Internal Examiner Signature Date

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Name of Chair man Signature Date

DECLARATION

This is to certify that thesis entitled "**SOCIO-ECONOMIC DETERMINANTS OF DIRECT HYBRID MAIZE SEED DEMAND AND MARKETING SYSTEM PERFORMANCE IN MECHA *WOREDA*, ETHIOPIA**" submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in "Agricultural Economics" to the Graduate Program of College of Agriculture and Environmental Sciences, Bahir Dar University by Ms. **Mushira Sisay** (ID. No. 0906106) is an authentic work carried out by her under our guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

Name: Mushira Sisay

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Signature and date _____.

2) _____ (Co-Advisor)

Signature and date _____.

DEDICATION

This thesis is dedicated to the memory of my lovely mother, Zufan Gezahegn. I love my mom.

BIBLIOGRAPHIC SKETCH

The Author was born in June 2/1977 in Amhara Region North Wollo, Raya Kobo District. After she completed her elementary and secondary school at Kobo Comprehensive senior secondary school, she joined to be elementary school teacher at Dessie Teachers Learning Institute. After her graduation, she started teaching in North Wollo Zone Lalibela district Enjafat Elementary School. After serving several years, she joined Distance Education in St. Marry University College, and Graduated in Natural Science with diploma in 2008.

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ACKNOWLEDGMENT

First and for most, I would like to give my glory and praise to the Almighty GOD for his invaluable cares and supports throughout the course of my life and helped me since the inception of my education to its completion.

Next, I would like to express my special and heartfelt gratitude to my major advisor, Dr. Zemen Ayalew, for his unlimited and unreserved support to make this thesis work successful. His inspiration and brotherly encouragement was critical for this output. His willingness to share knowledge and materials and his way of advice to produce competent citizen will never be forgotten.

My special thanks also goes to my Co-advisor, Dr. Zewdu Birhanie for his helpful and constructive comments during the research work. I thank you for my classmate colleagues, Mohamed Adem, Mohamed Amza, Howlet Mohammed, Dagnnet Asrat, Mezigebu Ayinalem, Girma Markos, and Melese Zeleke for the advising, encouraging and giving comments.

I am extremely thankful to my family/my lovely husband Mr. Mengesha Fentaw, for his encouragement, guidance, assistance and helpful comments in writing the research proposal and the thesis. And to give similar appreciation and thanks to my children Dawit Mengesha, Tsion Mengesha and Abrham Mengesha for their encouragement and support in all rounded issues.

Moreover, I extremely thankful to my brothers Mr. Daniel Nigatu, and Mr. Temesgen Sisay for their great assistance, encouragement, comment and helpful guidance in writing the research proposal and thesis.

Finally my special gratitude goes to all those who assisted me during the research study by providing information, advise and facilities.

ACRONYMS / ABBREVIATIONS

ADLI	Agricultural Development Lead Industrialization
ANRS	Amhara National Regional State
ASE	Amhara Seed Enterprise
ATA	Agricultural Transformation Agency
BOA	Bureau of Agriculture
CGIAR	Consecutive group of International Agricultural Research
CIMMYT	Centro International de Majora Miento de Maize Y Trigo (International Maize and Wheat Improvement center).
CSA	Central Statistical Agency
DE	Design Effect
DSM	Direct Seed Marketing
EIAR	Ethiopia Institute of Agricultural Research
ESE	Ethiopia Seed Enterprise
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
HA	Hectare
HLI	Higher Learning Institute
IFPRI	International Food Policy Related Institute
ISSD	Integrated Seed Sector Development
LSB	Local Seed Business
ME	Marginal Error
MOANR	Ministry of Agriculture and Natural Resource
NGO	Non-Governmental Organization
NMM	Net Marketing Margin
OLS	Ordinary Least Square
PRA	Participatory Rural Appraisal
RARI	Regional Agricultural Research Institute
RSE	Relative Standard Error
SNNP	Southern Nations, Nationalities and Peoples
SPC	Seed Producer Cooperative

TGMM Total Gross Marketing Margin

WARDO *Woreda* Agriculture and Rural Development Office

WCA West and Central Africa

TABLE OF CONTENT

Contents page

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES IN APPENDEX

ABSTRACT

Ethiopia is mainly an agrarian country with the huge majority of the people directly and indirectly depending on agriculture and hence, agriculture plays an essential role. For agricultural sector development, seed is a basic and vital element to increase production and productivity using other complementary inputs and modern systems. This study is intended to analyze determinants of direct hybrid maize seed demand and system performance in the study area and to explain the problems of farmers in relation to the quantity of seed purchased the system in Mecha Woreda, ANRS. Two stages sampling technique was used in sampling procedures and followed to select 150 respondents. Semi structured interview schedule and questionnaires were used for collecting the essential quantitative and qualitative data from the sampled respondents and seed suppliers respectively. To address the objective of the study, descriptive statistics and econometric models were employed. Multiple Linear Regression models were employed to analyze the determinant factors affecting the quantity of seed purchased. Among the different variables hypothesized to determine the quantity of seed purchased, seven variables had statically significant effect to the quantity of seed purchased. These are: household head age, educational level of the household head, extension contact, landholding size, distance from the distribution store, seed cost and quantity of fertilizer. From the survey result direct seed marketing system shortened the seed chain, avoid the seed bureaucratic distribution. The system avoids seed leftover, supply quality seed on time with affordable price and with accountability and traceability level (in seed quality problems). It is recommended that, the existing extension service should be strengthened in a way that working in agreement with relevant actors to bring about change for efficient and effective delivery of agricultural inputs/improved seed and fertilizer. As to the enabling policy environment, the government should also consider a maize pricing policy and access to market policies and should subsidize the seed producers in different ways.

Key words: Direct seed marketing system, Hybrid maize seed, multiple linear regression two stage sampling

1. INTRODUCTION

1.1. Background of the Study

Ethiopian economy is largely dependent on agricultural sector as the country generates the lion share of its foreign currency earnings from the sales/export of agricultural commodities. The agricultural sector contributes 42% to the GDP and represents 90% of the total export earnings of the country. 84 % of the country's population engaged in various agricultural activities and fulfill their household consumption to sustain livelihood (CSA 2016). It is the main source of capital to be accumulated for the process of establishing the future industrialized Ethiopia, which again shows the determinant role played by the sector to bring about sustainable economic development in the country. So, the development of the agricultural economy in Ethiopia facilitates the rapid growth of production and then this productivity continues to use different agricultural inputs. Poverty reduction is the overriding goal of development and the primary challenge facing the development community today (Dawit Tsegaye.et al, 2017).

Increasing agricultural productivity and thus production using improved agricultural technologies has been recognized as a precondition for achieving food security. Out of the total grain crop production, Cereals contributed 86.68% (about 231,287,970.83 quintals) of the grain production. The productivity of Maize, *teff*, wheat and sorghum made up 26.80% (71,508,354.11 quintals), 16.76% (44,713,786.91 quintals), 15.81% (42,192,572.23 quintals) and 16.20% (43,232,997.52 quintals) respectively (CSA, 2015).

In Ethiopia, there are four focus crops, and these are maize, wheat, *teff* and sorghum. Similarly there are 60 registered seed companies producing seed on behalf of other seed producing companies (enterprise), on contractual basis(Guush Tesfamariam,2014).Many companies met the criteria of producing and marketing seed for the four focus crops. The market share of the top four public seed companies with four focus crops (maize, wheat, teff and sorghum) is significant. For maize, the top four companies produce 81% of the seed, while the remaining 14 companies account for 19% of market share. For wheat, the top four companies produce 97% of the seed, while the remaining four companies account for only 3%. For teff, the top four companies

produce 95% of the seed, while the remaining five companies account for only 5 % (Emana *et al*, 2017).

As compared to other cereal crops, Maize is the major and most productive crop in Ethiopia. In 2016, maize production coverage area was 2,135,571.85 hectares with total production of 78,471,746.57 quintals. The majority of Ethiopian farmers grow maize, mostly for household consumption, with 75 % of all maize produced being consumed by the farming household. From 2015/16 to 2016/17 production year, the productivity was increased from 33.89 qu/ha to 36.75 qu/ha (CSA, 2016). The demand for improved technologies, including improved seed and fertilizer, has increased in Ethiopia. This demand for improved technologies comes from smallholders, producer organizations, and private companies (Ali Tegegne *et al*, 2017). On the other hand, estimates indicate that the current maize yield could be doubled if farmers adopt higher quality inputs and familiar agronomic practices (Mesfin Astatikie *et al*, 2012).

In similar way, Maize is an important crop for food security in Ethiopia; CSA data shows that 80% of the maize produced by smallholders is used for household consumption, 10% for sale and the remaining 10% for seed and other purposes (CSA, 2017). Furthermore, maize has the lowest cost per calorie among all major cereals, about 'one-and-a-half and two times lower than wheat and *teff*, respectively. It is also a cheaper source of protein relative to other cereals; 'maize provides 0.2 kg of protein per USD, compared to 0.1 kg of protein per USD from *teff* and 0.2 kg of protein from wheat and sorghum. As the result of the above data the crop is the most preferable and marketable supply type (Solomon Abie, 2011).

When we look into the accessible seed supply system in the country, MoARD employs a bottom-up demand assessment, whereby the regional BoARDs (regional state experts) develop annual seed demand statistics with input from *woredas*, development agents (DAs), and individual farmers about their seed requirements. At the end of the cycle, the government distributes supply proportionally through the cooperatives based on the original demand, without considering shifts in demand due to changes in rainfall pattern and market situation (ATA, 2017). As a result many years, seed supply is well under demand, because of either disparity in the original estimates or supply bottlenecks. This shortage of supply has created incentives for actors to blow up their demand and for black market sales (Dawit Alemu, 2010).

The use of good quality seed of adopted and improved varieties is broadly recognized as fundamental to ensure increased crop production and productivity. The potential benefits from the distribution of good quality seed of improved varieties are massive. And then the availability of quality seed of wide range of varieties and crops to the farmers is the key to get food security in Ethiopia. Improved productivity, higher harvest index, reduced risks from pest and disease pressure, and higher incomes are some of the direct payback potentially accrued to the farmers (Michaele Gebreselassie, 2013).

Thus, the Ethiopian seed distribution and marketing system is mainly centralized. Based on their demand planning process, the Ministry of Agriculture and Natural Resource (MoANR) orients Ethiopian Seed Enterprise (ESE) on the type and quantity of seed to be supplied to cooperative unions, which access the seed to the primary cooperatives and farmers functioning under them (Dawit Alemu and Tripp, 2010). The supply of adequate and quality seeds to a large number of farmers has an essential contribution on the agriculture for food security and economic development of the country. This in turn resides in the involvement of many parties in the seed sector as well as collaborative partnerships and innovations, hotbed policies and institutions based on a shared knowledge and experience to that the seed business is fostered to attain sound supply chain management attributing to active seed marketing (Guush Tesfamariam, 2014).

The approaches and procedures of seed demand assessment in Ethiopia are guided by the overall seed system prevailing in the country along with the key factors involved in the system. The demand for the seeds of the different crop varieties is currently assessed following bottom up approach starting from *kebele* to national level (ATA, 2017). Practically the key factors that determine the demand are related with farmers acquaintance to the varieties, the expected performance of the varieties under the prevailing production conditions (Agro-ecology, whether condition, soil fertility, the expected market conditions for the crop, the level of awareness of the farmers about the varieties, and farmers' ability to access the seed. (BOA, 2017 unpublished).

In order to empower the seed marketing systems in Amhara region, the implementation level of hybrid maize seed marketing system faced different obstacles. This research is conducted to show the challenges on direct hybrid maize seed demand and marketing system performance and

propose appropriate solutions for the identified challenges. However, in the implementation stage, the marketing system has not been researched and documented.

1.2. Statement of the Problem

Agricultural sector is mostly characterized by small-scale subsistence farming and low productivity. This low productivity is partially due to limited use of improved crop varieties. So the availability and use of improved seed varieties play an important role in this effort (ISSD,2012).However increased production of agricultural crops depends not only on the development of higher yielding varieties of seeds, but also on the efficiency of the seed systems available to ensure that these seeds reach the farmer on time and affordable price. Effective seed marketing is thus an essential component of activities to improve food security, and increase productivity. Particularly access to and use of seeds is significant factors for the ability of smallholder farmers to increase agricultural production and productivity, ensuring food security and improving livelihoods (FAO, 2016).

Supplying high quality and improved seed is preferred by farmers. Supplying the seed in sufficient quantities, in a timely manner, to accessible locations, and at affordable prices is a national development objective pursued by the Ethiopian government to secure food supply for the nation (Abebe Atlaw, 2010). However, there is a substantial gap between the production of seeds and farmers' demand for, knowledge of, access to, and usage of seeds (Shimelis Altaye, 2015). Most farmers in Ethiopia have very limited access to high quality and improved seed in convenient environment. And many released varieties of different crops with superior traits have not still been widely disseminated. For this and other reasons the formal seed distribution systems would not satisfy the household farmers demand at the national level (ATA, 2017).

According to Awotide and Tontsa (2011), the key to the availability of the seed will be the profitability and riskless of seed production relative to alternative uses of farmers' limited land and labor resources. The demand for the seeds of the different crop varieties is currently assessed following bottom up approach starting from kebele to national level. Nevertheless, the demand assessment is not linked with promotion of new potential varieties and new demand creation. This has created a situation where farmers express demand only to those varieties that they now before, than those released recently with superior performance (Dawit Tsegaye *et al*, 2017).

While demand is assessed, at grassroots level farmers need is expressed in terms of the type, quantity, quality, and time of delivery of the seeds of different crop varieties in relationship to their respective prices. This is among the critical and unsolved problems of hybrid maize product and productivity in the regional level (Mesfin Astatikie *et al*, 2012).

Seed quality deterioration, including adulteration and weight reduction in route is common and frequently visible facts. This is further motivated by use of multipurpose storage by cooperative unions and lack of appropriate storage facilities by primary cooperatives, especially when there is a carry-over of the seed. In addition, seed quality deterioration will also come up during transporting from one place to another (BOA, 2017 Unpublished)**.**Thus, to analyze the hybrid maize seed demand determinants and distribution system through participants with the seed marketing system, this research was to solve the demand determinants of household farmers for the seed marketing system in Mecha *Woreda*. Furthermore, to solve the challenges of farmers to purchase their demanded variety, hypothesizing the formulation of better strategies and to develop a well-organized farmer- based seed marketing system in Amhara region.

1.3. Research Objectives

1.3.1. General Objective

The general objective of this study is to explore the socio-economic determinants of the demand for hybrid maize seed and assess the marketing system performance in Mecha *Woreda*.

1.3.2. Specific Objectives

- To identify the determinant of the factors affecting the demand for hybrid maize seed
- To examine the performance of direct hybrid maize seed marketing system.
- To analyze the challenges of direct hybrid maize seed marketing.

1.4. Research Questions

The study addressed the following basic questions

- What are the determinants that affect the quantity of hybrid maize seed purchase by farmers?
- What is the performance of direct hybrid maize seed marketing?
- What are the challenges of farmers to use hybrid maize seed marketing systems?

1.5. Significance of the Study

This study is intended to explore the demand determinants and the performance of direct seed marketing in the context of hybrid maize. Similarly, the study is important to seed producers and all actors in the seed marketing systems and to overcome the income of seed producers, processors, suppliers and consumers. The need to find alternative ways to deliver quality seed in a cost-effective way, particularly for small scale farmers who have limited access to formal sources of improved hybrid maize seed requires empirically justified alternative approach. The system will increase access to quality improved seed at the right time, right place and at reasonable (affordable) price.

The finding of this study was contributed how the system is effective, efficient and affordable time and price to address the small holder farmers. The information generated from the study was helpful for public and private seed enterprise, for government organizations, policy makers, universities research centers. This research may be used as additional resources for further researchers in the study type and area. So, it is vital to explore how such system is operating and identifying the factors and demand determinants of seed marketing and their performance in Mecha *Woreda*. Therefore, this study intended to fill the gaps of household farmers' seed demand and the seed marketing system performance in the study area.

1.6. Scope and limitation of the study

The study is limited to Mecha *woreda* farmers who purchase hybrid maize seed in using direct seed marketing systems for hybrid maize production purpose. The study concentrates on maize production area coverage and with the sampled respondent household farmers involved in the survey and interviewed. Even though farmers in the study areas produce a variety of crops

ranging from annual to perennial, food and cash crops the study target crop is hybrid maize, which takes first rank in area and productivity among cereals.

1.7. Organization of the thesis

The thesis constitutes five major chapters. The second chapter presents review of literature on seed, seed systems, seed production facility in Ethiopia, seed market and empirical study from different sources. Brief description of the study area and methodologies are presented in chapter three. In chapter four, both descriptive and econometric results are presented and discussed in detail. Chapter five concludes (summarizes) the main findings of the study and draws conclusions with relevant to appropriate recommendations.

2. LITERATURE REVIEW

In this chapter, the relevant theoretical and empirical studies are reviewed and presented in detail. It is intended to give insights on definition and concept of seed marketing system, seed system and recent empirical findings on seed marketing.

2.1. Basic Definition and Concepts

2.1.1. Seed

Seed is a vital input in crop production and also an important source of all food and agricultural production. It is a genetic resource that carries plant genetic diversity which is vital for breeding and crop improvement. It is also a valuable asset not only for farmers but for the global society as a whole due to interdependence on genetic resources. It is the basic unit for distribution and maintenance of plant population. The use of good quality seed of adopted and improved varieties is widely recognized as fundamental to ensure increased crop production and productivity. The economic benefits from the improved quality seed production helps scaling up the livelihood standard as well as nutritional status of the common people (Dan and Lilian, 2016).

According to Abebe Atlaw (2010), it is a key input for improving crop production and productivity. Increasing the quality of seeds can increase the yield potential of the crop by significant folds and thus, is one of the most economical and efficient inputs to agricultural development. Generation and transfer of new technologies are critical prerequisites for agricultural development. It contributes a fundamental role on the development of seed production and distribution. Supplying high quality seed of improved verities in sufficient quantities, a timely manner and at affordable prices is a national development objective accepted by the Ethiopian government to secure food supply for the people.

Seeds are the most fundamental necessity for farming. Investing on improved, higher quality and higher yielding seeds can be a primary strategy for raising productivity on many Ethiopian smallholder farms. For this purpose, many Ethiopian farmers use improved variety seeds. Ethiopian seed enterprise is the only public seed enterprise responsible for production of seeds for all crops; its seed production is dominated by cereals especially maize and wheat. The seed

enterprise produces improved seed based on the official demand prediction of regional bureau of agriculture (ATA, 2014 cited Eleni Bisrat, 2014).

There was an imbalance between the demand and supply of improved seed. The supply of maize, wheat and *teff* seeds has improved considerably over the last years. But still, only 20% of the area cultivated with maize, 4% of the wheat area and less than 1% of the *teff* area are cultivated with seed from the formal sector. Accessing quality seed of improved varieties on time with sufficient quantity and long channels are the major problems in the development of agricultural product and productivity in Ethiopia. Similarly improving new high yielding and hybrid varieties requires increasing seed production and expanding distribution through increased competition in the seed systems (CSA, 2012 cited Christine Husman, 2016).

2.1.2. Seed system

A seed system is an organized arrangement of the procedures, rules and regulations to ensure sufficient seed supply to farming communities. The systems are composed of set of dynamic interaction between seed supply and demand, resulting in farm level utilization of seed and thus plant genetic resource. The seed system is essentially the economic and social mechanism by which farmers' demand for seed and various traits they provide met by various possible sources of supply. It refers to the full set of activities and stakeholders involved in effectively developing, producing, and distributing seed to smallholder farmers (FAO, 2004 cited Gezahegn Walelign 2008).

According to Abebe Atlaw and Lijalem Kirub (2010) the Ethiopian seed policy was first formulated in 1992, and serves as the basis for different laws and regulations. This seed policy focused on plant genetic resource conservation, crop variety development, testing and release, seed production and supply, seed import and export, and reserve seed stocking. Various activities have been undertaken to enforce the implementation of the policy. Despite the existence of a seed policy, seed law and seed standards, their implementation is still mostly at the infant stage. Access to quality inputs (improved seed and planting material, fertilizer and pesticides) through multiple outlets is essential for farmers to increase production and productivity in a sustainable manner. Thus, the seed program envisions contributing to the improvement of farmers'

livelihoods through innovative, sustainable, and market-led seed production and supply systems (ISSD, 2012).

Ethiopia's seed system has experienced incredible growth in the past five years. Farmers are more willing to invest in and adopt certified seeds. This is a result of large-scale popularization and awareness campaigns conducted through the collaboration of MoA, EIAR, BoAs and international partners such as Sasakawa Global, CIMMYT, and others. In response, more seed producers have emerged and increased seed supply significantly. Going forward, though, it will be necessary to reinforce the effectiveness and sustainability of existing stakeholders and create enabling environments for the entry of others, ultimately so that more farmers use the most appropriate certified seeds and have access to more choices (ATA, 2017).

The term seed system represents the entire complex organization, individual and institution associated with the development, multiplication, processing, storage, distribution and marketing of seed in any country. The seed system includes traditional (informal or local) system and the nontraditional (formal or commercial) systems (FAO, 2006). Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also a significant component of the seed system of any country. Currently, the seed system in Ethiopia can be classified into two broad sectors, the formal and the informal systems (Michaele Gebreselassie, 2013).

2.1.3. The formal seed system

The formal seed system in the Ethiopian context is a system that involves a chain of activities leading to certified seed of released varieties**.** The system is market-oriented and characterized by a continuous varietal replacement as a mechanism of technology transfer and as a market strategy. But the supply system is highly regulated and involves a chain of activities leading to clear products which are certified seed of verified varieties (Abdisa Gemeda *et al*, 2001). The seed supplying and distribution channel always starts with plant breeding and selection, resulting in different types of varieties, including hybrids, and promotes advanced fixed germplasm materials leading to formal variety release and maintenance. Guiding principles in the formal system ensure that, varietal identity and purity are maintained throughout the various generations of seed multiplication (Breeder or Pre-basic →Foundation or Basic →Registered and/or

Certified in some cases Commercial, with optimal physical, physiological and sanitary quality) (FAO, 2011).

Similarly, the formal seed sector is formal because it is government supported system and several public institutions are involved on it. The major actors of the formal system are: National Agricultural Research Systems (NARS), Ministry of Agriculture and Rural Development (MoARD), Ethiopian Seed Enterprise (ESE) and private seed companies specializing on specific crops like Pioneer. All seed producers and stakeholders are involved formally with seed supply distribution. Regional seed enterprise was established as a public seed enterprise and entered to the formal system. The seed provision covers seed production and supply mechanisms that are governed by defined methodologies, combined stages of multiplication and quality control (Abebe Atlaw, 2010).

The formal seed system can be characterized by a clear chain of activities. It usually starts with plant breeding and promotes materials for formal variety release and maintenance. Regulations exist in this system to maintain variety identity and purity as well as to guarantee physical, physiological and sanitary quality. Seed marketing takes place through officially recognized seed outlets and by way of national agricultural research systems and even through relief seed programs (Louwaars NP.De Boef W 1994).

According to Gezahegn Walelign (2008), the major challenge for formal seed supply was to produce sufficient seed of all varieties needed, and deliver it to farmers in a timely manner. This requires considerable organization, time, and space, and incurs risks due to costs and production. The central idea of the formal system is that, there is a clear distinction between 'seed' and 'grain'. Formal systems are especially important when seed is used to grow crops for commercial purposes (for example export or further food processing) and the uniformity and high quality of the product has to be guaranteed. The same general steps take place in the informal system as in the formal but as integral parts of farmers' grain production rather than as discrete activities. Formal seed supply system on the other hand, provides tested seeds to farmers in organized and often regulated channel that includes breeders, seed producers, seed marketing and distribution organizations (Abebe Atlaw, 2010).

2.2.4. The informal seed system

In Ethiopia, as in many other countries in sub-Saharan Africa, the informal seed system is still the dominant system for seed supply. It is the system in which farmers select their crops and varieties, produce their own seed, and/or locally exchange and purchase seed. Annual potential seed requirement of Ethiopia is estimated to be 150,000 tons, but the formal sector supply does not exceed 20,000 or only about 13 %. Moreover, the seed quality is mostly low and there was no mechanism of checking the source of the problems and lack of accountability and traceability (Gebremedhin Welo, 2015).

The informal seed supply system (or informal seed system) refers to the traditional arrangements used by farmers to supply the seeds they need to plant in the following season. Other names given to informal seed supply systems include farmer-managed seed system, farm-based or local seed production and supply or traditional seed system; and or farmers' seed system. Seed related activities tend to be integrated and locally organized, and the informal system embraces most of the other ways in which farmers they produce, disseminate and procure seed directly from their own harvest, through barter among friends, neighbors and relatives, and through local grain markets or traders (FAO, 2011).

Informal seed systems are traditional systems operating at the local and village level through farmer seed production and seed exchange mechanisms based on local considerations without public-sector regulation or support. Informal, or on-farm seed systems, vary among countries, regions and crops. They rely on seed-saving practices, that is, keeping part of the harvest for planting in the next season (ISSD, 2012). The system usually plants local varieties of seed kept from the previous year's harvest or obtained from neighbors' and/or the local market. On farm seed systems are essential for minimizing food security for developing countries. In the Ethiopian context, the informal seed system is seed production and distribution along with the different actors where there is no legal certification. Standards in the informal seed sector are not monitored or controlled by the government policies and regulations, and they are guided by indigenous knowledge and standards by social structures (Dirriba Edahe, 2013).

According to Solomon Abie (2011), the informal seed sector consists both of individual farmers retaining seed from the previous harvest and farmer-to-farmer seed exchange based on cash,

barter, social obligations, etc., by which farmers full-fill their seed requirements. Formal and informal seed supply systems are the two terms used to describe the systems of seed delivery to farmers and both are operational in developing countries and to a lesser extent in developed countries.

2.2. Seed production and distribution in Ethiopia

In Ethiopia, various actors and stakeholders are involved in seed production activities. All these actors and stakeholders, in one way or another, contribute to production, promotion, supply and marketing of improved seed in the country (Shimelis Altaye, 2015). Studies show that, only a small area of land is covered by improved seed. The national seed policy encourages both the formal and informal seed production. In the formal sector both public and private companies are promoted to produce and supply seed as a grower. Most certified seed is distributed through cooperative unions. In very limited cases, retailers (e.g., seed stores and private outlets) also sell and distribute seed. Seed production follows all the necessary procedures of seed certification where farmers are registered and fields are inspected for certified seed production (Teddie and Grace, 2010 cited Gebremedhin Welo, 2015).

Ethiopian seed enterprise is a state owned enterprise responsible for the multiplication and distribution of improved seed for all major crops. Over the last decade, the private sector has made some initial forays into Ethiopia's seed industry and more specifically, into the maize seed business. Some 26 firms are licensed to produce seed in the country, while 33 are licensed to retail and four to export seed. Yet in spite the active participation of Pioneer and other companies in Ethiopia's seed industry, the size and reach of the private sector is extremely limited(Dawit Alemu, *et al*, 2008).

Throughout history, several government entities, private companies, cooperatives and smallholders have contributed to seed sector development in Ethiopia. The participation and coordinating role of public entities are quite high in Ethiopia as compared with other sub-Saharan African countries. Recently, the contribution of private producers and other forms of producer organizations has increased. Projects are designed with the aim of increasing seed production and distribution by strengthening the public and private sectors and also promoting community-based seed production strategies it is reported that, the total area covered by

improved seed during main cropping season has been increased from 44,918.6 ha in 2006 to 122,508.4 ha in 2015. Similarly, the total amount of seed used has been increased from 26,585.7 tons in 2006 to 51,425 tons in 2015. This indicates that, the production and supply of improved seed is increased from year to year (Dawit Tsegaye *et a*l, 2017).

Basic seed for cereals are produced by respective research centers of EIAR and RARIs, the ESE, OSE and ASE, and by the licensed private seed companies. Bako Agricultural research center of Organization of Agricultural Research Institute (OARI) was the only producer of basic seed for hybrid Maize that were developed by the National Research system and the pre-basic was supplied by National Maize Project at Bako of EIAR. However, starting from the 2008/09 production season, Adet Agricultural Research Center of Amhara Regional Agricultural Research Institute (ARARI) and Hawssa Agricultural Research Center of the south Agricultural Research Institute (SARI) from the public sector and Agri-Ceft Ethiopia from the private sector are licensed for basic seed production of most of the popular public hybrid maize varieties(Solomon Abie,2011).

Maize is the most produced and consumed crop in Ethiopia. Similarly, maize accounts for the largest number of smallholder producers at 9.3 million, followed by 6.3 million for *teff* and 4.8 million for wheat (CSA, 2012/2013). Maize is an important crop for food security in Ethiopia; CSA data shows that 80% of the maize produced by smallholders is used for household consumption, 10% for sale and the remaining 10% for seed and other purposes. Furthermore, maize has the lowest cost per calorie among all major cereals, about 'one-and-a-half and two times lower than wheat and *teff*, respectively. 19 percent of the calories in the diet come from maize and its average consumption is 45kg/person. It is also a cheaper source of protein relative to other cereals; 'maize provides 0.2 kg of protein per USD, compared to 0.1 kg of protein per USD from *teff* and 0.2 kg of protein from wheat and sorghum (Rashid .S and A.Neggasa, 2011).

All maize produced in Ethiopia is consumed directly as human food in different forms supplying the highest level of per capita food consumption amounting to about 50 kg/year and over 40% of daily calorie intake. The hybrid maize has excellent yield potential of 120q/ha in research and about60 q/ha in farmer's demonstration field though the national average yield is about33.7 q/ha.

In the Ethiopian context, overcoming the problems of quality deterioration on maize seed would address the problems of food insecurity on house hold farmers (ESA, 2014).

In 2016/17 cropping year, the total area covered by hybrid maize was 517,210.23 ha, from the total production 18,143,268.40 qui hybrid maize was produced and this is about 35.08 qui/ha in Amhara region. West Gojam zone is a maize belt agro-ecological place. It constitutes the lion share of the total production of hybrid maize grain of the region which is 209,834.83 ha of land or 40.57% of land covered, from the total production 8,584,016.46 qui produced. The crop productivity was 40.91qui/ha. In this context the productivity of maize as compared to the regional level, west Gojam zone is the highest one (CSA, 2016).

2.3. Current features of Ethiopian seed systems

According to Louwaars NP. and Edeme (2013), the seed systems classified as farm-saved seed, community-based, public companies, commercial companies, and closed value chain. Farm-saved and community-based systems come under the informal system. Farm-saved seed refers to the practice of saving seeds for use from year to year. Community-based system is an informal arrangement wherein a group of farmers have established a system of producing and exchanging or selling quality seed.

Quality deterioration is a critical problem in seed sector of Ethiopia which attributes to the lack of traceability and accountability. The seed production is decentralized and there are different producers mainly cooperatives, private seed companies and public seed enterprises. The government pools the seed produced by all these producers and distribute through unions and primary cooperatives. From this and another centralized public seed distribution, the systems could not satisfy the demand of improved seed for the user farmers (Dawit Alemu, 2010).

In Ethiopia, seed production in the formal seed system is highly dominated by the public sector. The ESE and regional government seed enterprises play dominant roles in the formal seed system. They are governed by the board of directors of their respective federal and regional governments, and responsible for production, processing and marketing of seed to meet the regional and national seed demands. Even sometimes, the seed legislation may need to be temporarily suspended as in times of crisis due to drought, floods, disease outbreaks etc. Looking

at the future, it is recommended that Ethiopia should bring its seed legislation and regulations in conformity with the International Seed Testing Association in order to facilitate seed imports and exports of diverse crop cultivars as it may become necessary (Dawit Alemu *et al*, 2016).

Similarly, successful seed quality control mechanisms are the best way to generate seeds to next generation and the seed standards in Ethiopia have been prepared under the direction of the agricultural product standards committee and published by the Quality and Standards Authority of the country. Currently, the Authority revised its seed standards and prepared field and seed standards for 174 crops versus the 74 crops standards that were officially issued for implementation (Dawit Alemu *et al*, 2010).

In Ethiopia seed system development can be viewed as a dynamic process of matching the supply to the changing demand for seeds. But the inefficiencies of seed distribution in the Amhara Region is manifested with considerable amount of seed leftover in some parts; while shortage stands out in other parts. High leftover of seed is also contributed by lack of accountability in the system. The estimation of seed demand is done through government structure that has no direct responsibility for the unsold seed as the seed is distributed finally by cooperatives. For this purpose, the previous seed supply and distribution systems or conventional seed systems would be a problem for their supply and distribution approaches (Mesfin Astatikie *et al.*, 2012).

2.4. Seed marketing system

Market can be defined as an area in which one or more sellers give products or services and their clothe substitutes exchange with and compete for the patronage of a group of buyers. Marketing is a societal process in which individual and groups obtain what they need and want through creating, offering, and exchanging products and services of value freely with others or free buying and selling systems of goods and services (Kotler, 2001).

According to Assefa Abebe (2009), marketing has an economic value because it gives form, time, and place utility to products and services. As products definition, it is the performance of all the transactions and services associated with the flow of good from the point of initial production to the final consumer. As business firm, marketing is as a complete management concept through which the company sells itself as well as its line of product.

In other words, marketing can be defined as the performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of consumers. Efficient marketing system plays an important role in the economic development as it stimulates production, avoids unnecessary fluctuation in output and prices and reduces costs of production and unfair share of consumer's price. For attaining these benefits, marketing system and marketing technology have to keep pace with the production technology and socioeconomic development of the country. The concept of marketing system comprises physical distribution of economic input and products as well as the mechanism of process or coordinating production and distribution (Mengesha Yayo, 2015).

Seed marketing is the process through which seeds are distributed and sold to the farmer, mainly through farmer unions, cooperatives and other stakeholders. There are many actors involved in marketing and distribution. Interconnected activities at the ready of marketing stage are quality verification, price setting, storage transport and distribution. It is the most important as well as challenging aspects of seed industry by the nature of the products (ATA, 2017). Currently in the Ethiopian context, both the formal and the informal seed system play important role in the supply and distribution of seeds in the region. The informal seed sector in Amhara seed system context is defined as seed production and distribution along with the different actors where there is no legal certification in the process. The exchange of seed is farmer to farmer, community based seed multiplication and distribution. Moreover, on farm seed multiplication made by research centers, agricultural universities and colleges, that is part of their technology demonstration and pre scaling out activities (Guush Tesfamariam, 2014).

The farmers' seed system in many developing countries is already troubled with various challenges forced by different factors such as loss of crop types and varieties, and changes in socio-economic and agro-ecological conditions (Abebe Atlaw, 2010). Under such conditions, small-scale farmers remain deprived of diversity and alternatives while the formal seed sector is not in a capacity to satisfy seed demand of diverse crops that such farmers are in need of(Eleni Bisrat ,2014). The private seed sector, in this case, is of a little help since its interest is on crops and varieties that generate more profit. On the other hand, there is limited public seed sector investment for strengthening farmers' seed system. The effect of all these ultimately play a role

in exacerbating food insecurity in the country. There are huge problems with the seed marketing systems in the developing country the so-called Ethiopia (Mohammed Urgesa, 2011).

2.5. Brief history of hybrid maize in the Ethiopia seed system

Hybrid maize seed was introduced into Ethiopia during the Derg regime that ruled Ethiopia from 1974 to 1991. An important component of the agricultural policy of this regime was the creation of large, mechanized state farms. Initially, hybrid maize seed for these farms was obtained from Kenya (ATA, 2017). However, within a few years the government established the parastatal Ethiopian Seed Enterprise (ESE) to produce improved seed for the state farms and eliminate seed imports. In 1990, Pioneer Hi-Bred International, Inc., the US seed producer, was contracted to work with ESE in developing its seed production. Both ESE and Pioneer continued to operate even after the downfall of the Derg. Today ESE remains the largest producer of hybrid maize seed in Ethiopia, while Pioneer is the largest private hybrid maize seed producer, supplying seed both to the official seed supply system and directly to farmers in selected areas (IFPRI, 2014).

Ethiopia is the largest maize producing country in East Africa, and the fourth in the whole of Africa. It produces the type of maize preferred in neighboring markets (white non-GMO maize). Maize is Ethiopia's leading cereal in terms of volume produced. Over half of all farmers grow maize, mainly for subsistence. It is the cheapest source of calories and provides 20.6 percent of per capita daily calorie intake. In 2013/4, about 6.5 million tons of maize was produced by 8.8 million farmers cultivating over 2 million hectares of land. It is estimated that about 61 percent of the maize produced in Ethiopia is consumed by farm households whilst 25 percent is marketed. Partly because of this, maize has been selected as one of the priority crops for development as part of Ethiopia's agricultural transformation program (PARM, 2016).

Dawit Alemu *et al* (2011) stated that, Ethiopia presents one of the most important global challenges in agricultural development. It is among the poorest countries in the world, and its agricultural sector accounts about 44 percent of national GDP, 85 percent of employment, and 90 percent of the poor. They reviewed that, the adoption of improved maize seed ranging from 6-47% with respect to *teff*, barley and sorghum are the other main cereal crops cultivated in Ethiopia and their adoption rates are relatively lower than both wheat and maize.

Maize is largely produced in Western, Central, Southern and Eastern parts of Ethiopia. In Ethiopia, maize (*Zea mays* L.) is one of the major cereal crops grown for its food and feed values. It is one of the most important staple food, cultivated food crops and cash crops providing calories for the consumers and income for the traders. It is an important field crop in terms of area coverage, production and utilization for food and feed purposes. In Ethiopia, its total annual production and productivity exceeds all other cereals (23.24% of 13.7 million tons), and second after *teff* in area coverage (16.12% of the 8.7 million ha), maize is one of the most important crops grown in Ethiopia. The popularity of maize in Ethiopia is partly because of its high value as a food crop as well as the growing demand for the Stover as animal fodder and source of fuel for rural families. The adaptability and productivity of hybrid maize is very high in the western parts of Ethiopia especially in western Amhara (Dawit Alemu *et al*, 2008).

Improved maize varieties play a potential critical role to modernize Sub-Saharan Africa's agriculture, improve food security and reduce poverty. Maize is intentionally important crop for food security and economic growth in Africa. Maize is a key food crop across large swathes of Africa, and Africa's largest and most widely cultivated cereal with over 30 million ha cultivated and 50 million tons produced annually (Guush Tesfamariam, 2014). Currently maize productivity is a major determinant of food security from the household to the regional level. Improved maize seed is a key to increase productivity so as to make the surpluses to raise rural incomes and feed burgeoning rural and urban populations. Hybrid maize seed is the key to viable seed industries, further enabled by the structural adjustment induced market liberalization and privatization. Maize seed has thereby long been viewed as instrumental to deliver an Asian-style 'green revolution' for Africa (Olaf Erentien and Girma Tesfahun, 2017).

Under Ethiopian context, seed politics is dominated by maize, specifically hybrid maize. Policy-makers consider maize as a crop where huge productivity gains can be obtained to boost domestic production. Also, due to the fact that it cannot be recycled, there is huge demand by farmers, and all public and private seed companies are engaged in its multiplication creating competition among these actors (Mesfin Astatikie *et al*, 2012). The seed production practices of Hybrid maize requires special knowledge and skill compared to grain production. So it is important to follow the right field operation and post harvest procedures. Currently private's seed

producers, seed companies and farmers Unions who are members of the association are becoming important in seed business in the country (Dawit Alemu, 2010).

Based on the bottlenecks of the seed distribution system ISSD (Integrated Seed Supply Development) supported direct seed marketing system in the pilot programs to the four regional states. By these reason, study on the performance of direct seed marketing system piloting in Amhara region shows that, the new system is far more efficient and effective in distributing quality seed to farmers on time. The system bases equity as its central principle to supply seed to all farmers. Now the direct seed marketing system is thought to be considered from pilot stage to implemented stage in 4 zones and 40 *woredas* of maize potentials (BOA, 2017 unpublished).

2.6. Determinants of the seed marketing system

An effective commercial seed system can make a number of contributions to a nation's agriculture. A commercial seed supply can be an attractive option to saving and storing seed, which may involve much management time or special storage facilities, and farmers may be willing to pay for the convenience of a reliable seed supply 'on the shelf. Similarly, seed demand forecasting is the process of making projections of demand for products by examining past and present performance levels, combined with an assessment of available products and markets (IFPRI, 2014).

Agricultural productivity depends on the use and availability of better agricultural technologies and practices. As a result of intensification or maximizing the productivity of farmland with new agricultural inputs and intensification extending the size of the existing farms, the demand for improved technologies and including improved seed and fertilizer has increased in Ethiopia (Shimelis Altaye, 2015). The economics of hybrid seed production is worked out by adding expenditure on various items such as land lease, cost of preparatory tillage, cost and sowing of parental seed, registration and inspection charges, cost of fertilizer, hoeing and weeding, irrigation charges, plant protection, emasculation and pollination, picking of crossed bolls and transportation to gin and ginning charges. Therefore, the income is estimated from sale of hybrid seed and lint and thus net profit per hectare is worked out (Dawit Tsegaye *et al*, 2017).

Shimelis Altaye (2015) reviewed that, Supplying high quality seed of improved crop variety preferred by farmers, in sufficient quantities, in a timely manner, to accessible locations, and at affordable prices is a national development objective pursued by the Ethiopian government to secure food supply for the nation. The strengths, performance of centralized public seed distribution and marketing model is, however, below its potential. One important reason is the lack of making available to local farmers quality seed of improved crop varieties at the right time, at the right place, and at the right quantity. In addition, a lack of improved seed marketing services before, during and after sales has been identified as a key failure factor accounting for the low performance of public seed distribution and marketing model. There is a substantial gap between the production of seeds and farmers demand for, knowledge of, access to and usage of seeds (Michaele Gebreselassie, 2013).

In developing country more of Ethiopia, the inefficiencies of seed distribution in the Amhara Region is manifested with considerable amount of seed leftover in some parts; while shortage stands out in other parts. For instance, in 2009/2010 the leftover of hybrid maize seed was more than 1,000 quintals and the figure increased by over 100% in 2011. While this is partly due to imperfect demand forecasting, it is also very much related to the efficiency of seed distribution mechanism (Mesfin Astatikie *et al*, 2012).

2.7. Market structure, conduct and performance

According to Gizachew Getaneh (2005), market conduct refers to the behavior of firms which the strategy they use individually in competition with other firms in purchasing inputs and selling output, and in conjunction with other firms, which may take the form of informal cooperation or collusion. Similarly, market performance refers to the composite of end results which firms in the market arrive at by pursuing whatever lines of conduct they espouse and market structure refers to characteristics of market that significantly affect the behavior and interaction of buyers and sellers.

Mengesha Yayo (2015) reviewed that, market structure, conduct and performance (SCP) framework was derived from the neo- classical analysis of markets. The structure performance hypothesis states that, the degree of market concentration is inversely related to the degree of competition. More specifically, the standard SCP paradigm asserts that there is a direct

relationship between the degree of market concentration and the degree of competition among firms. However, SCP framework is not free from limitations. One drawback is its assumption of exogenous on market structure which means that it doesn't consider the dynamic aspect of the market, i.e. focuses only the static condition

2.7.1. Market conduct

Market conduct refers to the patterns of behavior that enterprises followed in adopting to the markets in which they sell or buy. There is not agreed up on procedures on analyzing the elements of market conduct. It defines the conditions which make possible exploitive relationship between seller and buyer and it is a systematic way to detect indication of unfair price setting practices and the conditions under which practices are likely to prevail (Mohammed Urgesa, 2011).

Bosena Tegegne *et al* (2011) reviewed that, the analysis of market conduct express the exploitative relationship between producers and buyers. In analyzing the buying and selling practices, the source of product, the existence of formal and informal marketing groups that affect the bargaining power, the nature of the buying/selling practices in place, the distribution channels used, and observed trading practices that were unethical were taken into consideration. During the analysis of pricing behavior, the chief determinants of price, price setting mechanisms, factors that influence the setting of price, the basic for price differentiation and the impact for physical location of the market on pricing and marketing arrangement are seriously considered.

2.7.2. Market performance

Market performance can be evaluated by analyzing the costs and margins of marketing agents in different channels. A commonly used measure of system performance is the marketing margin or price spread. Market performance refers to the impact of structure and conduct as measured in terms of variables such prices, costs, and volume of output. Desirable market performance is directly related to the competitiveness of an industry because distortions thereof tend to impede price efficiently. It can be evaluated by analyzing the costs and margins of marketing agents in different channels. A commonly used measure of system performance is the marketing margin or

price spread. Market performance is the effect on the costs the method of performing the service on production and consumption (Assefa Abebe, 2009).

2.8. Marketing margin

Marketing margin is the percentage of the final weighted average selling price taken by each stage of the marketing chain. It is also called the farm retail price spread. The aim of the marketing margin analysis is to show the relative importance of marketing costs in order to reveal and among markets (inter-market variations) to allow further market integration. Marketing margin could be determined by recording the volume of total trade carried out, gross margin obtained by dividing money sales minus money purchase by the volume handled. Prices can be compared at the different levels of marketing margins, which can be expressed either in cash or as a percent of the retail cost. The total marketing margin is the difference between what the consumer pays and what the producer receive for his product (Korie, 2013).

Karim Koshteh MH *et al* (2012) reviewed that, marketing margin is defined as the difference between the producer price and the consumer price and it can be affected by various factors. It is the difference between the value of a product or a group of products at one stage in the marketing process and the value of an equivalent product or group of products at another stage. Measuring this margin indicates how much has been paid for the processing and marketing services applied to the products at that particular stage in the marketing process. Marketing margin analysis is thus the first step in providing the factual information necessary to dispel the misconceptions which frequently arise when assessing the performance of marketing seed.

As Mendoza (1995) wrote, when there are several participants in the marketing chain, the margin is calculated by finding the price variations at different segments and then comparing them with the final price to the consumer. It should be understood as the gross marketing margins. In similar way, in this study, gross marketing margin was considered instead of net marketing margin. The consumer price is then the base or the common denominator for all marketing margins. Computing the total gross marketing margin (TGMM) is always related to the final price or the price paid by the end consumer and expressed as a percentage.

2.9. Marketing channels

Scholars reviewed that, marketing channel was first used to describe the existence of a trade channel bridging producers and users. Early writers compared marketing channels to paths through which goods or materials could move from producers to users. And it is an array of exchange relationships that create customer value in the acquisition, consumption, and disposition of products and services. This definition implies that exchange relationships emerge from market needs as a way of serving market needs. Channel members must come to the marketplace well equipped to address changing market needs and wants (Bosena Tegegne, 2008).

Ashenafi Amare (2010) reviewed that, the analysis of marketing channels is intended to provide a systematic knowledge in the flow of the goods and services from their origin (producer) to their final destination (consumer). This knowledge is acquired by studying the participants in the process, i.e. those who perform physical marketing functions in order to obtain economic benefits.

2.10. Empirical studies on the direct hybrid maize seed marketing system

Mesfin Astatikie *et al* (2011) compared both conventional and direct seed marketing in different *Woredas* of Ethiopia. The study was focused to compare both conventional seed system and pilot test direct seed marketing in quality service delivery in seed marketing and price of hybrid maize. In direct seed marketing areas in 2011, the availability of hybrid maize seed was very much improved and majority of the farmers reported that there was no problem of availability. In Dangla and south Achefer *woredas*, there were enough amounts of hybrid maize seed supply and the required type. On the other hand, in Mecha and North Achefer, there was limitation of supply particularly in terms of the type of varieties farmers looking for. For instance, in Mecha *Woreda* the demand was for BH 540 but what supplied was only BH 660. Due to this, there was big left over of BH 660 seed. Based on the survey result, the price was very high because of the monopoly of seed market, in the hands of cooperatives organizations that sell seed and fix high price. Generally, from his it was found that conventional seed system has constraints in serving the farmers in seed supplying on time and thus direct seed marketing is better in serving the farmers in supplying seed on time.

The studies were done to determine factors that affect the purchasing power of household farmers. Some of these studies which consider one dependent variable which was quantity of hybrid maize seed to be purchased are stated below.

Arffasa Kiros (2015) studied the comparative analysis of conventional and direct hybrid maze seed marketing system at Sibu Sire *Woredas*. The study indicates that were used OLS model to identifying the determinant factors that affect the amount of improved seed to be purchased. The results show that quantity of fertilizer utilized, income of the household, frequency of extension contact, education level of the household, land size and total livelihood unit were found significant for the quantity of seed to be purchased for hybrid maize seed.

Similarly, Eleni Bisrat (2014) studied the comparative analysis of direct and multi-level hybrid maize seed marketing system in Bona and Bensa *Woredas.* She also used OLS model to identify the factors affecting the quantity of hybrid maize seed at the same time for the two marketing systems. The result that identified was, market channel, tropical livestock unit, actual access to market information, experience in use of hybrid maize seed, access to seed on the right time, commercial fertilizer use, amount of annual income and family size were significant to influence the quantity seed to be purchased.

Another research was conducted with title of Does direct seed marketing matter? Exploration of attitudinal change partners in the southern region of Ethiopia. The research revealed that, direct seed marketing system is an alternative marketing mechanism whereby seed companies distribute and market their products and services directly to the end users. It also facilitates the exchange of seeds with farmers in terms of availability and accessibility supported by product information services directly to the end users, enhances seed marketing services, before, during, and after sales by seed companies and works especially for those (e.g., hybrid maize) that have higher commercial interest for private sector parties(Shimelis Altaye,2015).

2.11. Conceptual Framework on organization of the formal maize seed system in Ethiopia

According to ATA (2017) the seed production facilities in Ethiopia Currently, the majority of improved varieties are developed by the public agricultural research system, which consists of

the Ethiopian institute of agricultural research (EIAR), the Regional Agricultural Research Institutes (RARIs) and higher learning institutions (HLIs). The NARS also works closely with international research centers - mainly the Consultative Group on International Agricultural Research (CGIAR) and the International Maize And Wheat Improvement Center (CIMMYT) to access germplasm, build capacity and address broader systemic challenges. In addition, a handful of international seed companies such as Pioneer and Seed Cooperatives have begun to import, adapt, and register varieties from other countries, but these varieties still are evaluated by experts that represent public research institutions (Dawit Alemu, 2010).

The major actors of the formal system are: National Agricultural Research Systems (NARS), Ministry of Agriculture and Rural Development (MoARD), Ethiopian Seed Enterprise (ESE) and private seed companies specializing on specific crops like Pioneer. Therefore all are involved formally. Regional seed enterprise was established public seed enterprise and entered to the formal system. The seed provision covers seed production and supply mechanisms that are governed by defined methodologies, combined stages of multiplication and quality control. The formal seed system can be characterized by a clear chain of activities. It usually starts with plant breeding and promotes materials for formal variety release and maintenance. Regulations exist in this system to maintain variety identity and purity as well as to guarantee physical, physiological and sanitary quality. Improved certified seed is supplied to Ethiopian smallholders primarily through regional, state-run extension, and input supply systems that operate with a degree of guidance from the federal Ministry of Agriculture and Rural Development (MoARD)(Abebe Atlaw,2010).

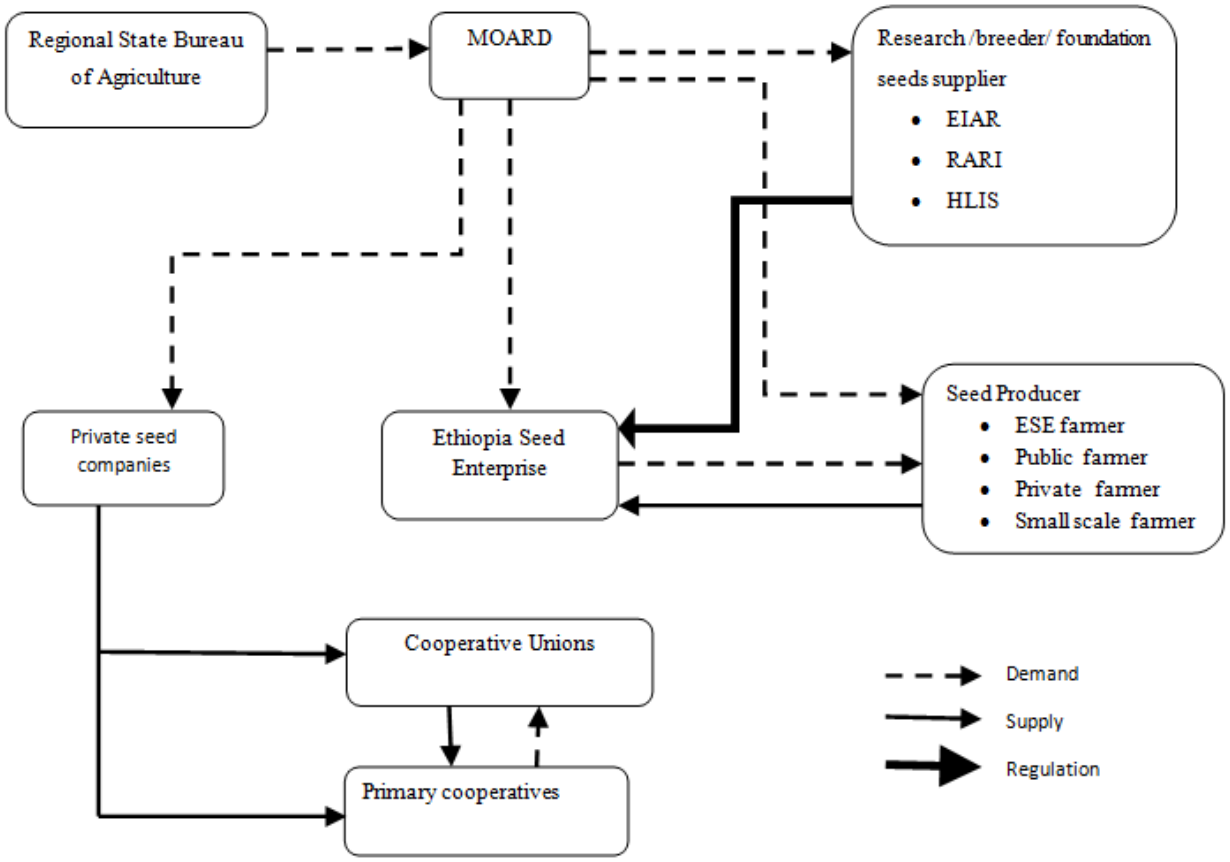


Figure (1) Organization of the formal maize seed system in Ethiopia

2.12. The performance of direct hybrid maize seed marketing in Amhara region

In Amhara region the creation of an effective regulatory system and enabling environment supports the well-functioning management of private and public sector warehousing services, which reduce post-harvest losses of production. A strong regulatory environment can also help to improve operational efficiency, introduce technologies, and allow for better quality control so as to meet the demands of both processors and other market actors (BOA, unpublished). The maize cluster in Amhara encompasses West Gojam, South Gondar and Awi zones, across 10 woredas and 240 kebeles, reaching 286,728 farmers. This area produces 17% of the nation's maize (which is the most important crop in the cluster) with production and revenue both being double that of the next most important crop *teff*. The vision for this cluster is to generate annual revenues of 81 million USD by 2020 through domestic sales of maize grain, flour, feed and processed cereals and snacks, including substituting imports of maize products of nine million USD. Ninety

percent of the products are to be processed in the cluster and 10% through contractual agreements with processors in Bahir Dar (CSA, 2015).

In Amhara region, two public seed enterprises, three private companies' and one farmer's cooperative unions supplied with the direct seed marketing system there product for the farmers through direct seed marketing system. The supplied varieties are BH540, BH660 and BH661 and constitute 31% of the sold product. From the total suppliers, Yimam Tessema seed enterprise dominated the seed market in 2016/17 by supplying locally demanded variety in response to farmers need. Out of the total seed supplied, 51.31% was sold in the direct seed marketing system while the remaining seed was transported to other location where it was required on time with the accountability of supplier without damping in the store of cooperative or dealer shop(BOA, 2017 see Annex table 3).

Direct seed marketing system is an alternative marketing mechanism whereby seed companies distribute and market their products and services directly to the end users via to the end users. The system facilitates the exchange of seeds with farmers in terms of availability and accessibility supported by product information and services. Thus, the system enhances seed marketing services, before, during, and after sales by seed companies. The system works especially for those (e.g., hybrid maize) that have higher commercial interest for private sector parties. The system also motivate producers to promote their seed and to compete with other producers on the basis of seed quality and information provided to farmers to increase their market share and build more sustainable seed business. Additionally, the seed distribution and marketing channels shorten and save the time, supply with affordable price and deliver to the end users with competition (IFPRI, 2014).

In 2016/17 production year, Yimam Tessema and ASE used more number of agents and centers to distribute the seed more than other enterprises. Next to ASE and Yimam, ESE and Afri-seed choosing four *Woredas* and selling agents equally. With these all effort of enterprise and partners, timely delivery of quality seeds, better access of alternative source of varieties, trust on quality of seed enterprises lead to cost saving, awareness of direct seed market and sense of competition among them. From this point of view, direct seed marketing can further scaled-up with other seed varieties and place to the region. In this regard direct hybrid maize seed

marketing reduced left-over of the seed as compared to the conventional seed marketing system (BOA 2017 see Annex4).

In Amhara region direct seed marketing system was piloted at the first time in 2011/12, in two *woredas* (Dangla and South Achefer) by two seed producers and two seed distribution centers or selling agents. During that time, Ethiopian seed enterprise and Avalo international seed enterprise were participated on the marketing system and the seed supply was increased from 4,873 quintals to 44,608 quintal of hybrid maize. Moreover, the participant *woredas*, seed producers and selling agents also increased from 2 to 40, 19 and 433 respectively (BOA, 2017 see Annex 5).

3. RESEARCH METHODOLOGY

This chapter summarizes description of the study areas, methods of data collection, sampling techniques, procedures and sample size and also contains methods of data analysis (descriptive and econometric model).

3.1. Description of the study area

Mecha is one of the *Woredas* in the west Gojjam administrative zone in the Amhara region. Currently, Mecha *woreda* is divided in two *woredas*, North and South. But, the data were collected before the restructure.

The *woreda* is bordered by Yilmana-Densa woreda to the East, South Achefer *woreda* to the West, Bahir Dar Zuria *woreda* to the North and Sekela *woreda* to the South. Mecha *Woreda* is located at 500 km northwest of Addis Ababa, the capital of Ethiopia and 35km to the west of Bahir Dar, the capital of Amhara region. The two agro climatic zones in the *woreda* are high lands or 'Dega' that covers 20% of the area and the remaining 80% consists of moderate (temperate) or 'Woyina Dega'.

The *Woreda* is situated at an altitude ranging from 1800 to 2500 meter and has area coverage of 1.56 billion square meters. From the total area of land, nearly half, 72,178 hectares are used for cultivation. Forest land and the grazing land cover 18,547 hectares and 15,591 hectares respectively. The land covered by forest, grazing and marshland are about 15,591 hectares 1,386 hectares18, 547 hectares respectively. Artificial forest is planted to solve the problems such as soil erosion, desertification and deforestation. With the aim of satisfying one of the millennium development goals of United Nations the inhabitants of the *woreda* were participated in planting and protecting trees.

The area receives an average annual rain fall ranging from 1000 to 2000 mm and average daily temperature from 24 – 27 ^{0}C. The *Woreda* is divided in to 39 rural and 4 urban *kebeles*. The population of Mecha *Woreda* was 323,315 in rural areas and 52,401 in urban areas, a total of 375,716. From the total population in the *Woreda*, around 86% lives in rural areas, where directly sustain their life and surplus producers from the agricultural and similar activities

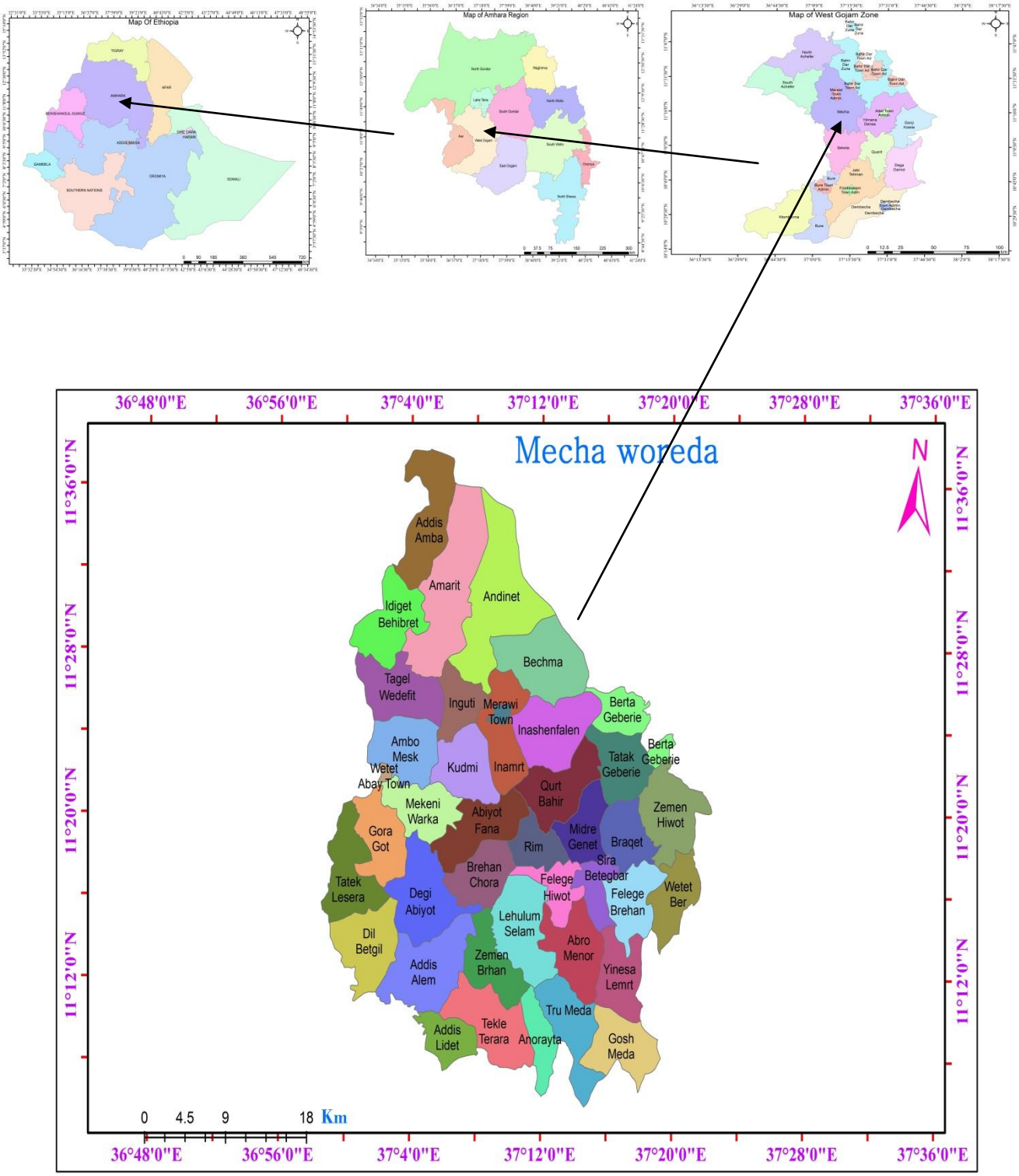
(WARDO Office, 2017). Generally, the soil type of the study area is characterized as 93% red soil, 3% black soil and 4% gray soil.

Mixed farming is practiced in all parts of the *woreda* and by each of the rural households (86%) in the community. It is at subsistence level and is practiced in fragmented holdings mostly due to lack of modern technologies. The average landholding at *woreda* level is 1.5 ha per household, and ranges from 0 to 3 ha among the farmers in the *woreda*. In the crop sub-sector, the main crops grown include maize, *teff*, finger millet, wheat, chickpea, beans, potato and cabbage. In the livestock subsector, cattle are dominant and large numbers of poultry, sheep and goats are also kept. Oxen, cows, heifers, bulls, calves, chickens, goats and sheep are found in numbers in most households.

The *woreda* was selected by considering Maize belt agro-ecologies in the regional level. It has been identified as great agriculture and market potential and the farmers in the area were small-holders and the field was prepared manually with the help of oxen power. In 2016/17 hybrid maize seed varieties were distribute using direct seed marketing system in Mecha *Woreda*.

In this cropping year, the number of small-holder farmers involved in Maize production in the *Woreda* was 8,584,061 on 209,837.83hactares of land producing 2,870,000 quintals of Maize grains would be produced (WARDO,2017 unpublished).

Figure (3.1) Map of the study Woreda



For the purpose of this research work, both primary and secondary data were collected. Primary data were collected randomly selected hybrid maize seed user farmers using a formal quantitative survey. A formal quantitative survey was conducted to collect information from farmers. The survey was implemented on 150 farmers from 5 "*kebeles*" of which were from the *woreda*. The questionnaire was drafted as part of the first round field visit and pre-tasted Insights and prominent issues revealed during this process were used to treat and adjust the questionnaire before actual field work. The questionnaire was translated in to local language to make easy to the communication between enumerators and the respondents.

Secondary data were gathered to support the information to be collected from primary sources. Secondary data were collected from *Woreda* Bureau of Agriculture, regional Bureau of Agriculture, Ethiopia Seed Enterprise, Amhara Seed Enterprise, Yimam Tessema Seed Enterprise Ayehu- Zingeni seed enterprise and Ethio-Agriceft seed enterprise. In addition, annual reports of the respective office, seed enterprise and websites were visited and used.

3.4. Sampling Techniques and Sample size

The sample design for this study is a two-stage cluster sample design implemented in order to identify (ultimate units) sample interviewers of agricultural households. At first stage of sampling, five sample *Kebeles* are selected using PPS or Probability Proportion to measure of size of agricultural household, that means the higher measure of household size of kebele has more chance being selected a sample. List of *Kebeles* will be taken from Mecha Woreda. So, the sampling unit for this study was maize grower in the five *kebeles*. The local leader or development agent of the area provided the sampling frame.

In the second stage of selection, a variants number of interviewer's per cluster will be (included) selected with a pre-defined random sample selection criteria from the fresh or listing of all eligible households within each *kebele* to select by simple random sampling methods, to decide the following procedures for selecting our sample of eligible households from each sample *kebele*. After he/she (data collector) introduce himself/herself to the *kebele* leaders and concerned bodies and having somebody who knows the area very well as a guide, each data collect get the list of all households from *kebele* leaders then searching for an eligible household

with-in each village in the *kebele*. Then the first eligible household he/she finds along his/her way is taken as the first participant.

Then the other participants will be selected by taking every other eligible household that is, jumping one eligible household and taking the next as a participant. The process of selection ends after the required participant is selected.

In the selection process of the rural *Kebeles*, agricultural office experts were participated and consulted for collecting data. From Mecha *woreda* the five sampled *kebeles* are Enamirt, Enguti, Tagel, Kudmi and Ambo-Mesk. From each kebele 27-32 agricultural households has been randomly selected.

The appropriate sample size was important part of the study. Prior to the actual data collection emphasis were be given by the investigator, on the determination of appropriately estimated sample size was basically dependent on the purpose of the study, available resources and level of precision required.

The proportion of the population coverage of agricultural household in the study woreda was 0.86 (86%) of the total population (From recent assessment), relative precession of 4.9% since for at homogeneity level of indicator 4.9% RSE was a good precision in sampling theory, 95% confidence interval, design effect of 2, and 10% non-response rate. The total sample size was determined by the survey sampling theory of Lilie Kish formula (1965). The formula for calculating the final sample size in terms of the number of households, while taking non-response into account.

To use the formula of

$$n = deft^2 \frac{(1/p - 1)}{\alpha^2}$$

Such that, sample size determination under given relative standard error RSE for a reference variable (proportion) p of the study:

$Deft^2$ = Design effect

α^2 = Relative standard error

P = proportion of the population to agricultural household coverage.

Table (1) Sample size distribution of the sample kebeles

Name of selected kebeles	No of HH	Number of sampled households
Enguti	830	30
Kudmi	930	32
Tagel	830	30
Ambomesk	882	31
Enamirt	750	27
Total	4,222	150

3.5. Methods of data analysis

Descriptive and econometric analysis tools were exploited for analyzing the data from the sampled respondent household farmers in the study areas. The entire information that was collected from formal survey was used to prepare the final output of the study. This survey was supplemented by focus group discussion and informal discussion with key informant interview was used.

3.5.1. Descriptive and Inferential Statistics

The descriptive statistics include percentages, ratios, means, variances and standard deviations in the process of examining and describing farm household characteristics, resource ownership, and market characteristics of hybrid maize seed production. Multiple linear regression models employed to analyze factors affecting the quantity of seed purchased. The raw quantitative data collected from the rural household survey were edited, coded, entered, cleaned, and analyzed using both SPSS versions 20 and STATA-12 statistical software. Specifically, *T*-test and one-way ANOVA (*F*-test) were used to show the association between Dummy and categorical Dependant variables with the outcomes respectively. Finally, major constraints in quantity of hybrid maize seed purchased are presented.

3.5.2. Analysis of Direct Hybrid Maize Marketing Performance

In the direct seed marketing system hybrid maize seed production and marketing, farmers produced raw seed and supplied to ASE, ESE and private seed companies with contractual farming. ASE, ESE and private seed companies purchased the raw seed and process and store in its own warehouse. After the seed is certified in the laboratory, the seed companies choose the *Woredas* and the representative selling agent by adding transportation cost on price of the seed. In this system, the producers give the selling agents as a commission50-100 birr per quintals this is added cost to the seed (BOA, 2017 unpublished).

The final products reach to consumers (seed user farmers) directly to a market chain. The aim of the marketing margin analysis is to show the relative importance of the marketing costs in order to reveal real differences between and among markets (inter-market variations) to allow further market integration. The target remains the producer's share that revolves and works up the production and marketing mechanisms for the achievement of food security and social welfare objectives (FAO, 2011).
Marketing margin analysis can be used to evaluate market performance in the system (Mondaza, 1995).

The total Marketing margin was calculated using the following formula:

$$TGMM = \frac{\text{End Buyers price} - \text{producer price}}{\text{End Buyers price}} \times 100$$

Where, TGMM = Total Gross Marketing Margin

Producers' Gross Marketing Margins is useful to introduce the idea of farmer's portion, or producer's gross margin (GMMP) which is the share of the price paid by the consumer that goes to producer. The producer's margin is calculated as

$$GMMP = 1 - TGMM$$

Where, GMMP=the grower's share in consumer price.

3.5.3. Econometrics Model

In this study was assessed to hybrid maize seed and its determinants, information compile on Quantity of hybrid maize seed purchased are use to undertake multivariate analyses. Since, Determinants of hybrid maize seed purchased measured as Continues data (i.e. Quantity of hybrid maize seed purchased) are assess using the recently adapted continuous data modeling was Multiple Linear Regression Model (MLRM) have been shown to be statistically more appropriate (Poston, 2002).

Many applications of regression analysis involve situations in which there are more than one regressor variable. A regression model that contains more than one regressor variable is called a Multiple Regression model

Multiple Regression model is a statistical model for estimating the relationship between a dependent variable and two or more independent (or predictor) variables. Simply, Multiple Linear Regression (MLR) is a method for studying the relationship between a dependent variable and two or more independent variables. Purposes of this statistical method are in Prediction, Explanation, and Theory building statistical results.

The operation of this Model were Used the ordinary least squares solution (as does simple linear or bi-variable regression) and Describes a line for which the (sum of squared) differences between the predicted and the actual values of the dependent variable are at a minimum.

The model represents the "function" that minimizes the sum of the squared errors.

$$\boldsymbol{Y_{predictor} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots\ldots\ldots\ldots + \beta_n X_n + \epsilon}$$

Where,

$Y_{predictor}$= dependent variable or the variable to be predicted
=Quantity of hybrid maize seed purchased .

X = the independent or predictor variables

$\boldsymbol{\beta_0}$ = constant or Y Intercept , representing the value of Y when X 0.

$\boldsymbol{\beta}_i$ is the intercept and $\boldsymbol{\beta}_i$ determines the contribution of the independent variable x_i

ϵ =The ε is a random variable with mean 0 and variance σ^2.

The β s show the relative contribution of their independent variable on the dependent variable when controlling for the effects of the other predictors

MLR produces a model that identifies the best weighted combination of independent variables to predict the dependent (or criterion) variable.

3.5.4. Multicollinearity Diagnostics in Statistical Modeling

Multicollinearity is a statistical phenomenon in which there exists a perfect or exact relationship between the predictor variables or a high degree of correlation amongst the explanatory variables. Before fitting the model it is necessary to carry out multicollinearity test because of the fact that multicollinearity may cause lack of significance of individual independent variables, while the overall model may be strongly significant (Monteshwe, 2006). It may also result in wrong signs and magnitudes of regression coefficient estimates and consequently in incorrect conclusions about relationships between independent variables.

Different methods are often suggested to detect multicollinearity problem among them, Variance Inflation Factor (VIF) technique was employed to detect multicollinearity in continuous explanatory variable. According to Gujarati (1995), VIF (Xi) can be defined as:

$$VIF = 1/1 - Ri^2$$

Where Ri^2 is the multiple correlation coefficients between X*i* and other explanatory variables, for each selected continuous variable (X*i*) were regressed on all other continuous explanatory variable .The coefficient of determination (Ri^2) constructed for each case. The larger the value of Ri^2, the higher the value of VIF (X*i*) causing higher multicollinearity in the variable (X*i*) for continuous variables. If the value of VIF is 10 and above the variables are said to be collinear (if the value of R^2 is 1), it would result in higher VIF and cause perfect co linearity between variables.

In OLS, estimates are consistent but not efficient when the disturbances are heteroscedatic. In the case of the limited dependent variable models also, if we ignore heteroskedasticity, the result estimates are not even consistent i.e. is the regression coefficient is upward biased (Maddala,

1997). In this study heteroskedasticity was tested for some suspected variables by running, heteroscedatic.

3.6. Definitions of Variables and working hypothesis

Dependent Variables

Quantity of seed purchased: It is a continuous variable measured in kilogram and represents the certified hybrid maize purchased by household farmers'.

Independent variables

It is hypothesized that household farmers purchased hybrid maize seed are influenced by the mutual effect of a number of factors.

Variables were selected as explanatory variables considering econometric theory, the outcome from previous literature and experience of farmers as the combination of these strategies would help to draw the relevant variables for the study. Based on the review of seed marketing system literature, past research findings and the researcher's knowledge of the farming system of the study area, among the large number of factors which were expected to relate to farmers' participate in quantity of seed purchased behavior 12 potential explanatory variables were considered in this study and examined for their effect in farmers‟ decision to purchase the seed.

The variables include institutional (number of extension contact, credit availability, and distance from the distribution store), demographic (age of the household farmers, sex, marital status number of family members and educational level) and economic (land holding size, annual income, cost of seed and quantity of fertilizer).

Age of the house hold head (AGEHH) – It is a continuous variables measured in years. Age of the house hold is the representative measure of farming experience of households.

(Arffasa Kiros, 2015) reviewed that, aged household are passive to participate in new marketing system where as young farmers relatively active to accept new marketing system. From these young household farmers participate the seed marketing systems and purchased hybrid maize seed. Hence, Age is expected to have negative signs of on quantity of seed purchased by household farmers.

Educational level of household head (EDUHH) Intellectual capital or education, measured in terms of formal schooling the household head is a continuous variable and assumed to have a positive effect on purchasing decision. The exposure of education should increase the farmers' ability to obtain, process, and use information relevant to the purchase of hybrid maize seed and thus thought to increase the amount of seed purchase by farmers. Kassu Kubayo (2009) stated that the better the education level the farmer has the better understanding concerning the knowledge of improved agricultural technologies. The better the education level the farmer has the better will be his accepting about the knowledge of improved agricultural technologies.

Number of extension contact (NUMEXCONT) it is a continuous variable measured by the average number of contacts the development agents make with farmer in a year. Extension service is considered as a source of information on utilization of agricultural extension. If the farmers get better extension services, they are expected to purchase than others. It is the major source of information of the household farmers. Gezahegn Walelign (2008) stated that the coefficient of extension service was found positively significant, which implies that regular visit of an extension worker is necessary to enhance the rate of adoption by providing necessary information, knowledge and skills to the farmers. The more the farmer has contact with extension agents the better he/she has information about input utilization or the purchasing power of hybrid maize seed varieties.

Number of family member (NUMFAMMEM) - It is a continuous explanatory variable and refers to the total number family members in the farmers. Large number of households will be able to provide large no of labor and to use huge amount of input.

Eleni Bisrat (2014) stated that number of family members increase the consumption amount of food in the house hold increase the volume of seed purchased by farmers. Hence it is expected to have a positive relationship with the dependent variable.

Income (Income HH) - It is a continuous variable that expressed the farm and nonfarm/off farm income of the household head during the survey year measured in birr. If the amount of income increases, the house hold farmers purchased agricultural inputs and make a decision to take risk for using new agricultural technologies. Getachew Merga (2010) agreed that the higher the gross income the better would be the ability of farmer to afford adoption of the new technology.

Land holding size (LANDSIZE) – This is a continuous variable measured in hectares. Land is a major asset in rural households. It can be taken as a proxy for wealth level. It has a positive relationship with hybrid maize seed purchased by farmers. According to Getahun Degu (2003) cultivated land per household is hypothesized to increase a farmer's adoption of new variety seed and fertilizer. The larger the farm area implies more resources and greater capacity to purchase inputs like fertilizer and improved seed. Therefore, this variable is expected to influence the amount of seed purchased by household farmers.

Credit availability (Credit) – It is dummy variable which (access to credit = 1, if not zero). It has a positive relationship with quantity of seed purchased by farmers. The accessibility of farm credit especially from formal sources is basic components of the modernization of agriculture and to increase productivity, those farmers who have access than no access to credit. Access to credit would improve the economic capacity of the farmer to purchase hybrid maize seed. Michaele Gebreselassie (2013) argued that the availability of seed credit especially from formal sources is vital components of the transformation of agriculture and to increase productivity. Those Households who have access to seed credit are believed to adopt technology more than those who have no access to credit.

Quantity of fertilizer (QUAFER) – It is a continuous variable, measured in quintal which refers to the utilization of NPSBR and UREA fertilizers to increase the production and productivity of hybrid maize production. This results in increase to the amount of hybrid maize seed purchased by farmers. The variable has significant or positive impact to purchase hybrid maize seed.
Eleni Bisrat (2014) concluded that use of complimentary inputs especially fertilizer application is very essential to increase the yield potential of hybrid maize seed.

Time of seed supply (TIMESEESUP)-It is the time at which the seed is available and supplied in quality and quantity for sale and deliver on time to the market. It is a dummy variable that takes a value of 1 if the household has access on time and 0 otherwise. According to Solomon Abie (2011) the household get the seed just on the time of planting along with the available resources can harvest and supply the maximum yield of hybrid maize seed thereby increase the income of the household. Before the seed is available for sale and the longer is stays in the market, the more farmers are expecting to purchase huge amount of seed.

Distance from the store (DISFSTOR) – It is a continuous variable measured in Km and the distance from home to the seed distribution center. This variable has a negative impact to the dependent variables, which affect the purchasing power of the household farmers. Previous study Abraham Tegegne (2013) stated that distance to nearest market is hypothesized to affect volume of vegetables sales negatively.

Cost of seed - It is a cost payed by household farmers to use the required amount of hybrid maize seed from the seed selling agents. It is a continuous variable measured in birr. The seed cost positively affects the amount of seed purchased by farmers. If the seed cost is expensive, the household farmers will have limitation to purchase, where as the reverse is true. Arffasa Kiros(2015) concluded that the price of improved seed is high farmer may have limitation to use demanded quantity of seed and the high the cost of seed the less quantity of seed farmers might have use.

Directly purchased from producer (DIPUPR) - It is dummy variable (purchase or yes=1, not purchase or no=0).Directly purchased seed affects the cost, time and preference of hybrid maize seed. In this system the farmers purchase hybrid maize seed with it.

Table (2) Independent Variables

Serial No.	Variables	Type	Hypothesized Sign
1	Age of households	Continuous (years)	-
2	Number of family members	Continuous (numbers)	+
3	Land holding size	Continuous (ha)	+
4	Distance from the distribution center	Continuous (Km)	-
5	Cost of seed	Continuous (Birr)	-
6	Directly purchased from producer	Dummy (1= yes, 0=No)	+/-
7	Credit availability	Dummy (1= yes, 0=No)	+/-
8	Annual income of household	Continuous (Birr)	+
9	Number of extension contact	Continuous (Number)	+
10	Quantity of fertilizer	Continuous (kg)	+
11	Educational level of household	Continuous (Number)	+
12	Time of hybrid maize	Categorical	+/-

(Source Own Survey, 2017)

4. RESULTS AND DISCUSION

This chapter deals with the analysis of the cross-sectional data and interpretation of analytical result which presents the major findings of the study under four sub sections. The first sub is section demographic and socio-economic characteristics of the household farmers'. The second section deals with the constraints of farmers to purchase hybrid maize seed in the study area. The third section presents performance analysis of the direct hybrid maize seed which includes marketing channels and margins of the seed system. The fourth section presents results of econometric analysis which contains the determinants factors of quantity of hybrid maize seed by using OLS.

4.1. Demographic and Socio Economic Characteristics

4.1.1. Demographic Characteristics of sample households

From the total sample respondents, 91.33% were male-headed households and only 8.67% were female-headed in the study area. In terms of marital status, whereas 3.33% of the household head were not married, 86.67% of the sample households were married, 4% divorced and 6% of the sample households were widowed.

Household farmers' age is considered as a key factor, younger farmers have the risk-taking behavior as compared to aged ones who have experience to benefit from the new technology. The minimum and maximum age of all respondents in the study was 36 and 66 respectively. The mean age of the total interviewer household farmers was 48.58 year with the standard deviation of 6.35.

Family size is the total number of family members of the household farmers. The number of the family can influence the livelihood of the household either positively or negatively. If the majority of the family members are in active labor force group, the households can obtain enough labor force and that enhances the chance to purchase hybrid maize seed. In such condition, family size is expected to have positive effect in hybrid maize farming of the household. The total number of family members of the respondents is from 1 to 11 persons per household and the mean family size was 6.01 persons per household with a standard deviation of 2.01.

The educational level of the household farmers is another decision factor in the adoption of new technologies. Of the total number of respondents, the educational status is from neither reading nor writing to grade 12, and the mean of education level is 4.46 grade and standard deviation of 2.64. There is a statistical difference between those attended class and illiterates. As the level of education is high, the household farmers are able to gain information with the participation of different training programs and accept information simply than the low grade level or illiterates.

Table (3) Quantity Demanded by Respondents' Demographic Characteristics

Variable	Category	Frequency	Percent	Mean QD	F/T-value
Sex	Household head in Male	137	91.33	16.19	-4.5389***
	Household head in Female	13	8.67	8.65	
Marital status	Not married	5	3.33		1.02
	Married	130	86.67		
	Divorced	6	4		
	Widowed	9	6		
Variable	Mean	Std.err	Min	Max	Corr.coeff
Education	4.46	2.64	0	12	0.9413***
Age	48.58	6.35	36	66	-0.8901***
Family size	6.01	2.01	1	11	0.6980***

***, **,*denotes significant at P<0.01, 0.05 & P<0.1 respectively Source own survey (2017)

4.1.2. Socio Economic Characteristics

This shows that the farm characteristics of the variable to purchase the amount of hybrid maize seed in the study area. Different characteristics associated to the farm owned by the respondent farmers' are among the major determinants of technology use decision.

According to Astewl (2010), farm household on the type of activities, and agricultural holders engaged with farm holding has been categorized in to three groups, there are crop only, livestock only and both crop and livestock (Multiple agriculture). Moreover, the household farmers produce more amount of production.

On this study the land holding size of the households was from 0.25 hectare to 2.75 hectares of land respectively. The mean farm sizes of the sampled households are 1.38 hectares with standard deviation of 0.57. The result of t-test analysis reveals that there is statistically significance difference between the dependent variable with respect to landholding size of the households is at 1% significance level. The landholding size of the farming increases the household farmer's product and productivity by choosing the improved variety seeds. The seed rate of hybrid maize in the study area was 25 Kg/ha (WARDO, 2017unpublished).

In terms of land utilization, the farm allocated to maize is less than other crops. According to respondent's, land allocated to maize is decreasing from year to year depending on the shortage of market access of maize production. In relation to the minimum and maximum sampled households' experience in hybrid maize seed users was in between 5 years to greater than 10 years. The major problem in this production system was shortage of market access, late delivery of inputs or the shortage of fertilizer and illegal seed dealers. Landholding size is appositive relation to the amount of seed purchased by household farmers.

The minimum and maximum annual income of respondents was Birr 13,700 to 98,000 respectively. The mean annual income of the total sample households was Birr 48,578.73 with standard deviation of 20,348.09. The income of household farmers was fundamental to the quantity of seed purchased. The t-test also showed that there is statistical difference between the dependent variables with respect to income of the households is at 1% significance level. The income the household increases the purchasing power also increases.

The minimum and maximum cost of seed incurred by the households to purchase hybrid maize seed was Birr 2460 and 5000 per quintal. The average cost of seed was a mean of Birr 3788.84 and standard deviation of 761.11. The result of t-test analysis reveals that there is statistically significance difference between the dependent variable with respect to the cost incurred by the households is at 1% significance level. This indicates that, there is free market in the direct seed marketing system to compare the seed producer with their price and seed quality.

The minimum and maximum amount of fertilizer used by household farmers is 1 and 5 quintal respectively. The average utilization of fertilizer was a mean of 2.93 quintal and standard deviation of 1.24. The result of t- test for the quantity of fertilizer was found to be at 1% statistically significant level. In this case the household farmers purchased greater amount of fertilizer similarly to purchase huge amount of hybrid maize seed.

Table (4) Quantity Demanded by Farm Characteristics of the Respondents'

Variable	Mean	Sta.err	Min	Max	Corr.coeff
Land holding size	1.381667	0.5739717	0.25	2.75	0.9167***
Quantity of fertilizer	1.675	0.7835076	0.25	4	0.5448***
Seed cost	3547.707	735.0304	2,000	4,480	-0.6028 ***
Income of the household	48578.73	20348.09	13,700	98,000	0.9216 ***

***, **,*denotes significant at P<0.01, 0.05 & P<0.1 respectively Source own survey (2017)

Institutional Factors

The minimum and maximum extension contact in the study area was 6 and 48 times respectively per year. On average the extension contact per year was 16.68 with the standard deviation of 11.06. The t-test shows that there is significance difference between the dependent with respect to extension contact at 1% significance level. The household farmers contact with the

development agent, in *kebele* level is to gain information with new technologies of agricultural inputs.

The type of extension contacts was mainly use of fertilizer, technical support for manure preparation and utilization, use of improved seed, weed control mechanism and market information to purchase improved seed. According to the survey result, in the *Kebele* level there were 3 extension workers, in the level of degree with department of plant science, animal science and natural resource.

From the total sampled households 94.67% of the households need credit and 5.33% of the sampled households needn't credit. In the direct seed marketing system there is no credit access. Of the total sampled households more of them need credit due to the shortage of money in the planting time. For this purpose, if there is credit access to solve the shortage of money, they can purchase hybrid maize seed.

The distance from household farmers from home to seed distribution center and measured in kilometer. The minimum and maximum distance at the respondents was walking on foot or in vehicles ranges from 1 to 15 kilometers respectively. The mean distance from the store is 5.22 Km and standard deviation 1.93.

Timeliness of seed supply system is particularly significant for small smallholder farmers. Having seed available for timely planting is critical to obtaining full benefit from its use. Out of the total respondent 28% have the seed was supplied before 1-2 week in planting season ,64% of the household responds the seed was supplied at the planting season and the remaining 8% responds let delivery or not supplied. There is no statically significant difference between the dependent variable and timeliness of the improved seed.

Table (5) Quantity Demanded by Institutional factor of the respondents'

Variable	Category	Frequency	Percent	MeanQD	F/T/value
Time of seed supply	before 1-2 week in planting season	42	28		1.9789
	at the planting season	96	64		
	let delivery or not supplied	12	8		
Credit availability	Yes	142	94.67	15.98	-3.8574 ***
	No	8	5.33	7.81	
Variable	Mean	Std.err	Min	Max	Corr.coeff
Number of extension contact	16.68	11.06134	6	48	0.8296***
Distance from the store	5.22	1.9312	1	15	-0.8954***

***, **,*denotes significant at P<0.01, 0.05 & P<0.1 respectively Source own survey (2017)

4.2. Determinant of quantity of hybrid maize seed

Based on the theoretical literature factors that are expected to affect the households purchase quantity of hybrid maize were employed in the model. However, before the actual inauguration of the data analysis in the multiple linear regression model the following diagnosis were taken.

Multicollinearity diagnosis test was taken to filter for variables that are dependent to each other. Prior to running the OLS regression model, all the hypothesized explanatory variables were checked for the existence of multi-co linearity problem. Based on the VIF result, the data have no serious problem of multicollinearity. The VIF values displayed in Appendix 1 have shown that all the explanatory variables have no serious multicollinearity problem Heteroskedasticity test was also carried out to test the presence of heteroskedasticity using Breusch-Pagan program.

It was found that there is no problem of heteroskedasticity (to see appendix, 2).In addition to this there is no Endogenity problems (to see appendix 3).

From the explanatory variables considering economic theory, findings from previous literature and experience of farmers as the combination of these strategies would help to draw the relevant variables for the study. These variables include demographic (age of the household head, education of HH, and family size), economic (land size, income, cost of seed), and institutional (credit, extension contact, distance to seed distribution centre, time of seed supply, directly purchased and quantity of fertilizer). Of the total hypothesized variables, seven of the mare statistically significant and can affect the quantity of seed purchased by farmers. The study shows that more of the explanatory variables are in line with their hypothesized direction.

The regression model explained 99.00 % (R^2 = 0.9864) the total difference of quantity of hybrid maize seed purchased by selected (respondent) farmers.

Seed cost: An increase seed price and other related costs by one birr would reduce seed purchase of household farmers by 0.00030 kg/ha. This indicates that as seed cost and other price increased, the quantity of seed purchased by farmer will be decreased in small amount of hybrid maize seed varieties. There are cases when farmers choose to blow non-improved varieties accessible in their neighborhood due to high seed price and economic constraints. The result concurs with the findings of Arffasa Kiros (2015).

Education level of the household: If the educational level of household head increased by 1year this lead to an increase of hybrid maize seed amount purchase by 0.4186kg/ha. This indicated that educated household farmers are gained information than illiterate ones and to purchase improved hybrid maize seed with risk adverse case. This result coincides with Arffasa Kiros (2015) who have reported significant and positive relationship with educational level and quantity of hybrid maize seed purchased.

Frequency of extension contact: An increase of extension contact by one unit can lead to an increase of hybrid maize seed amount purchase by 0.0300 kg/ha. This expressed that agricultural extension service can affect household head in the chance of purchasing hybrid maize seed varieties. As it has been concluded in several studies, extension contact has a positive effect on

adoption of improved maize varieties. Mohammed Urgesa (2011) suggested that access to extension contact avail information regarding technology which improves production that affects the marketable surplus. This result concur Michaele Gebreselassie (2013) who have reported significant and positive relationship of extension contact and use of agricultural technologies.

Distance from the distribution store: An increase the distance traveled by 1 km would decrease of hybrid maize seed amount purchase by 0.2568 kg/ha of seed. A study by Gezahegn Walelign (2008) concluded that farmers with closer contact or nearer to market area can get better information about the price of both agricultural input and output and other information which might help farmers to make decision. This implies that the distance of seed distribution store would affect significantly to the amount of seed purchased by farmers.

Age of the household head: Age is an important factor in the acceptance of improved varieties, previous studies showed consistent results of its effects. From the result obtained, as the number HH head age increases a unit, the quantity of hybrid maize seed purchased by HH head decrease by 0.1176 units This result coincides to Kassu Kubayo (2009) and Bedru and Dagne(2014) reported that, age of the household head was significant and negative relationship with agricultural technologies. Moreover Ashenafi Amare (2015) found that Younger household heads showed a better tendency of adopting new agricultural packages than older one. Household heads get older; they do not want to accept innovations as they expect production risks or high labor demand in using that technology. This indicates when the age of the household increases the probability of taking risk to use improved agricultural inputs would decrease.

Land holding size: Land is the significant factors of agricultural production. The study reveals that 1 ha increases in land size of the household leads to an increase the hybrid maize seed by 1.1738kg/ha and significant at 1% probability level. The landholding size returned appositive and significant effect in some studies. The findings in this study correspond to Gezahegn Walelign (2008) he found that farmers with better size of land will be interested to allocate their land for new technology.

Quantity of fertilizer-: Amount of fertilizer (NPSBR and UREA) to be purchased by household farmers' for the production hybrid maize seed production. Arffasa Kiros (2015) suggested that utilization of fertilizers (DAP and UREA) has statistically significant and positive impact on the

volume of seed to be purchased by the farmer households. This variable is positively associated the quantity of hybrid maize seed purchased by the household farmers' and statistically significant at 1% probability level. The study reveals that the purchasing power of one quintal increases in fertilizer leads to increase the hybrid maize seed by 0.235 kg/ha.

Number of obs=150,

R-squared = 0.9687

Prob > F = 0.0000, F (12, 137) = 9.66, Root MSE = 11.228, DF=137.

Table (6) OLS Estimation Results of Determinant of Quantity of seed purchased

QUAHYBRMAI	Coef.	Std. Err.	T
AGEHH	-.103238***	.0210181	-4.91
NUMFAMEM	.0720781	.0437553	1.65
LANDHOLSIZ	.852903***	.2622637	3.25
DISFROSTOR	-.176065**	.0712236	-2.47
COSSEED	-.0017415***	.000301	-5.79
DIREPURSEE	.02718	.1675393	0.16
CREADAVAIL	.4566373	.2992633	1.53
ANNINCOHH	.0000102	7.98006	1.28
TIMEHYBSEED	.0758898	.114418	0.66
NUOFEXCON	.0191532*	.0103058	1.86
QUFER	2.121878***	.2359675	8.99
EDULEVHH	.1910781***	.0714525	2.67
_cons	19.60936	1.772447	11.06

***, **,*denotes significant at P<0.01, 0.05 & P<0.1 respectively Source own survey (2017)

4.3. Analysis of Direct Marketing System performance

In the direct hybrid maize seed marketing the main actors are farmers with contractual farming, seed dealer and growers. The major accountability of seed producers are multiplying certified hybrid maize seed on their own farm plot with full agronomic practices, demanded variety and management according to contractual agreement. The accountability of seed producer companies is supplying hybrid maize parent materials by signing contractual agreement including seed market after crop harvest. Therefore, the crop is expected to meet certain standard requirements and criteria. The type of pricing structure in a production contract generally involves a price that is related to the price of a public variety. Usually seed price is determined ahead of harvesting time based on cost of production quality and quantity of seed. Contract conditions will vary from enterprise to enterprise based on objectives of the enterprises. Additionally, the marketing margin analysis was computed as follows below.

Actors	Cost	Added Cost	Selling Price	Gross Margin	%Total Margin
Farmers(growers)	400	550	950	550	34.38
ASE	950	1050	1950	1050	65.62
Total				1600	100
Farmers(Growers)	500	500	1000	500	33.33
ESE	1000	1000	2000	1000	66.67
Total				1500	100
Farmers(Growers)	500	500	1000	500	34.48
Ethio-Agriceft Seed Ent.	1000	950	1950	950	65.52
Total				1450	100
Farmers(Growers)	500	450	950	450	30
Yimam Tessema Seed Ent.	950	1050	2000	1050	70
Total				1500	100

Table (7) marketing margin in direct seed marketing system (BH-661) Source own survey, 2017)

In the direct seed marketing system, the final selling price of seed was different at a primary cooperative (selling agent) level. Therefore, the price of hybrid maize seed (BH-661) in ESE,ASE, Yimam Tessema seed enterprise and Ethio-Agriceft seed enterprise was 2000 birr/quintal, 1950 birr/quintal,2000 birr/quintal, and 1950 birr/quintal at seed selling centre through seed dealers. This price was the price which seed user farmers paid directly to take the seed through cash on hand basis. Based on marketing margin analysis, ESE was higher percentage margin than other actors in the seed distribution channel. This indicates that the actor

which incurred more cost gets greater margin. Next to that the contractual seed grower farmer shared with four seed enterprise (Yimam, ESE, ASE, and Ethio.agri. was 30%, 33.33%, 34.38% and 34.48% respectively from the consumer of the seed price (Table8).

Actors	Cost	Added Cost	Selling Price	Gross Margin	% Total Margin
Farmers(growers)	700	800	1500	800	33.62
Ayehu Zingeni Seed Ent.	1500	1580	3080	1580	66.68
Total				2380	100
Farmers(Growers)	800	900	1800	900	48.65
ASE	1800	950	2750	950	51.35
Total				1850	100
Farmers(Growers)	700	900	1600	900	40.91
Ethio-Agriceft Seed Ent.	1600	1400	3000	1400	59.09
Total				2200	100
Farmers(Growers)	700	800	1500	800	34.78
Yimam Tessema Seed Ent.	1500	1500	3000	1500	65.23
Total				2300	100

Table (8) marketing margin in direct seed marketing system (BH-540) Source own survey, 2017)

The final selling price of the seed was different at a primary cooperative (selling agent) level in the DSM. Therefore, the price of hybrid maize seed (BH-540) in Ayehu Zingeni Seed enterprise, Yimam Tessema seed enterprise, ASE and Ethio-Agriceft seed enterprise was 3080 birr/quintal,3000 birr/quintal,2750 birr/quintal,3000 birr/quintal at seed selling centre through

seed dealers. This price was the price which seed user farmers paid directly to take the seed through cash on hand basis. Based on the marketing margin analysis, Ayehu Zingeni Seed enterprise was higher percentage margin than other actors in the seed distribution channel. This indicates that the actor which incurred more cost gets greater margin. Next to that the contractual seed grower farmer shared with four seed enterprise (ASE, Ethio-Agriceft Yimam and Ayehu was 51.35%, 59.09%, 65.23% and 66.68 % respectively from the consumer of the seed price (figure, 4.2). From this, it can be concluded that farmers involved in hybrid maize seed production are beneficial next to the seed producer enterprise.

The system has shortened the lengthy, bureaucratic process of seed accessing and allowed the farmers to buy seed on time, with option from different seed producers. The quality and quantity of seed sold by the seed suppliers have greatly improved as the system established placed their accountability and traceability mechanism. Seed growers have got the chance to get feedback about the performance of their seed directly from farmers. It has also facilitated extension activities by development agents (DA) and minimizes work load of agricultural input experts and minimizes seed leftovers which were the main problem on the conventional system.

Direct seed marketing is short step process of moving packaged seed from the hoard of the enterprise where it is to be marketed to the farmer after processed and packed. The direct hybrid maize seed marketing is implemented in 40 woredas, by 420 selling agents (primary cooperatives), 13 private dealers and by 19 seed producers. In 2016/17 production year 44,608 quintal hybrid maize seed was supplied and 13,688 quintals sold. The average leftover seed was 28.96 %(BOA, 2017 unpublished).

The marketing channels of the seed distribution systems with the conventional seed marketing systems are; Seed producer's → Cooperative Union→ primary cooperatives→ consumers (user farmers). The marketing channels of the seed distribution systems with the direct seed marketing systems are; Seed producer's → consumers (user farmers). From the seed distribution channels, the direct seed distribution channels are short but the conventional seed distributions are long (BOA, 2017 unpublished).

4.4. Problems of farmers to purchase quantity of seed

The problems of farmers in quantity of seed purchased were identified during respondent survey. From the result obtained, market problems with their production, excessive production in similar season, shortage of the demanded variety, late delivery of input (hybrid seed and fertilizer), and expensiveness of inputs were identified and ranked according to their importance.

Variable	Category	Frequency	Percentage	F-test
Problems of farmers to purchase hybrid maize	Market problems with their production	96	64	5.54***
	Excessive production in similar season	20	13.33	
	Others(shortage of the demanded variety)	14	9.33	
	Late delivery of input(Hybrid Maize)	13	8.67	
	Expensiveness of input(Seed and Fertilizer)	7	4.67	

Table (9) Problem of farmers in the direct hybrid maize seed marketing (Source own survey, 2017)

From the result obtained, a market problem with their production was ranked as the first problems quantity of seed purchased by the farmers. The survey respondent revealed that currently to produce huge production, but the price of the product was cheap in the study area. From the purpose of this, many farmers didn't produce hybrid maize seed.

The second problems described by the sample respondents were excessive production in similar season. During the survey respondent, participants pointed out that there were market problems (production of maize) in the study area.

The third problem described by the sample respondents was mismatch with demand in terms of kind of hybrid maize seed. During the focus group and key informants discussion, participants pointed out that there was difference between the demands in kind and inputs delivered in the study area. From the survey result improved maize variety like Limu (P3812W) has got high

demand by the farmers for its high adaptability and yield potential. However, the delivered maize varieties were BH- 540 and BH-660, which were out of their demand.

The forth problems of farmers in quantity of seed purchased is late delivery of input (hybrid seed, chemicals and fertilizer). As crop production is associated with planting time, inputs should be delivered ahead of time. According to survey respondent, they suffered with problems regarding to the delay of inputs supply which in turn contributed pest attack and yield loss for lately planted crops.

The fifth problems of quantity seed purchased were expensiveness of inputs. As the survey result showed, the price of input (hybrid maize, fertilizer and chemicals) increased from time to time. The focus group discussion revealed that currently agricultural input price was escalated beyond the affordability of many farmers. The discussant mentioned that the price of fertilizer and seed increased by more than double fold comparing to past 2-3 years. This in return discouraged farmers to demand for production enhancing inputs. This may discourage them to search for improved hybrid maize seed with affordable price and otherwise the farmers not produce hybrid maize production and to replace the land by permanent plant.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary and Conclusion

The study was aimed at socio economic determinants of direct hybrid maize seed demand and marketing system performance in Mecha *Woreda*, ANRS.The specific objectives of the study were to analyze the performance of direct hybrid maize seed marketing system and identify the determinant factors affecting the demand of hybrid maize seed purchased by farmers in the study area.

The data were collected from 150 maize grower households interviewed using semi structured questioners. The households were from five major maize producing *Kebeles* in the study *Woreda.* The analysis was made descriptive and inferential statistics and statistical model. Seed marketing system in the study area is direct marketing and distribution system. These discovered that, many public organizations and stockholders are involving in hybrid maize seed system. All have different responsibilities with a series of distinct and yet highly mutually supporting activities. The outputs from each step serve as primary inputs into the resultant activities, and the economic returns to each doings depend on efficient performance of the others.

Moreover the seed marketing system is shortened the lengthy and bureaucratic process to access the hybrid maize seed of the system and to overcome the product and productivity of using new technologies i.e. improved hybrid maize seed. It allows farmers' to buy seed on time, with options from different seed producers with their choice. The quantity and quality of seed has sold greatly improved and placed with accountability and traceability mechanisms. The major problem of using or purchasing hybrid maize seed is the late delivery and expensiveness of agricultural inputs.

The descriptive statistics result shows that the hybrid maize grains are purchased mostly from cooperative unions, retailer, wholesaler and consumers. This indicates that the household farmers are now with the problems in market access with their maize grain production.

According to the study the productivity of hybrid maize is increased from year to year. But the main problem is lack of market information. Other problems to gain the survey data's are the cost of inputs increased from time to time, but the price of production decreased. And the supply

of inputs (fertilizer improved seed and Anti-pest chemicals) was a late delivery or not supplied by seed dealer shops. From the above problems the household farmers purchase illegally with high amount of price.

In similar ways from the FGD result, seed growers have got a chance to get feedback about the performance of their seed directly from farmers and also minimized seed left over which was the main problem on previous hybrid maize seed marketing system. Direct seed marketing system is the most preferable marketing system by their short chain, adequate price, free market and supply quality seed. The seed system is implemented only on single kind of cereal crops and going on less than half of the regional parts.

The key informant interviewer replied that, such kind of direct hybrid maize seed marketing system should implement in different other cereal seed and the system cover other eastern parts of Amhara Region. Other problems are the intervention of Region Bureau of Agriculture with the system, shortage of standardizes warehouse management system and lake of infrastructure in return back of the left over seed after sales, and delay of supplying basic seed.

The quantity of fertilizer is an important factor for the utilization of hybrid maize seed. Moreover, the direct hybrid maize seed marketing system is also inflexible to provide seed varieties of their choice to farmers. The seed producers supplied only 3 kinds of varieties within Mecha *woreda (*i.e., BH540, P3812W or Limu and BH661).

From the survey data the supply of hybrid maize seed varieties is limited or not supplied at all with their demand. Similarly the improved hybrid maize seed supplied by the producers are weighted from6.25-12.5 kg, smallholder farmers are likely to determine on the amount of quantity seed with their demand.

5.2. Recommendation

Increasing maize productivity and productivity remains an important goal for Ethiopia's agricultural policies. There is several policy instruments open to the government in that may positively influence input use and maize production. The following are the policy recommendations that can be deduced from this study.

The government should also consider a maize pricing policy and access to markets policies as it was seen that farmers with a higher degree of commercialization were producing more.
Farmers purchased certified seed; incur higher transaction costs. Therefore, policies that reduce the occurrence of transaction cost will minimize the burden on farmers and thus increase the production of hybrid maize and to insure food security of the households. These include policies that limit the risk of adulteration through tighter policing of actors along the hybrid maize seed supply and the seed producers must supply hybrid maize seed with affordable price and the government should subsidize the seed producers in different ways.

The distance from the seed distribution store is the main problem of household farmers to purchase hybrid seed. The problem solving methods are opening the seed distribution center and supporting and providing the extension service to private agents. As much as possible seed retailing shops has to be opened near to the farmers' home.

Intercropping can support to use improved seed and fetches good income encouraging farmers which has access to irrigation to use their land efficiently combining improved agricultural technologies. Frequent training of farmers on intensive current agricultural technologies utilization can improve productivity per unit area of the farmers to overcome shortage of land. Training and adapting double cropping system can be a solution for shortage of land to use improved seed.

The study concluded that accessibility of quality seed supplied at right time for planting has influence the demand for improved seed. Since farmers concern the seasonal nature of agricultural production, sowing the crop ones in a year using rain fed. So seed supplier has to make frequent review on planting time of different agro-ecological zone due to global climate

change and providing rain water harvesting and cultural method of production through irrigation to meet the accurate demand for improved seed.

Seed companies should be encouraged to increase the number of seed agents/distributors at the *Kebele* level. The Seed Company gives a certain capacity building to the seed dealers, to give extension service for the household farmers and announce your seed in different systems. This will intern increase competition, and shorten the seed value chain.

The government should consider input support policies which have also been seed to be cheaper to implement as compared to food relief programs. Policies that increase the flow of information from the extension to farmers are also proposed e.g. increasing the number of contacts between extension and farmers through funding of field days and demonstrations. To decide problems related to the use of production enhancing inputs by farmers, establishing efficient extension service in the study area is mandatory. In this regard, the extension organization should work in agreement with research centers and NGOs in updating knowledge to be transferred to farmers' research extension groups supported with relevant extension methods and approaches.

To decide problems related to the use of production enhancing inputs by farmers, establishing efficient extension service in the study area is required. In this regard, the extension organization should work in agreement with research centers and NGOs and supported with relevant extension methods and approaches. Likewise, the extension service should give attention in accessing information/knowledge to household farmers through including women groups in its program as to contribute in income generating activities and for accumulation of capital at household level.

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7. APPENDICES

Appendixes 1: Tests of Vif

Variable	VIF	1/VIF
EDULEVHH	8.35	0.119770
ANNINCOHH	6.88	0.145259
LANDHOLSIZ	6.05	0.165317
AGEHH	5.00	0.199922
DISFROSTOR	4.93	0.202888
NUOFEXCON	3.57	0.279778
COSSEED	2.31	0.433787
NUMFAMEM	2.15	0.464375
QUFER	1.60	0.623713
CREADAVAIL	1.30	0.769170
DIREPURSEE	1.22	0.820387
TIMEHYBSEED	1.09	0.918856
Mean VIF	3.70	

(Source own compilation, 2018)

Appendixes 2 : Tests hetrodusticety

Hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of QUAHYBRMAI

chi2(1) = 0.96

Prob > chi2 = 0.3281

(Source own compilation, 2018)

Appendixes 3: Tests of Endogenity

Tests of Endogenity

Ho: variables are exogenous

Durbin (score) chi2(1) = .025753 (p = 0.8725)

Wu-Hausman F(1,138) = .023697 (p = 0.8779)

(Source own completion, 2018)

AppendexTable3. 2008/09(2015/16) production year direct hybrid seed marketing system supply and distribution by seed Enterprise

Seed enterp.	Variety						Total	
	BH-660		BH-661		BH-540			
	Supply	Distr.	Supply	Distr.	Supply	Distr.	Supply	Distr.
ESE			2,125.1	1,916.56	1,629	1,371.38	3,753.73	3,287.93
ASE			6,822.68	6,369.86	6,231	5,567.83	13,053.61	11,957.68
AvaloIn.	4.88		1,275	808	696.54	650.54	1,976.14	1,458.8
Afriseed	2,371.60	2,369	3,502	2,390	1,762.1	1036.6	7,635.75	5,795.29
Ethioagrceft	2,824.98	2,718	3,727	1,640	243	52.25	6,794.93	4,410.03
Nile seed en.	5,60.80	5,60.80	393	379			953.3	939.68
Yimam			2860	2,252	686	647.63	3,545.9	2,899.38
Biniam					1,071.5	1,071.5	1071.5	1,071.5
Enaget	3,59.13	4,72	1,360	1,218			1,719.21	1,689.78
LomaandZ			518	262			518.3	261.88
Ayehu			338	226	6,009	5,282	6,347.23	5,508.03
Bayih-Mi	27	27	1,549	1,012	293.25	188.25	1,868.95	1,226.73
Semahegn			364	251			364.1	251.25
Aba-Belsti			1,359	705			1,358.76	705.23
Marwoled			50	32			50	32.3
Tsega	33.50	34	473	272	453	98	959.8	402.65
Freeland	82.80	80	20				102.8	80.4
Merkeb			473		504	268.38	504	268.38
Total							52,578	42,227

AppendexTable (4.) seed supplier in Mecha woreda by direct hybrid maize seed marketing

No	Supplier	Variety	Quantity supplied in qut	Quantity sold in qui	%distribution
1	ESE	BH540	71	71	100%
		BH661	220	173	78%
2	ASE	BH540	166	166	100%
		BH661	15	15	100%
3	Afri seed industry plc	BH540	25	2	8%
		BH661	225	178	58%
4	Yimam Tessema seed industry plc	BH540	168	131	78%
		BH661	1278	1278	100%
5	Ayehu zingeni seed plc	BH540	639	64	10%
		BH661	35	35	100%
6	Ethio Agri-ceft seed plc	BH540	5	5	100%
		BH660	530	530	100%
		BH661	192	82	43%

(Source: Region bureau of agriculture, 2017/18)

AppendexTable (5) Seed supplier participated in regional level

No.	Number of selected woreda	Number of seed producer enterprise	Number of sales agents	Supply of improved maize seed in quintal	Amount of improved seed to be sold in quintal	Left-over seed in%
2011/12	2	2	2	6,851	4,873	28.87%
2012/13	7	7	45	15,226	13,563	10.92%
2014/15	14	11	112	27,345.1	26,108.1	4.52%
2015/16	24	12	280	26,324.27	21,346.25	20.12%
2016/17	27	17	249	44,608	31,688	28.96%
2017/18	40	19	433	44,608	31,688	28.96%

(**Source:** Region bureau of agriculture, 2017/18)

Survey Questionnaires

Survey Questionnaires on Socio Economic Determinants of direct hybrid maize seed demand and marketing system performance in Mecha *Wored,* Ethiopia.

1. Household characteristics

1.1. Enumerator full name: _____ Signature _____

1.2. House-hold Head: a) Full name _____ b) Sex: male=1 female=0.

1.3. Marital Status: _____ married=1 single = 2 divorced = 3 widowed = 4

1.4 Family Size in Sex, Age, Education and (including the household head), Relation to household head, and Main occupation

No	Name of HH Members(1)	Sex		Age in years(4)	Education level(5)	Relation to HH Head(6)	Main Occupation	
		Male(2)	Female(3)					
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Code for (8) · Son/Daughter=1 · Wife/husband=2 · Parent=3 · Relative=4 · Employee=5

·Others = 6 specify ----------

Code for (9) · Farming = 1 · Animal rearing = 2 · House work = 3 · Student = 4

· Handicraft including Weaving/spinning/pottery = 5 others = 6 specify----------

1.5 Type of house you are living in. Grass roofed =1 Corrugated tin roofed = 2 both = 3

2. Income Source

2.1 What are your family major sources of income? Rank in order importance Sale of crops =1 Sale of livestock and/or products = 2 Off-farm income = 3 Non-farm = 4 5(specify).

Household Livestock production

Live Stock Type	Total Number	Remark
Cow		
Oxen		
Calves		
Bulls/Woifen		
Sheep		
Dog		
Donkey		
Horse		
Mule		

2.2. How much is estimated annual income of your family?)

Type	Amount of sales in quintal	Sales in birr
Maize		
Teff		
Finger millet		
Wheat		
Barley		
Vegetables		
Non-farm income		
Total		

2.3. What amount of money you earn annually from your income source?

2.4. Provide the information on the area covered and the yield obtained from the crops cultivated in 2016/17

2.5. Do you experience in hybrid maize seed production? Yes=1 No=0 If yes ---------- years

2.6. How did you get the information of hybrid Maize Seed varieties for the first time?

2.7. When did you start using hybrid maize seed varieties for the first time?

2.8. What is your annual income from hybrid maize grain production in birr?

2.9. In your opinion, which food crop would improve household incomes in your area? _____

2.10 Which crop do you produce for market in order of the importance _____?

2.11 What makes this crop suitable for commercial /marketing? _____

2.12 What are the major problems in maize hybrid seed marketing?

3. Farm Characteristics

3.1 Do you own land? 1 = Yes 0 = No. If yes, mention the source and size of farmland? 1. Own farm size_____ 2. From share cropping_____ 3. Rented from other source_____

3.2. If you do not have pair of oxen, how did you solve the problem of oxen shortage? Renting from others = 1 borrow from others = 2 support from relatives 3. Share of my lands 4.Exchange of oxen with my family 5.Others----------

3.3 What do you use for maize production? Irrigation=1 Rain fed=2 both=3

Irrigation land _____ha and rain fed_____

3.5 How did you allocate land to hybrid maize before 2016/17 1 = more than other crops 2 = equal to other crops 3 = less than other crops

If more than, other crops why? _____ If less than other crops. Why? _____

3.6. How did you allocate land to hybrid maize in 2016/17 1= more than other crops 2 = equal to other crops 3 = less than other crops. If more than other crops, why? _____ _____, If less than other crops. Why? _____ _____ .

4. Availability of hybrid maize seed

4.1Where did you get your hybrid maize seed in 2016/2017 production year? (Circle) ASE =1 ESE=2 Pioneer =3 BOARD=4 Merkeb Union =5 Yimam Tessema = 6 Ayehu Zingeni= 7

Why selected this seed source? _____

_____ .

4.2 How did you get the hybrid maize seed? During 2016/17(circle) Purchase=1 Loan/credit=2 Gift= 3 Barter=4 other =5specify _____

4.3. How many kg of hybrid maize seed did you purchase in 2016/2017_____

4.4 How many kg of hybrid maize seed did you plant in 2016/17 _____

_____.

4.5 Do you use local varieties or improved varieties 1= improved hybrid 2 = OPV 3 = local varieties

4.6 If local varieties why? Shortage of hybrid maize seed=1 price of hybrid maize seed was high = 2 lack of timely supply of hybrid maize seed=3 lack of credit to purchase hybrid maize seed=4 cost of local seed was cheap = 5 other = 6 specify

4.7. If hybrid maize varieties why? _____

_____.

4.8 Which hybrid maize varieties are preferred to you _____

_____.

4.9 If OPV varieties why? _____.

4.10 How many OPV maize varieties do you cultivate? _____

4.11 What is the average productivity of hybrid varieties on your land _____/ha

4.12What is the average productivity of OPV varieties on your land _____ /ha

4.13 What is the average productivity of local varieties on your land _____/ha

4.14 Which factors will motivate you to buy hybrid maize seed varieties? 1=Lower price 2= Better seed quality 3= New variety 4= Good extension advice 5=5Good awareness about Variety/seed 6= productivity 7= marketability

4.15 Do you buy the same hybrid maize varieties every year 1=yes, 0=No what were the Varieties? If no every what year you change new variety? _____

And why _____

4.16 Did you get the required hybrid maize variety of seed in 2016/2017? Yes =1 No=0 If no which

Varieties did you demand effectively and supplied to you? _____

_____

4.17 Did you get the required quantity of hybrid maize seed in 2016/17? Yes =1 No = 0 if no why? 1= less quantity 2 = excess quantity.

4.18 Did you get hybrid maize at right time in 2016/17? Yes = 1, 0 = No

4.19 Did you get the required quality of hybrid maize seed in 2016/17? Yes = 1 No=0

4.20 Did you get hybrid maize seed at the right place in 2016/17 yes = 1 No = 0

4.21 Did you get hybrid maize seed with affordable price in 2016/17 Yes =1 No=0

4.22 Did you get the required varieties, quantity, and quality of seed with affordable price at right time and place in 2016/2017? Yes = 1 No = 0

4.23 If yes, what benefit did you achieve? _____

4.24 Have you ever interrupted growing improved maize varieties since your start? Yes = 1 No = 0 If yes why? Seed not available = 1 Seed too expensive = 2 not adaptable varieties = 3 Susceptible to diseases = 4 Poor quality of seed = 5 other = 6 (specify) ____

4.25 What did you do when hybrid maize seed you required is not available? 1 = shift to other crops 2 = purchase from local market 3 = lending from relative or neighbor

4.26 In which years did you take this decision? _____

_____.

5. Bag size (Pack and Labeling)

5.1 Packaging

5.1.1 What was the packaging material for hybrid maize seed in 2016/17 crop season? Sisal sack/ 'Cloth bag = 1 Plastic sack '*Madaberya*' = 2 Sisal sack *'jonia'* = 3 others =4 (specify) ------

5.1.2 How many kg of hybrid maize seed was packed in one package during 2016/17 crop season? (Minimum) ----------Kg (Maximum) ----------kg

5.1.3 Was the type of bags or seed container convenient for you? 1= yes 0 = No, if No, what were the reasons _____

5.1.4 what is your preference of packaging weight in kg? In order of importance 0.5 kg = 1, 1 kg = 2, 2.50 kg = 3, 5 kg = 4, 6 kg = 5, 10 kg = 6, 12.5 kg = 7 others = 8 specify _____

5.1.5 What is your reason to prefer----------kg package?

1. ----------

2. ----------

3. ----------

5.14 What are your criteria to judge good quality of hybrid maize seed? Specify

1. ----------

2. ----------

3. ----------

5.15 Did you observe any problem in getting hybrid maize seed 2016/17? If any state 1= Quality problem 2 = Quantity of supply problem 3 = Timely supply problem 4= required variety (Type) supply problem

Due to the above problem did you lost any economic benefit? Specify----------

5.1.6 What measures to be taken to mitigate the above problem?

1. Quality problem ----------

2. Quantity of supply problem ----------

3. Timely of supply problem----------

4. Supply of required variety problem----------

5. If not supplied at right place _____

5.1.7. To what extent are you satisfied with the supplying system of the hybrid maize seed before 2015/2016? Not satisfied at all = 1, poorly satisfied = 2, averagely satisfied = 3, highly satisfied =4

5.1.8. Did you get the required hybrid maize variety of seed in 2016/2017? Yes =1 No = 0

5.1.9. Did you get the required quantity of hybrid maize seed in 2016/2017? Yes =1 No = 0

5.2 Did you get the required quality of hybrid maize seed in 2016/2017? Yes =1 No = 0

5.2.1 Did you get the hybrid maize varieties at the right place in 2016/17 yes = 1 No = 0

5.2.2 Did you get the hybrid maize seed with affordable price in 2016/17 Yes = 1 No = 0

5.2.3 Did you get the required variety, quantity, quality of seed with affordable price at right time and place in 2016/2017? Yes = 1 No = 0

5.2.4. Did you observe any problem in getting hybrid maize seed in 2016/17? If any state Quality problem = 1 Quantity of supply problem = Timely supply problem = 3. Required variety (Type) supply problem = 4

5.2.5. To what extent are you satisfied with the supplying system of the hybrid maize seed in 2012/2013? 1. Not satisfied at all = 1, poorly satisfied = 2, averagely satisfied = 3, Satisfied = 4 5 = highly satisfied

6. Timeliness and source of Hybrid maize seed

6.1 Is there demand assessment every year practically? Yes = 1 No = 0

6.2 How did you submit your hybrid maize varieties demand in 2016/17? _____

6.3 In which month your demand was collected before 2016/17 _____

6.4 Who did collect your seed demand before 2016/17? _____

6.5 Which month is the best to collect your demand _____ and why ___

6.6 In which month the seed varieties were supplied in 2016/2017 _____

6.7 In which month do you plant maize seed varieties in 2016/17_____

6.8 What are the factors which influence you to shift your first demand assessment in terms varieties and quantity of seed? _____

6.9 How often did you fail with your first assessment? Sometimes = 1 every year = 2 every 2 year s =3 what were the reasons _____

_____

7.10. Do you think that the formal system is efficient to get the hybrid maize seed? Yes = 1 No = 0 If no, what are the reasons _____

_____

7.11 How did you observe quality of seed from formal seed system before 2016/2017? 1 = V/ Good, 2 = Good, 3 = fair 4 = poor

7.12 If it was poor quality in terms of what? 1= broken seed 2 = rotten seed 3 = storage pest damage 4 = poor germination 5 = mixture 6= shriveled seed, 7 = Fake seed, 8 = Other (Specify)

_____

7.13 How do you rate the quality of seed from formal seed system in 2016/17? Rank as 1 = very good, 2 = good, 3 = poor

7.14 Would you rank the problems from your practical point of view by varieties and year?

7.17 How did you cope up with poor quality of seed mostly? _____

7.18 Did you buy seed of hybrid maize varieties to sow from local market? Yes=1 no=0

7.20 How do you distinguish whether seed or grain from local market _____

8. Price of Hybrid Maize seed Varieties

8.1 Is seed price and grain price are different on local markets most of the time? Yes = 1, no = 0

If yes when seed price _____ birr/ kg grain price_____ birr/ kg

8.2 What was the average price of hybrid maize seed before 2016/17production year? _____Birr/kg

8 .3 was the price of the seed from formal seed system affordable to you? 1 = Yes, 0 = No

If your answer is no, what was its impact on you in the use of improved crop inputs?

1= using small quantity of hybrid seed 2 = using local varieties 3= decision for not using

4= others (specify) _____

8.4 What was the average price of hybrid maize seed in 2016/17production year? _____ Birr/ quintal.

8.5. What is your opinion on the prices of maize hybrid in 2016/17? Fair = 1 expensive = 2 very expensive = 3

9. Road Infrastructure

9.1 Is there road facility which helps you for seed & inputs purchase and market out late?

Yes = 1 No = 0

9.2 What is the range of distance you travel to get hybrid improved varieties from your home before 2016/17 _____ kms or _____ hours?

9.3 What are the different means of transport you use to transport fertilizers and seed from the distribution center (FTC?) 1. Car _____ birr including you 2. Own pack animals, if rented _____ birr /day 3 on foot/human load

9.4 How frequent often you should go to seed distribution center to get the farm inputs before 2016/17_____

9.5 How about condition of main road during travel to seed distribution center?

1= Good all weathered condition 2 = only good during dry season 3 = Poor both during dry and wet condition

9.6 If the road is poor how do you cope up? 1 = walk on foot 2 =_____

9.7 Does the distance have negative effect on you to use agricultural inputs? 1. Yes 0. No

If your answer is yes, what do you suggest to improve the service? _____

_____

9.8. If the service cooperative/union / works on input distribution, being as a member what are the problems encountered during distribution and what is your suggestion to improve service delivery.

9.10 Problems encountered _____

_____

9.11 Suggested solutions _____

_____

9.12 Where did you purchase hybrid maize seed in 2016/2017? 1 = Conventional 2 = Direct marketing/dealer 3 = Other_____

9.13 If you purchased seed from conventional seed system from which enterprise/organization did you purchase in 2016/17_____

Why _____

9.13 If you purchased seed from direct seed marketing system from which enterprise 1=ASE2= Yimam 3 = Afri-seed 4 = Ayehu Zingeni, 5 = Free land 6 = Enaget 7 =Nile, 8 = ESE

Why _____

9.14 How many kilometers did you go to get hybrid maize variety and other inputs in 2016/17

_____

9.15 Do you think that direct seed marketing is useful in supplying and distributing the seed on time? Yes = 1, No = 0

If yes, in what form _____

_____

9.16 What were the main problems of conventional seed distribution _____

_____

9.17 What were the constraints of direct seed marketing? _____

_____

10.20 What were the advantages of direct seed marketing? _____

_____

11. Quantity of fertilizer used

11.1 What kind of inputs do you use in maize production? 1 = Herbicides 2 = Fertilizers 3 = Compost 4 = others (specify) _____

11.2. Did you use fertilizer in your maize plot in 2015/16? Yes = 1 No = 0

Crop type		Seed/kg	Price/qui	Fertilizer/kg						Manure	Chemicals	
				NPSBR	Price/qui	NPSZN	Price/quin	Urea	Price/qui		Type	Amount/kg/liter
Maize	PHB3253											
	Limu											
	BH540											
	BH660											
	BH661											
Teff	Quncho											
	Cr-37											
	Others											
Finger millet												
Wheat	Kekeba											
	Digelo											

Barley												
Others												

11.3 What was the reason for the above rate of fertilizer? Own experience = 1 Recommended = 2 others = 3 (Specify)_____

11.4 How about trends of your fertilizer utilization over time? Increased = 1 decreased = 2 Constant =3 stopped using =4

A) If increased why? To use full package = 1 enough supply = 2 reasonable price = 3 to improve productivity=4

B) If decreased why? Availability of compost = 1 land is fertile = 2 Fertilizer not available =3 expensive fertilizer price = 4, reduction in grain price = 5 others = 6 (specify) _____

11.5. What was the price of fertilizers in 2016/17 production year? a) DAP _____ Br/Qt; b) UREA _____ Br/Qt

11.8 How much kg of DAP & UREA fertilizers did you use for grain maize production in 2016/17? DAP _____ Kg & UREA _____

11.6 What constraints did you face on fertilizer use of maize? Inadequate supply = 1 high price = 2 absence of fertilizer on credit base = 3 bad weather = 4 no benefit = 5 late delivery = 6 others (specify) _____

11.7 Did you get fertilizers in time 2016/17? Yes = 1 no = 0

11.8 Did you get enough amount of fertilizer last season? Yes = 1 no = 0

11.9 Which method(s) do you use to control weeds in maize production? Hand weeding = 1, Herbicides = 2, both = 3, others = 4 (specify) _____

12. Credit services

12.1 What are your sources of finance for purchase of inputs? Crop sales =1 Livestock sales =2 Off-farm activities = 3 Credit = 4, Others = 5 (specify)

12.2 Did you borrow over the last three years? Yes or No

12.3.If not why?----------

12.4. If yes, for what purpose? 1. for consumption 2.for fertilizer 3.for seed 4.others

12.5.Do you access to credit to purchase seed?1.Yes 2.No

Name of credit service	In one year	In two year	In three year

13. Extension and information services

13.1. Did you get an extension service? Yes = 1 No = 0

13.2. If yes, frequency of contact? _____ (total number of visits per year)

13.3. Types of extension service given by the agents? Use of fertilizer =1 use of insecticide = 2 use of hybrid maize seed = 3 use of manure = 4 Weed control = 5 Crop rotation = 6 Home economics = 7 Use of credit =8 market information = 9 others =10 (specify) ____

13.4 Have you ever hosted demonstration or any other trials? Yes =1 No = 0 if yes which organization _____on _____ crop

13.5 Have you ever attended a field day or demonstration trial? Yes =1 No = 0.If yes, which organization _____ on _____ crop.

13.6 Did you attend any training program about hybrid maize seed production and marketing? Yes =1 No = 0 If yes, who organized the training for you. Das = 1 Woreda agricultural Office =2 woreda cooperative promotion office = 3 Multipurpose Coop = 4 Agricultural research Centers =5 University researchers = 8 contractor / Enterprise = 9 others =10 (specify) 13.8 If not why?

13.7 If yes, on how many training workshops did you participate per year _____

13.8 Where do you sell your maize grain mostly? 1= local market 2 = nearest town 3 = at farm gate 4 = central market

13.9 How many hours do you walk to sell your maize produce from home? _____ hr

13.10 When do you sell your maize grain production? Immediately at harvest =1, three month after harvest = 2, after storage at peak planting time = 3

13.11 Why you sell your maize grain production immediately at harvest time? Financial constraint s = 1, Lack of improved storage facility = 2, Fear of price drop due to weather condition =3, Storage pest = 4 _____

13.12 Who determines the price of your maize grain? _____

13.13 Who are the most purchaser of maize grain produce 1= Wholesalers 2= retailers 3=consumers 4= processors 5 = cooperative

13.14 At what time maize grain demand increases mostly? _____ Why?

13.15 How do you get maize grain market information? _____

13.16 Do you have a radio to listen to any agricultural marketing program?? Yes =1 No =0

13.17 If yes, how often? _____ (days/year)

13.18. What are the major factors/problems influence hybrid maize seed marketing efficiency systems in your areas? _____

Part B: Structured Questionnaires (Interview) for Woreda input supply system Experts, Process Owners, &WARD Office Heads

The interview issues are focused on performance of improved hybrid maize seed

1. Who supplies hybrid maize seed varieties to farmers? Explain----------
2. Who handled the transportation into this woreda?
   1: Producer 2: transporter 3: Self4: Other (specify) ……
3. Do you have access to storage facilities? 1.Yes 2.No
4. If your answer is yes, in question 3.describe ……
5. What kind of support services do you provide to farmers?
   1: Information 2: transport 3: credit facilities 4: guarantee
   5: If others, what are they? ……

7. Rank the following problems facing to farmers from the woreda for the socio economic determinant of hybrid maize seed marketing system in level of severity from 1-6

1. Extremely severe, 2. Very severe,

3. Somewhat severe, 4.Somewhat less severe,

5.Very less severe, 6.Extremely less sever

Item	Level of severity					
	1	2	3	4	5	6
Limited Varieties						
Late delivery						
Availability/long distance						
High price						
Inadequate quantity						
Poor quality						

8. Do farmers have the power to determine on the hybrid maize seeds they use?

Item	1=Yes	No=0
Type of Variety		
Quantity		
Price		
Purchase Time		

9. What factors influence the choice preference of hybrid maize seed varieties by farmers?

Ser.No.	Variety	Reasons for selecting the varieties
1	BH540	
2	BH543	
3	PHB3253	
4	JABI	
5	BH660	
6	BH661	

10. What interventions have been under taken to promote the availability, quality and hence the interest of farmers` in hybrid maize seed selection?

11. What institutional and regulatory frame works is available to strengthen local hybrid maize seed businesses in the woreda? Specify?

12. What is hybrid maize beneficiary farmers standard of living compared with other households in your area?

1: Poor 2: Average 3: Good

13**.** What types of complaint do you receive about the quality problems of hybrid maize seeds from farmers?

14. What strategies would you suggest to manage the complaint of farmers?

15. What are the potential strengths, limitations and threats of hybrid maize seed marketing and performance of the systems in the Woreda?

16. List the major impediments of the accessible hybrid maize seed marketing and supply system organization for seed sector development?

17. What approaches would you recommend to promote the development of farmer-based hybrid maize seed sector in the woreda as well as in the region in general?

Part C: Focus Group Discussion Issues with Woreda Input supply system Experts, Process Owners, and Woreda Office Heads

1. Woreda Hybrid Maize Seed Sector Development general problems ,major issue
2. Hybrid maize seed availability.
3. Hybrid maize seed quality& variety issues

   Quality: …….

   Variety: ……

4. Hybrid maize seed marketing, delivery, & pricing:

   Seed marketing: …….

   Delivery: …….

   Pricing: ……

5. Coordination /synergy between;
   - Seed partnerships:
   - Seed systems:

6. What are you doing to solve this problem at present? What else should be done?

7. Issues related to inter woreda/tabia level seed sector development partnership experience sharing discussions held if any;

□□Major issues;

8. Participation of the local seed sector development partners in woreda/tabia hybrid maize seed sector discussions:

   - The responsibility of the Partnerships' institutions:
   - Generating a common understanding for problem solving:
   - Awareness raising on regional & national seed policy:

9. What is the performance of improved hybrid maize seed marketing systems?

Explain in Strength----------

In weakness----------

Part D: Structured Interview Questionnaires for Tabia level Extension Workers

1. What kind of support services do you provide to farmers?

1: Information (awareness& training)

2: extension services

3: credit facilities

4: guarantee

5: If others, what are they? ……

2. What kind of support services do farmers search for?

3. What is the nature (quality, variety, quantity) of farmers hybrid maize seed demand?

Specify…….

4. Rank the following problems you faced from the woreda for the socio economic determinant of hybrid maize seed marketing system in level of severity from 1-6

1. Extremely severe,

2. Very severe

3. Somewhat severe

4. Somewhat less severe,

5. Very less severe,

6. Extremely less sever)

Item	Level of Severity					
	1	2	3	4	5	6
Limited Variety						
Late Delivery						
Availability/Long Distance						
High Price						
In Adequate quantity						
Poor Quality						

5. What is the demand of farmers for hybrid maize seed pricing in relation to the other local maize seed system? ……

6. What factors influence the choice preference of hybrid maize seed varieties by farmers?

Se.no.	Variety	Reasons for selecting the varieties
1	BH540	
2	BH543	
3	PHB3253	
4	JABI	
5	BH660	
6	BH661	

7. What is hybrid maize beneficiary farmers standard of living compared with other households in your area?

1: Poor 2: Average 3: Good

8. What types of complaint do you receive about hybrid maize seeds from farmers?

9. What strategies would you suggest to manage the complaint of farmers?

Part E: Data to be gathered from secondary sources

Existing maize production system:

1. Total cultivated land in the woreda (area, ha): ……

2. Total maize cultivated land in the woreda (area, ha): ……

3. Total area covered by maize (area, ha): ……

1: Local (area, ha): ……

2: Hybrid (area, ha): ……

4. Performance of hybrid maize seed production demand & supply system from 2006-2009E.C

Se.no.	Subject	2006	2007	2008	2009
1	Total household hybrid maize required, Kg(DD)				
2	Hybrid maize required(demanded)for cultivation, Kg				
3	Hybrid maize supplied, Kg				
4	Local price for maize seed production,(ave price/kg)				
5	Local price maize grain for home consumption,(ave p/kg)				
6	Selling price of hybrid maize seed to farmers, (ave price/kg)				
7					
8					

5. Maize area harvested, yield and production from 2006-2009E.C.

Hybrid Maize

Year	Area Harvested /hectare	Yeild(Kg/ha)	Production(quintal)
2006			
2007			
2008			
2009			

1. Hybrid maize demand & supply planning 2006-2009

Year	Stated/expected demand in quintals	Actual hybrid maize supplied to the region/BoARD	Actual hybrid maize supplied to the woredas	Hybrid maize sold to farmers/actual demand
2006				
2007				
2008				
2009				

2. Maize area harvested, yield and production from 2006-2009

Hybrid Maize

Year	Area Harvested /hectare	Yeild(Kg/ha)	Production(quintal)
2006			
2007			
2008			
2009			

3. Hybrid maize selling price 2006-2009E.C.

Ser.no	Subject	Type of Variety	Selling price (ave p/kg)Year			
			2006	2007	2008	2009
1	Ethiopia Seed Enterprise					
2	Amhara Seed Enterprise					
3	Ayehu Zingeni					
	Yimam Tessema					
	Freeland					
	Afriseed					
4	Pioneer Seed Enterprise					

Part F: Interview Questions for (ESE, ASE, Ayehu, Yimam, Ethio-Agriceft Board Input supply system& extension Process Owners

1. Who supplies hybrid maize to the region/Board: ……..
2. Suppliers location: …….
3. Do the supplier has stores either at regional and/or woreda level: 1.Yes 2.No
4. If the answer is no, in question number 3 who is the owner of the stores: ……
5. Explain the Average rainy months in the region:

……

6. List hybrid maize distribution channel in Amhara starting from the source/supplier
7. What unique Challenges are facing at every component of the common hybrid maize seed marketing and performance system in the region?

Hybrid maize seed sector actors	Unique challenges

8. What are you doing to solve this problem at present? What else should be done?

9. Have there been any scientific studies that benefit hybrid maize seed farmers? Yes No

Specify…….

10. What are the potential strengths & limitations and opportunities & threats of direct hybrid maize seed marketing system and their supply in the region?
11. What do you think are the major limitations of the conventional seed policies and laws?
12. Do current programs and policies facilitate to structure and guide seed sector development partners; public, private, NGOs, civil societies…….at regional and local levels?

Mentioned the regional and local level partners:

13. List the seed programs & policies that guide development partners

14. Are the prevailing regional seed policies indicate and differentiate the roles of the government, commercial seed sectors, and farmers themselves in hybrid maize seed oriented value chains to attain the development of the hybrid maize seed sector development? Yes No

 If the answer is yes, in question number14 specify each development partners role

 If the answer is no, in question number14what should be the role of the government & private seed systems?

15. Do the existing seed programs and policies support the diversified seed systems in the region?

1. Yes2. No

16. If the answer is yes, in question number15,

Describe……

17. List the major challenges of the prevailing hybrid maize seed marketing and supply system structure for seed sector development?

18. What mechanisms would you suggest to develop new farmers` based varieties of hybrid maize seed that can be fairly uniform and well adapted specifically to their local production conditions and preferences?

19. What strategies would you recommend to enhance the efficiency and effectiveness of both the formal & informal seed systems, and the proper integration at every component of the hybrid maize seed value chain?

20. Generally, what approaches would you recommend to efficiently integrate the demand & supply side and promote efficient and responsive hybrid maize seed marketing and their performance of the system in the region?

21. Briefly describe the critical regional socio economic determinant of hybrid maize seed sector development problems in terms of;

Major issues;

- ❖ Availability
- ❖ Seed quality assurance system
- ❖ Seed marketing, delivery, & pricing
- ❖ Coordination/synergy between;

- o Seed partnerships
- o Seed systems
- o Farmers practical realities, seed programs & policies

22. What are you doing to solve this problem at present? What else should be done?

23. Explain the regional or inter zonal/woreda/*tabia* level seed sector development partnership experience sharing discussions conducted if any in terms of these major issues;

- Participation of the private sector in regional hybrid maize seed sector discussions
- The responsibility of the Partnerships' institutions
- Generating a common understanding for problem solving
- Establishing an independent seed regulatory body
- Awareness raising on regional & national seed policy

"Free marketing in the regional seed sector"!