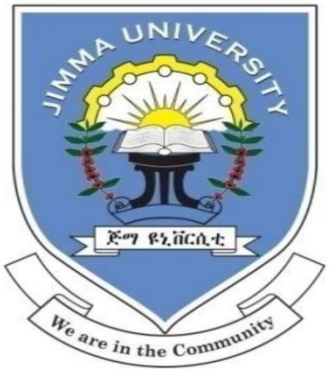
Factors affecting smallholder farmers maize production and market participation; in case of Dedo district, Oromia Regional state, Ethiopia

A Thesis Submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Business Administration (MBA)

BY

KENATE BEYENE TUKI



JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

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DECLARATION

I hereby declare that this thesis **"Factors affecting smallholder farmers maize production and market participation; in case of Dedo district, Oromia Regional state, Ethiopia.''**has been carried out by me under the guidance and supervision of Wendosen Siyum (Ass.professor) and Mirs Lalise Kumera (MA)

The thesis is original and has not been submitted for the award of any degree or diploma to any university or institutions.

Researcher's Name	Date	Signature
_____	_____	_____

CERTIFICATE

This is to certify that the thesis entitles **"Factors affecting smallholder farmers maize production and market participation; in case of Dedo district, Oromia Regional state, Ethiopia'',** submitted to Jimma University for the award of the Degree of Master of Business Administration (MBA) and is a record of confide research work carried out by Mr. *Kenate Beyene* under our guidance and supervision

Therefore, we hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree or diploma.

Main Adviser's Name	*Date*	*Signature*
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Co-Advisor's Name	*Date*	*Signature*
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ABSTRACT

Identifying factors affecting smallholder farmers maize production and market participation is the most important activities to achieve development. It is still hindered by subsistence oriented production system though there have been efforts to transform in to market oriented production system. However, in most cases smallholder farmers encounter lots of strenuous challenges such as lack of extension service and market information. Consequently, this study attempted to contribute to the consideration of factors affecting smallholder maize production and market participation in case of dedo district. A two stages random sampling technique was applied to select 192 sample maize producers, from 3500 total population of four kebeles to collect primary data through semi structured questionnaires. Both descriptive statistics and inferential analysis model were used for data analysis. Ordinary least square and two stages Henchman were applied to identify the factors affecting maize production and market participation respectively. The result of linear regression models shows that ages, education level, total lands owned, farming system, farm experience, family size, extension contact and crop rotation positively and significantly affect quantity of maize production whereas plot distance, soil and off-farm activities negatively and significantly affect maize production. Result of probit model analysis showed that ages, education, farming experience, frequency of extension contact, cultivated land for maize, means of transportation and access to market information positively and significantly affect farmers decision of maize output market participation :whereas participation on off-farm activities was found to affect the participation decision negatively and significantly. According to henchman second stage of truncated result, education level of the household head, land cultivated for maize and farm experience have significant and positive effect in the volume of maize marketed supply: whereas gender, credit accessibility, distance to the nearest market and off-farm activities were found to have negative and significant effects on volume of maize marketed supply. Therefore, this study recommends that, for the purpose of maize production, market participation and extent of participation among maize farmers, proper marketing infrastructure like maize market center should be put in place. The government and other policy makers should increase production and marketing information as well as ability of maize farmers through avenues like mass media, extension service, and other means of strengthens capability.

Key words: *factors, smallholders, production, participation, supply, market.*

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ACRONYMS

ARSA	Agricultural Republic of South Africa
ATA	Agricultural Transformation Agency
CSA	Central Statistical Agency
DDARDO	Dedo district Agricultural and Rural development Office
GDP	Gross Domestic Product
FAO	Food and Agricultural Organization
FSNWG	food Security and Nutrition Working Group
GTP	Growth and Transformation program
IFAD	International Food and Agricultural Development
MOFAD	Ministry of Food and Agricultural Development
SPSS	Statistical Package for Social Science
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations and International development Organization
USAID	United State Agency International Development
WB	World Bank

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

The majority of the population in Sub-Sahara Africa (SSA) lives in rural areas where poverty and deprivation is severe. It is estimated that about 70 percent of the rural poor in SSA depend on agriculture for their livelihood directly or indirectly (IFAD, 2011). Therefore, any poverty reducing strategies that focus on agriculture are more effective than other sectors in poverty alleviation. Commercialization changes the focus of production from consumption to production for the market; it translates into high productivity, greater specialization and subsequently higher incomes for smallholder farmers (Jaleta *et al*, 2009, p. 18).

Farming sector plays a crucial role in sub-Saharan Africa as it is indubitable on its significant share in national GDP, employ creation and prioritization in development agenda. It employs about 40% of the active labor force globally. In sub-Saharan Africa, Asia and the Pacific, the agriculture-dependent population is over 60%, while in Latin America and high income economies the proportions are estimated at 18% and 4% respectively (World Bank, 2006). In Ethiopia crop growing plays a essential role in scarcity lessening, food security and in general development by taking the share of the 36.2% of foreign exchange earnings and serves as a means of lively hood for about 83% of the rural residents (ATA, -2017 and USAID, 2018).

Maize is the sole most important crop in terms of both number of farmers engaged in cultivation and crop yield. Eight million smallholders were involved in maize production during 2008/09 production season, compared to 5.8 million for teff and 4.5 million for sorghum, the second and third most cultivated crops in Ethiopia, respectively. In 2007/08, maize production was 4.2 million tons, 40 percent higher than teff, 56 percent higher than sorghum, and 75 percent higher than wheat production (Shahidur *et al*, 2010). Ethiopia is one of a significant maize producer in Africa and the first among east African countries (Yallew, 2016)). Maize is Ethiopia's most important cereal commodity, as source of food for consumers and as source of income for farmers. Regarding production maize represents about 27.43% of the total cereal production and 16.79% of the total cereal area (WB, 2018). The smallholder farmers that comprise about 80

percent of Ethiopia's population are both the primary producers and consumers of maize (Dawit *et al*, 2008).

The Ethiopian government has put a lot of much effort in promoting agricultural productivity and efficiency of smallholder farmers since agriculture continues to be the dominant sector in Ethiopia's economy. Shahidur *et al*, (2010) showed that cereals account for 65 percent of the agricultural value added, equivalent to about 30 percent of the national GDP. The role of maize is central to agricultural policy decisions as a prime staple food for food security and overall development of the agricultural sector. The increase in crop production in the past decade has been due to increases in area crops cultivated areas. But to what extent the area cultivated can continue to expand remains an important question. Even expansion of cultivated area will have to come almost exclusively from reduction in pasture land. Given also high population growth and the limits of area expansion, increasing productivity by enhancing efficiency and intensive usage of resources will lead to achieve more yield and food supply to overcome malnutrition and poverty. Hence improvements in resource usage efficiency and increasing productivity will reduce encroachment of population to marginal agricultural lands.

Corresponding to this, subsistence production systems continuously dominate the sector in which 95% of total area under agriculture is cultivated by smallholder farmers who produce more than 90% of total output (USAID, 2018). Even though the massive contribution the sector provides, its significance is limited because of various factors and its characteristics of natural resources intensive, rainfall dependent and application of under required input and low output (MoARD, 2010).

Lately the growth and transformation plan also made agricultural growth as its core growth program as the national level and to maintain it as source of economic growth. Whatever, strategies and policies the sector is characterized by its low productivity in general and low maize productivity in particular. The reason behind for low production of maize in Ethiopia compared to other parts of the world is due to factors like fail to adopt improved variety seed, fail to apply fertilizer, and fail to have full access to extension services and which is followed by demographic

characteristics of farmers, institutional factors, environmental related factors and socio-economic issues (ATA, 2017).

The engagement of smallholder farmers in maize production contributes for the growth of countryside society and enhancement of rural living. It needs an enhancement in its production system and marketing of agricultural production. With this regards agricultural market participation has been considered as the integration of subsistence smallholder farmers into improved inputs and output markets with aim to increasing their income and by this reducing poverty (Mignouna, 2015). However in order to lift large number of rural poor's out of their poverty condition subsistence crop production cannot improve the rural income without a production system that is market oriented.

Markets offer households, of all sizes, the opportunity to specialize in agricultural production according to their comparative advantage. Markets are beneficial because they enable households the ability to experience welfare gains from trade. Particularly, for subsistence farmers, markets can be a tool for increasing their welfare, measured through the proxy of income. Better market participation is critical and key precondition for alteration of the agriculture sector from subsistence to commercial production (Tariku, 2018). Similarly, the smallholder farmers who engaged in subsistence farming have low marketable excess causing them to be in low symmetry poverty fissure. A bound that smallholder farmer need to make to lessen poverty and famine is to transform from the low production and low marketability subsistence farming to high level market oriented farming, by this they increases their production and market participation (Barrett, 2008). But the smallholder's market participation of maize output market encounter a lot of demographic, institutional, economic and marketing challenges (ATA, 2017).

It has been defined as a reason and result of development because when markets are accessible they provide an opportunity for households to sell their surplus output which increases their incomes and in turn buy other commodities and services they need. With increased income among poor households demand for other goods and services increase thereby motivating development (Boughton *et al*, 2007). Therefore, with most people in Ethiopia depending on agriculture for their

livelihood, particularly those involved in maize production, increasing market participation is one way that will pull them out of poverty and facilitate development.

The study area comprises mixed farming zones where crops are grown for food and cash. The major crops grown in the district are maize, wheat, barley, sorghum, and teff (DDARD, 2020). The district has potential of maize production while it's restricted by many factors. Relating with this there are many determine factors which affect smallholder farmers maize production and market participation in the region in general and Dedo district in particularly. As a result whether crop production is the one of the livelihood system in dedo district and where more than 80% of the households participate in cereal production mainly maize, wheat and sorghum DDARDO, (2020) the area covered for maize and the obtained within the district was 6,101ha and 256,242 quintal in 2018/19 respectively; which was low compared with the other parts of the country in terms of agro ecological zone of the area.

Despite the significance of maize in the livelihood of many farmers and income generating crop in the district, the production and supply is constrained by different factors. These include diseases (pests and virus causing drought), high transportation cost, lack of soil fertility, inadequate coordination between research center, lack of seed multiplication and extension, lack of market information, lack of access to appropriate storage and marketing facilities and poor infrastructure and shortage of access to bank credit. As result majority of societies living standard is under poverty line. Thus, the question of smallholder participation and level of participation in agricultural product marketing is of huge significance to policymakers seeking to encourage rural economic growth and poverty reduction (Barrett, 2008). Though, studies conducted earlier on maize sub-sector in Ethiopia Hagos (2014), Yallew (2016) , Walelgn (2019) did not touch factors affecting production, participation and intensity of market of smallholder maize producers in spite of the fact that it is essential for the agricultural development.

So that identifying the factors regarding the determinants of smallholder maize production and market participation is essential for making knowledge based decision that are geared towards improving the maize production and market participation of farmers in maize output market and contributes to the national development goals of eradicating poverty and improving food security.

Therefore, the study was emphasized on identifying factors affecting production and market participation of maize producer farmers in Dedo district.

1.2 Statement of the problem

previous studies explain that smallholders find it difficult to participate in markets because of a series of constraints that decrease the incentives for participation, which may be reflected in hidden costs that make access to markets and productive assets difficult (Makhura *et al* , 2001). Agricultural productivity remains low and most of the produced the farm products used for the home consumption by the farm households (ATA, 2015).

Despite the encouraging advances in other parts of the world poverty continues to be a matter of grave concern in Sub-Saharan Africa. Rural areas are often disproportionally ill-fated, and farmers lacking sufficient means to overcome the costs of entering the market may, with few alternative sources of income, be potentially stuck in a poverty trap (Barrett, 2008). A growing strand of literature suggest that trade policy, e.g. reducing tariffs and abolishing subsidies, will not be enough to trigger rural development (Barrett, 2008). Participation in well-functioning markets will naturally spur economic growth by an efficient allocation of resources and the exploitation of comparative advantages. There is a potentially important relationship between market participation and poverty in markets for food grains, i.e. staples, since these goods make up a considerable proportion of the consumption in a poor household.

In Ethiopia, maize production and marketing performance is insufficient and dominated by subsistence production practices. Therefore, agricultural policies that focus on farmers' livelihood enhancement through technology implementation and crop productivity should go related with market participation and market development. Good-looking the production and marketability of the farmers' agricultural commodity is considered as a central goal towards achieving the overall of goal of the national development of Ethiopia (Dejene, 2015). Maize is the most vital cereal commodity in Ethiopia, in which used for consumption and means to generate income by farm households (Aman, 2014).

Supply of agricultural crop in the study area is subjected to seasonal variation where surplus supply at harvest and surplus supply later on is the main feature. Parallel to other part of the country, whether the study area is endowed with different natural resources, agricultural production which includes maize production in the region is not sufficient (FSNWG , 2010). The nature of the product on the one hand and lack of properly functioning marketing system on the other, often resulted in lower producers' price. The study area comprises mixed farming zones where crops are grown for food and cash.

Among producing crops wheat, rice, teff, sorghum and maize are crops farmers usually market them for their cash purposes, Hence different studies have been conducted in different areas about marketing aspects of these crops, for example teff and wheat were conducted by Asfaw (2012) in Halaba district, marketing system and the reasons for high price increase by taking three major staple food grains in Ethiopia: maize, wheat and teff. However, marketing aspects of maize crops were not undertaken in the study area which have potential production volume and marketability problem of maize at all levels and the socio economic variable change and their influence on the quantity supplied of maize still unresolved in the study area. This made the undertaking of marketing analysis of maize crops in the woreda good looking. Therefore, the study was designed to address the prevailing information gap on the subject and contribute to proper understanding of the challenges and assist in developing improved market development strategies to benefit of smallholder farmers, traders, and other market participants.

According to Olwande and Mathenge (2012) and Benjamin *et al*, (2014) there are many factors which affect farmers' market participation which include farmer's characteristics, private asset variables, transaction cost variables, public assets variable, membership of cooperative and amount of output produced. The challenges which affect maize production includes demographic and personal characteristics of farmers, institutional factors, accesses to key inputs like improved seeds, fertilizers, agricultural extension services and environmental related factors which includes irregular rainfall patterns and overall environmental degradation leading to increasingly heavy pest and weed incidence in maize producing areas.

As a result of low maize production rates farmer's marketed surplus is also low. Relating to this maize production and other agricultural crop production are subsistence in nature, rain fed and the amount of maize output supply to the market varies from season to season. Beside this, while within the district various agricultural production activities were carried out mainly crop under consideration; but most of studies conducted in the region including the study area given high emphasis on livestock sector Birhanu, (2012) ; Bultossa, (2016), fishery sector Hussein *et al*, (2010), and socio economic and environmental impact of large scale agricultural investments, which leaving factors affecting production and market dimension of crop production as whole and maize in particular. This depicts factors which determine smallholder farmers maize production and market participation and the status of maize market participation in the study area is unknown.

Conversely, marketing aspects of maize crops were not undertaken in the study area which have potential production volume and marketability problem of maize at all levels and the socio economic variable change and their influence on the quantity supplied of maize still unsolved in the study area. Hence, the study was designed to address the existing information gap on the area under discussion and contribute to proper considerations of the challenges and support in increasing better market expansion strategies to benefit of smallholder farmers, traders, and other market participants.

Therefore, this study contributes to the above mentioned issues, through identifying and seriously, examining factors hindering maize production and market participation of smallholder farmers in dedo district. In addition to identification of problems, providing knowledge which contributes for appropriate overview about obstacles in production and market participation sides of maize which helps to reach necessary interventions to deal with these problems.

1.3 Research Questions

In this regard the study attempted to answer the following research questions:

1. What factors affect maize production of smallholder farmers in the study area?
2. What factors affect farmers' market participation decision?
3. What factors affect volume /intensity of maize supply in the study area?

1.4. Objectives of the study

1.4.1 **The general objective** of this study was to identify factors affecting smallholder farmers maize production and market participation in Dedo district, Oromia regional state, Ethiopia.

1.4.2 **The specific objectives of the study:**

1. To analysis factors affecting maize production of smallholder farmers in the study area.
2. To identify the factors affecting of smallholder farmers market participation decision.
3. To identify factors affecting the volume/intensity of maize supply in the study area.

1.5 Scope of the study and limitations of the study

This study focused on identifying and analyzing the factors affecting of smallholder farmers maize production and market participation in Dedo district, Oromia regional state, Ethiopia. The study addressed only one woreda in terms of location selected. The study also analyzed factors affecting smallholder farmers maize production and market participation only; due to this the study will not depicts the overall status of farmers overall maize production and market participation.

1.6 Significance of the study

This study would contribute to the knowledge of the factors affecting the production and market participation of smallholder maize producer farmers in the Dedo district. It would be therefore, a significant addition to the body of knowledge on maize production and market participation in the region. Through its contribution to the body of knowledge, the study will help inform policy makers and in guide the formulation of the policy that focus on factors affecting maize production and market participation. Also both government and nongovernmental organizations those who are engaged in the development of maize crop production and marketing sub sectors would be benefited from the results of this study. The study will also help full as source of document for researchers who will focus on the studies of the same or related kind in other parties of the countries.

1.7 Organization of the thesis:-

This thesis was organized under five chapters. The remaining parts of the thesis are organized as follows. Chapter one was introductory part, chapter two was literature on theoretical and empirical evidences that support and guide this study. Chapter three was research methodology (description of the study area, data types, sources and methods of data collection, sampling procedures and sample size determination, methods of data analysis, and variable definition) of the study. Chapter four present results and discussion (descriptive and econometric/inferential results) and present and discusses in detail. Chapter five will summarizes, conclude the main findings of the study and draws recommendations

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1 Theoretical literature

2.1.1 Definition and Basic concepts

Smallholder farmers are defined in various ways depending on context, country and ecological zone. This explains interchangeable use of the term 'smallholder' with 'small-scale', 'resource poor' and 'peasant farmer'. The World Bank's Rural Development Strategy defines smallholders as those with a low asset base, operating less than 2 hectares of cropland and depending on household members for most of the labor (Word Bank, 2014). FAO study defines smallholders as farmers with limited resource endowments, relative to other farmers in the sector (Dixon *et al*, 2015). According to Escobal *et al,* (2016), smallholder farmers are farm households with access to means of livelihoods in land relying primarily on family labor for farm production to produce for self-subsistence and often for market sale. These definitions have a similar theme in the characteristics of smallholder farmers, namely constraints in land and labor. Smallholder farmers differ in individual 12 characteristics, farm sizes, resource distribution between food and cash crops, livestock and off-farm activities, their use of external inputs and hired labor, the amount of food crops sold and household spending structure.

Market: it is a place or a point within which force of price making operates and exchanges of title tend to be Accor moaned by the actual movement of the goods and services being transacted (Beckman and Davidson, 1962). According to Boughton (2007), it provides house holds the opportunity to benefit from trading their produces and it enables them to sell their surpluses and purchase goods and services they need, based on comparative advantage.

Marketing: According to Kotler, Armstrong (2003), Marketing is a societal process, by which individuals and groups obtain what they need through creating, offering and freely exchanging products, services and values with others. Marketing involves the movement of produces from their point of production to the point of consumption (Gondi *et al*, 2014).

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2.1.2 Maize production

In the global viewpoint maize production is linked to technology. Maize is one of the most important cereal crops in the world, in farming economy both as food for human beings, feed for animals and other industrial raw materials. It is one of the world's leading crops cultivated over an area of about 142 million hectares with a production of 637 million tons of grain. In Nepal, the current area planted under maize was 849,892 ha with an average yield of 2.02 t ha (CBS, 2014). It is estimated that for the next two decades the overall demand of maize will be increased by 4% ~8% per annum resulting from the increased demand for food. Such increase in demand must be met by increasing the productivity of maize per unit of land, (Paudyal *et al.*, 2001;Pingali, 2001). Conversely, over the decades, the farming production including maize has either remained immobile or improved at a very slow rate (Kaini., 2004).

Effective maize production depends on the right application of production inputs and a good practice of farming that will sustain the Environment as well as better-quality variety of seed, fertilizer, weeding chemicals, insect and disease dealing chemicals, tillage through improved mechanization, proper harvesting, marketing issues of raw materials and availability of financial resources(ARSA , 2003)

Most of the maize produced and consumed in Africa comes from smallholder rural farms. Production takes place under difficult conditions characterized inter alia, by poor soils; low-yielding varieties; inadequate access to yield-enhancing inputs such as fertilizers and improved seeds; inadequate access to finance by producers, suppliers and buyers; and variable climatic and environmental conditions. According to CHUMO,(2013).Africa produces 6% of the total world maize production, most of which is used for human consumption Governments in East and Southern Africa have given top priority to maize production, because maize in this sub region is as important as rice and wheat in Asia. Maize is an essential crop for food security of Ethiopian households and is a source of calorie available at the lowest cost compared to all other major cereals (Bealu *et al* , 2013). On average Ethiopia consumes a total of 1,858kilocalories daily of which four major cereals (maize, teff, wheat, and sorghum) account for more than 60percent, with maize and wheat representing 20 percent each (Shahidur, 2010). It has also continued to be an important cereal crop in the SNNPRS as a source of both food and cash income (Degu, 2001).

2.1.3 Market participation: refers to the markets actors‟ decision on whether to be involved or not in the flow of produces from producers to end consumers (Yaynabeba , 2013). Majority of smallholder farmers in rural areas are surrounded in a vicious circle of poverty characterized, *inter alia*, by low economic returns due to low market participation. Poverty reduction and improving the livelihood of the rural smallholders has strong relationships with their market participation (Mathenge *et al*, 2010). Increased market participation by the poor has been found to be vital as a means of breaking from the traditional semi-subsistence farming and a key factor to lifting rural households from poverty.

The importance of participating in product markets is based on the evidence that incomes and, thus livelihoods of smallholder producers are likely to improve if they have better access to markets for their produce (World Bank, 2008). Market participation is a major pathway for rural people in assuring better income and improving their food security. Improving access to markets has paramount importance in increasing smallholders‟ market participation and the extent of their participation, *ceteris paribus* (Key *et al* , 2000). However, smallholders do not often participate much in food crops markets due to subsistence production and also higher costs associated with searching for markets (World Bank, 2008; Jayne *et al*, 2005).

2.1.4 Maize production in Ethiopia

Maize is Ethiopia's leading cereal crop in terms of production with 6.2 million tons produced in 2013 by 9.3 million farmers across 2 million hectares of land (CSA , 2013). Majority of smallholder farmers produces maize in Ethiopia, as compared to other cereals their production dominate the countries overall maize Production, by producing 95 percent or nearly 9 million tons of maize. Maize grows under different ranges of environmental situations in Ethiopia that is especially between 500-2400m above sea level. In Africa Ethiopia is considered as a significant producer of maize and still the country have the potential to enhance the production level. In terms of cultivated area, it is the second most widely cultivated crop next to teff. Ethiopian farmers grow maize, primarily for subsistence with 75% of all maize output consumed by farming households, making it a key crop for overall food security and for economic development in the country (USAID, 2018).

Maize production system in Ethiopia varies from place to place. The production practices commonly found are mono cropping, intercropping, and relay cropping or double cropping with different crops such as beans, horticultural crops and forage crops. The crop fits into different crop sequences and crop rotations based on soil fertility and environmental condition in different areas. It is grown mostly in the main growing season known as *meher*, which depends on May-September rainfall. The crop is also grown in petty rainy season locally known as *belg*, which relies on January-April rainfall. During the chief season, it is grown under rain-fed situations, whereas during the off-season it is grown frequently under residual moisture at bottomlands with supplementary irrigation (Mosisa *et al,* 2012.).In Ethiopia the national average yield is about 3.9 t/ha(CSA, 2018).The key maize producing zones in Ethiopia includes East Wollega, west gojam, and west and south Eastern shoa, together, they produce over half of the total maize production in Ethiopia. While maize is Ethiopia's most important cereal commodity; there are several constraints which continually affect maize Production. Rashid (2010) states that low in put usage; limited crop rotation and significant Post-harvest loss of 15 to 30 percent of production are among the factors which decrease the Production of maize below the potential level in Ethiopia.

2.1.5 Farm Inputs

To achieve high productivity in maize production, the amount or quantity and quantity of inputs used is paramount. The required amount of input and quality of farm inputs are an essential prerequisite for high maize yields. Land, water, chemicals such as fertilizers, pesticides and herbicides and high-quality seed are among key inputs for maize production (IPBO, 2017).

Among the needed farm inputs, seed is recognized and considered having the highest ability of boosting on-farm productivity potential of all other agricultural inputs. Improved Yields or output and the productivity since seed determines the actual amount of crop Varieties of seed are essential agricultural inputs that supports farms to obtain improved Agricultural yields. The genetic manipulation of selective breeding improved the productivity and value of crops obtained. Chemical fertilizer is another important input to increase smallholder farm production. This is because the use of organic and inorganic Fertilizer help to improve the soil fertility status if soil fertility is not improved the use of other Technologies such as high-yielding varieties will not have a significant impact (Bihon, 2017).

2.1.6 The role of market participation

Effective markets can potentially play an important role in ensuring agricultural transformation in SSA by improving rural incomes, enabling efficient allocation of resources, reducing poverty and improving livelihoods (Etuk , 2013).

Barrett (2007), notes that the presence of markets and increased market access are vital requirements for the integration of rural smallholder farmers in the global commercialized economy and for growth of agrarian societies. Development corporations and policy makers have emphasized the relevance of agricultural marketing for development. In order to increase smallholder farmers' output, the focus should be on markets that effectively emphasize greater use of specialized production methods. For smallholder farmers to fully exploit the potential offered by market participation there is a need to have strong institutional capacity and policies that support market development (Barrett, 2007). Market access and participation are major determinants of productivity (Gebremedhin *et al*., 2009). It is generally expected that farmers with good market access, specifically, those who are able to sell their surplus output and in turn buy goods and services, will be relatively more willing and incentivized to commercialize their produce than those with poor market access.

2.1.7 Maize marketing in Ethiopia:-

Farmers still sell their surplus maize in the open market to local consumers, assemblers or to regional traders. Farm level storing facilities are insufficient and producers often sell their marketable surplus directly after harvest when prices are lowest. Trade takes place as a "cash-and-carry" transaction. Buyers and sellers meet personally, negotiate prices and inspect the grain on the spot and complete the transaction with cash payment to the seller/farmer. As there is no reliable market information and organized exchange systems, buyers and sellers have to bargain and negotiate to arrive at mutually agreed prices. Because of producers' lack of market information, the role of brokers in the exchange system is substantial (FAO, 2015).

The number of traders at primary, secondary or central market levels has increased considerably, and many operate without licenses, undercutting formally registered traders Demeke *et al*, (2012)**;** no study has estimated this number yet. Since access to capital is limited, most traders have to sell the produce they buy as quickly as possible, rather than store it for sale later during

the lean season. Such a system is highly inefficient because it involves several levels of marketing and introduces huge overheads on the final market price (Rogstadius , 2009). In totaling to absence of storage, famers have inadequate income to employ (e.g., for clothing, to repay debts and other social obligations) and they settle those obligations by selling to assemblers immediately after harvests at a low bargaining power.

The supply market is also uneven as a result of the small volume held by traders and the limited number of large scale buyers. Large buyers also face the challenges of procuring a uniform and consistent supply of quality maize because there is no formal quality control infrastructure such as instruments for checking the level of moisture content, color or size, resulting in concerns about the presence of infections(Rashid *et al*, 2010) With no standardization and quality assurances, grains have to be inspected visually and repackaged every time they change hands, which likely increases the marketing costs along the value chain.

2.1.8 Empirical Review

Smallholder farmers' production and marketing influenced by many factors, including natural factors and manmade factors. These factors hinder their ability to produce more of the product and supply to the market collectively. According to Masuku (2001) assessed the factors influencing the choice to trade maize and alternative of marketing chain by smallholder farmers in Swaziland by means of a logistic regression. The study originate that the result to participate in the maize market was inclined by off-farm income activities, past experience, access to information, participation in agricultural schemes, family members without education, and farm size. The alternative of the maize selling succession was influenced by transportation costs and farm size. As a result, efforts to facilitate farmers to easily access farming information in a manner that they can understand would be among the other factors that needed progress. In addition, the study suggested that policies that would enable farmers to classify themselves and their marketing activities to reduce transportation costs and increase the area under cultivation be intended to ensure competent utilization of the formal markets and subsequently improve farmers‟ income. Maluku's study concentrated on market participation decision only whereas the present study stretched its objective to encompass market participation decision and degree of their participation. The previous study was benefited the existing study in identifying factors affecting market participation decision.

Gebremedhin and Hoekstra (2007) considered cereal marketing and household market participation in Ethiopia, with respect to teff, wheat, and rice. The study aimed at analyzing the market participation of farm households, market actors, market channels, and determinants of household market participation for these crops. Descriptive statistics and regression analysis were used. The study found that smallholder farmers‟ participation in agricultural marketing had a significant role in improving the use of agricultural inputs and enhancing productivity apart from increasing production. The result of the study revealed that important market places for buyers are either those located at the district urban centre or in the peasant associations within the district. This disguised that markets outside the districts were not significant for producers and the vital selling channels were wholesalers and urban collectors for the crops. The study is relevant to the current one in developing appropriate method of characterizing marketing channels and identifying important buyers for producers output in the markets.

Mussema and Dawit ,(2012) evaluated the market chain of red pepper at HSD and Silti zone of Ethiopia. The objective of the study was to identify factors affecting volume of pepper supply. The study used a Heckman two-stage model to assess the factors that affect red pepper producers‟ output market participation. The study found that the quantity of red pepper produced and extension service had positive and significant influence on market participation, while yield of cereals had negative and significant effect on market participation. The study also found that livestock numbers and non-farm income negatively and significantly influence the amount of red pepper supplied to the market.

It was concluded that policies that would improve pepper production capacity by identifying new technologies and create stable demand for surplus production would enhance farmers‟ decisions on marketable surplus. As a result, policy should be designed on integrated farming system to minimize income risk and to improve the livelihood of the farmers. Lapar *et al*, (2002) studied that, except for the level of formal education, all factors that affected market participation also affected the extent of market participation.

In general, smallholder farmers crop production and market participation to raise level of product supply to market influenced by many factors such as resource ownership:- land, oxen, livestock,

money; demographic characteristics such as education, age, gender and government policies as of (Masuku , 2001; Gebremedhin and Hoekstra , 2007 and Mussema and Dawit , 2012).

2.1.9 Analytical framework

A farmer's decision to participate in markets is influenced by many socioeconomic, institutional and farm specific characteristics. To analyze smallholder's market participation and intensity/ amount of maize supply different scholars used different models. Tobit model was suitable to show the participation to market and extent of participation at the same time but those variables affecting market participation can affect the sales volume/ extent of participation decision assumed at the two stages together. This is the main problem of tobit model, which is considered as the limitation which cannot properly explain the effects of the variables, because those variables that significantly affecting affect may not predict the status. Tobit is limited which indicates that it is observed if and only if it is below or above some entrance or cut off levels i.e. left and right censoring, hence it is called censored regression model. Based on this the model assumes that zero values of market participation related with non-participation of farmers are the results of their rational choice i.e. non- participant farmers are decides to sell noting in the market. This is to mean that tobit model is inefficient model, to predict market participation and extent of participation. This is why some empirical studies consider that tobit model is not adequate thus uses of alternative approaches are suggest (Fernando , 2011).

In this case since the variables to be assumed are market participation and volume of market supply, the double hardle model prfered which consists of two stage process. The study used the Heckman's two step procedure because of its ability to handle the anticipated problem of selection bias in the sample The Heckman two-step uses the probit model and it is the first stage to determine the probability of selling in the market or market participation decision and the second stage is the extent of marketed supply. It uses the probit model to identify factors that affect decision to participate in the marketing and a truncated regression model to analyze the participation by the participating households in the second stage (Heckman , 1979),

Hickman's sample selection model is designed to account for the reality that the observed sample may are non-random. It uses the probit model to identify the factors that influence decision to participate in the market and in the second step, uses the ordinary least squares (OLS) regression estimate to determine the household extent of participation, under henchman two stage, the bias

that results from omitted variables bias is eliminated, for the case of censored samples method. The model implies that observed zero level of participation are the result of participation decisions only i.e. zero observation in the outcome equation is due to first hurdle. It assumes that there are no zero observations in the second stage once the first-stage selection is passed. According to the Hickman two step models, only non-participant respondents can report zero intensity of market participation. The model further assumes that individuals who participate in the market do not report zero values at all (John , 2014).

The difference between double hurdle and Henchman model is that, double hurdle model assumes the non-participants at the first stage and second stages and state that non- respondents selection is because of random selection situation, but Henchman two stage treats separately, i.e once the non-participants assumed as in the first stage, then later in the second stage censored from the assumption. Therefore, for this study Heckman two step estimation models were used.

2.1.10 Determinants of smallholder farmers maize production

The major factors affecting maize yields are the production environment, production systems, seed varieties and other production inputs and financial outlays on research. All other things being equal, yield potential appears to be higher in moderate environments than in tropical environments. Factors that influence productivity of a particular producer may be classified as: the quantity and quality of inputs used including land, labor and capital, fertilizer, seeds farm and farmer characteristics and external factors such as government policy. Farm and farmer characteristics on the other hand include factors such as size and topography of area cultivated, location of the farm with respect to input and output markets, age, gender, education level, household size, access to extension services, and access credit (Michael, 2013).

According to A stewel (2017) on his study on determinants of rice production using multiple regression models, rice production was positively and significantly influenced by sex of household head, oxen ownership, land size, labor availability and amount rice seed used.
Access to finance is essential for the further development of maize farming enterprises: - Credit is necessary for maize farming associations running collection centers, buying products from producers and selling on in bulk. However, significant financial assets are not essential for maize farming at subsistence level. A good maize farming project will work to ensure that all available

capital assets are taken into consideration, without dependence on any that are not. For example, too many projects have depended on the importation of the beeswax foundation used in frame hives: this is impossible for beekeepers without financial assets (Zilberman, 2014).

According to Berihun (2014) on his study on factors affecting agricultural production using ordinary least square estimation found that, agricultural production negatively affected by age and plot distance. While family size, TLU, land size dummy slope, fertilizer, row spacing, credit and farmers participation in different association are variable which affect agricultural production positively and significantly. According Justin (2015)a study carried out on factors influencing maize production by using regression model maize output was positively and significantly influenced by farm size, land allocated for maize, sale of maize, fertilizer application, tillage method and education level of the household.

The effect of Agro-climatic conditions on maize production mainly soil conditions and weather factors including rainfall, temperature and humidity. Climate change impacts include the increased atmospheric pollution, increased intensity and frequency of storms, rise in sea level, altered rainfall amounts and distribution, altered hydrological cycles, rising temperatures, desertification, decline of mountain glaciers and snow cover, Arctic warming, persistent droughts and flooding (FAOSTAT , 2006).

According to Kassa (2015) who carry out a study out on factors on affecting agricultural production by using multiple regression, finds that total land holding size, possession of oxen, amount of fertilizer; improved seeds irrigation, soil quality, crop rotation, village distance to the district market have variable which positively and significantly influence the agricultural production obtained. Average distances of plots from the homestead were negatively and significantly affect agricultural production in the study area.

According to Beyan (2016) on his study on factors affect smallholder farmers farm income by using multiple regression estimates that age, education , cultivated area, livestock holding, irrigation use and fertilizer was variables which positively and significantly affect smallholder farmers' farm income. According to Richard ,(2016) using multiple regression finds that

pumpkin production was influenced by age education level of household head, household size, on-farm income, farm area under pumpkin and arrangement in off farm activities were statistically important and positively influenced smallholder pumpkin production

2.1.11 Determinants of smallholder farmers' maize market participation

There are factors influencing the marketability of cereal products in general and maize product in particularly. Smallholder commercialization is part of an agricultural transformation process in which individual farms shift from a highly subsistence-oriented production towards more specialized production targeting markets both for their input procurement and output supply. To attain this essential goal of structural transformation through a smooth process of smallholder agricultural commercialization, policy and strategy interventions to improve the functioning of input and output marketing, improvements in service provision, and the development of infrastructure stand out prominent (Jaleta *et al*, 2009).

Recent information and communication technology (ICT) and development initiatives in Africa have been to promote the use of mobile phones that can potentially improve smallholder farmers' access to information and markets (Misaki., 2018). This stress is based on the idea that farming sectors in developing countries mostly comprise resource poor, small-scale subsistence farmers Tadesse & Bahiigwa (2015) who face high transaction costs and have poor access to information that bounds their market participation. Effective use of ICT devices such as mobile phones is considered ideal in reducing asymmetries of information between traders and producers and subsequently reducing farmers' transaction costs (Deen-Swarray , 2016).

Azam *et al*, (2012) also found that variables capturing information processing: ownership of a radio, television, or telephone has a positive impact on market participation. The authors found that for households which owned one or more of the previously stated communication devices were 46 percent more likely to participate in the market than households which did not own a communication device. Contrasting the previous findings, Alene *et al*, (2008) found that access to communication had positive but insignificant impacts on market participation.

Maize yield affects market participation (Heltberg and Tarp, 2002). As output increases, farmers will retain a smaller portion for consumption and make a larger proportion available for off-farm

consumption (Hussein, 2018). Therefore, factors that increase yield can positively impact market participation. Increased production can arise from several sources: access to inputs, improved knowledge, or farm machinery. Owner of the agribusiness is an individual whom farmers can trust and know that what they purchase will be of good quality. The use of inputs also relies upon the existence of physical infrastructure to allow the timely availability and delivery of farm inputs so that marketable surplus can be increased. Increased investment in the public good of agricultural research may be very important to raise crop productivity and reduce minimum asset thresholds for market participation in Mozambique (Boughton *et al*, 2007).

Smale *et al*, (2011) noted that maize is the most widely-grown staple food of Sub-Saharan Africa and is often used as a wage good, yet market participation differs depending on population densities. The majority of maize producers live a substantial distance away from population centers. Barrett (2008), found in a study conducted in eastern and southern Africa, that distance to market had a negative and significant impact on smallholder market participation. According to Azam *et al*, (2012), the same negative and significant impact of distance to market was found in rice market participation in Cambodia. In agreement with Barrett and Heather (2011) found that remoteness is a substantial barrier to market entry in Madagascar. Alene *et al*, (2008) found that remoteness impacts participation, even within input markets. In Kenya, remoteness of the fertilizer market reduced total marketed supply by over 40 percent.

According to Mathenge *et al,* (2010), Male headed households were expected to have higher probability to be net sellers of maize than female headed households because it has been argued that the former have better access to technologies than the latter. Age of the household head has been a proxy for experience in empirical studies of agricultural output market participation and other technology adoption studies. It was therefore expected that age will be positively correlated with net selling market participation regime. On the other hand, formal education is usually a reflection of human capital and management skills. This means that education is expected to be positively correlated with net selling market participation regime. Finally, households headed by members who have farming as their main occupation are expected to be more market oriented especially in maize given the fact that maize is the most widely grown and staple food among the surveyed households.

The effect of maize price on market participation regime is indeterminate because high maize price could induce households to sell more maize leading them to buy back more latter. At the same time, high prices of maize could make producing households not sell because they fear buying the same maize back at even higher prices. On the other hand, transport and communication equipment ownership was hypothesized to be positively related to net selling regimes because this equipment reduces transaction costs. Distance to the main market is a major factor in determining participation behavior of smallholder farmers in output markets. This is because households who are far away from markets face higher transaction costs which mean that they are likely to sell and buy less with the only remaining option being self-sufficient (Nyoro, 2014).

2.1.12 Conceptual Framework

Conceptual framework is an illustrative representation of variables in a study, their preparation depends on meaning and how they interrelate in the study. It shows how the independent variables influence the dependent variable of the study. The framework below is design of possible underlying factors influencing maize production and market participation among smallholder farmers. The independent variables are grouped together on one side but the dependent variable is placed on the right hand connected with an arrow as a sign of direct relationship.

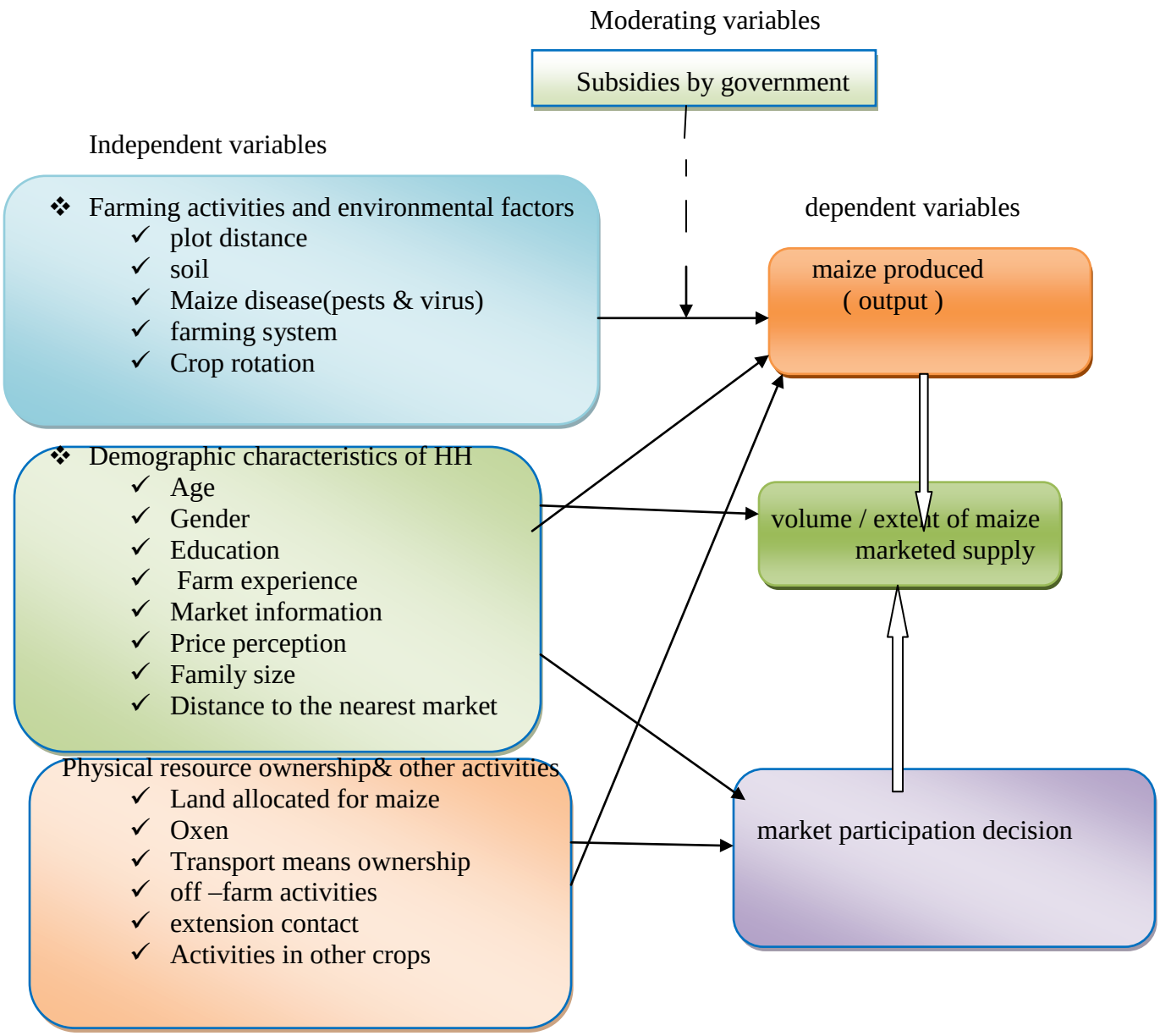

Figure 2.1: Conceptual Framework showing the relationship between the independent and dependent Variables: Source: own survey 2020.

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

In this chapter, research methodology used in the study including description of the study area, data types, sources, method of data collection, sampling procedures, method of data analysis, definition of variables and hypothesis discussed respectively.

3.1. Description of the Study Area

Jimma zone is one of the zones of the Ethiopian Region of Oromia. Jimma is named for the former kingdom of Jimma, which was absorbed into the former province of Kaffa in 1932. Jimma is bordered on the south by the southern nations, nationalities and peoples region, and the northwest by Illubabor on the north by Misraq Wollega and on the northeast by the Mirabshewa. Part of the boundary with Mirabshewa is defined by Gibe River. The highest mount in this zone is mount Maigudo (2,386 m). Towns and cities in Jimma include Agaro, Genet and Saqqa. The town of Jimma was separated from Jimma zone and is a special zone now.

The Central Statistical Agency (CSA) reported that 26,743 tons of coffee was produced in this zone in the year ending in 2005, based on inspection records from the Ethiopian Coffee and Tea authority. This represents 23.2% of the Region's output and 11.8% of Ethiopia's total output, and makes Jimma one of the three top producers of these goods, along with the Sidama and Gedeo Zones.

Demographics

Based on the 2007 Census conducted by the CSA, this Zone has a total population of 2, 486, 155, an increase of 26.76% over the 1994 census, of whom 1,250,527 are men and 1,235,628 women; with an area of 15,568.58 square kilometers, Jimma has a population density of 159.69. While137, 668 or 11.31% are urban inhabitants, a further 858 or 0.03% are pastoralists. A total of521, 506 households were counted in this Zone, which results in an average of 4.77 persons to a household, and 500,374 housing units. The three largest ethnic groups reported in Jimma were the Oromo (87.6%), the Amhara (4.05%) and the Yem (3.12%); all other ethnic groups made up 5.23% of the population. Oromiffa was spoken as a first language by 90.43% and 5.33% spoke Amharic; the remaining 4.24% spoke all other primary languages reported. The majority of the

inhabitants were Muslim, with 85.65% of the population having reported they practiced that belief, while 11.18% of the population practiced Ethiopia Orthodox Christianity and 2.97% professed Protestantism.

According to a May 24, 2004 World Bank memorandum, 9% of the inhabitants of Jimma have access to electricity, this zone has a road density of 77.0 kilometers per 1000 square kilometers (compared to the national average of 30 kilometers), the average rural household has 0.9 hectare of land (compared to the national average of 1.01 hectare of land and an average of 1.14 for the Oromia Region) and the equivalent of 0.5 heads of livestock. 15.1% of the population is in non-farm related jobs, compared to the national average of 25% and a Regional average of 24%. Concerning education, 57% of all eligible children are enrolled in primary school, and 12% in secondary schools. Concerning health, 29% of the zone is exposed to malaria, and 63% to Tsetse fly. The memorandum gave this zone a drought risk rating of 298.

Dedo is one of the wored as in the Oromia Region of Ethiopia. Part of the Jimma Zone, Dedo is bordered on the south by the Gojeb River which separates it from the Southern Nations, Nationalities and Peoples Region, on the west by Gera, on the north by Kersa, and on the east by Omo Nada. The major town in Dedo is Sheki.

The altitude of this Dedo woreda ranges from 880 to 2400 meters above sea level. Major peaks include Haro Gebis, Walla, and Derar Korma. Perennial rivers include the Unat, Kawa, Waro and Offele. A survey of the land in this woreda shows that 63.1% is arable or cultivable (38.4% was under annual crops), 13.6% pasture, 9.3% forest, and the remaining 14% is considered swampy, degraded or otherwise unusable. Teff, corn and vegetables are important cash crops. Coffee is also an important cash crop for this woreda; over 50 square kilometers are planted with this crop.

Industry in the woreda includes 35 grain mills. Iron, coal and oil shale deposits are known in Dedo, but have yet to be developed. There were 53 Farmers Associations with 29,781 members and 10 Farmers Service Cooperatives with 18,429 members. Dedo has 34 kilometers of dry-weather and 70 of all-weather road, for an average road density of 66.2 kilometers per 1000 square kilometers. (The Oromia Regional government has stated that a 34 kilometer road linking

Dedo with Mole and Boneya is under construction.) About 73% of the urban and 5.7% of the rural population has access to drinking water.

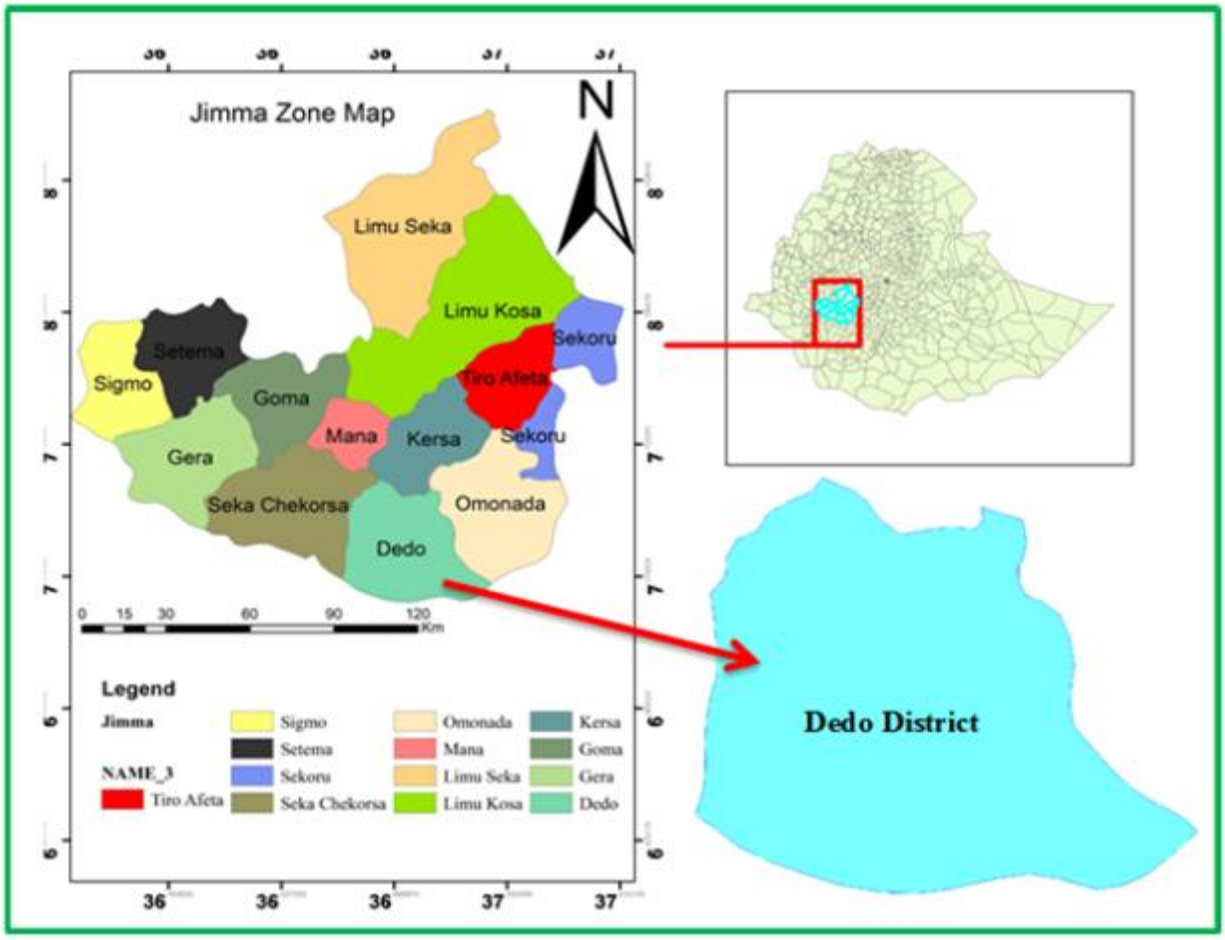

Figure 2: Map of the study area
Source: - From Dedo woreda, 2020

Population

The 2007 national census reported a total population for this woreda of 217,494, of whom 105,700 were men and 111,794 were women; 4,350 or 2% of its population were urban dwellers. The majority of the inhabitants were Moslem, with 92.98% of the population reporting they observed this belief, while 5.42% of the population said they practiced Ethiopian Orthodox Christianity, and 1.47% was Protestant.

3.2 Data type, source and Method of data collection

This study used household survey data collected from Dedo district for the year 2018/2019. The research is basically relied on quantitative and qualitative types of data collected from both primary and secondary data sources. To address the stated objectives of the study, primary data was collected from 192 sample household in the selected kebeles. Besides to primary data, this study used secondary data collected from different journals, internet, published research and bureau of agriculture and commercial industrial office of the district.

A survey schedule which incorporates a semi structured questionnaire was administered to collect primary data from randomly selected sample households relating to production and market participation of maize. Before a start of actual data collection, facilitative works such as training of enumerators on interview produces and primarily assessment to sampled kebeles was made then the questionnaires was pre- tested on selected respondents to evaluate the appropriateness of the design, clarity and interpretation of the questions, relevance of the questions and to estimate time required for an interview, on the basis of the results of the pre – test necessary modification was made before the implementation of the survey the questionnaire covered different topics in order to handle relevant information related to the study objectives.

3.3 Sampling Technique and Sample Size Determination

Dedo district was purposively selected because f the over ways of the problem in maize production and market participation than the other districts. From 26 kebeles, four kebeles which consists of about 3500 total population randomly selected since all kebeles have homogeneity characteristics in maize production, of this kebeles 192 sample respondents selected by simple randomly sampling method among kebeles household taking into account by probability proportional to the size of maize producers in each sample kebeles. Accordingly192 households were selected for survey. The sample size was determined based on the following formula given by Yamane [1967] the formula was used for sample size determination as:-

$$n = \frac{3500}{1+3500(0.07)^2} \approx 192$$

Where; n=sample size,

N=population size (sampling frame)

e=level of precision (7%)

Table 1: Sample distribution of maize producer households in selected kebeles

This is proportionally to assign the number of household heads sample respondents to each kebeles and accordingly, 0.05486 obtained by dividing 192/3500.

No of selected kebeles and total number of sampled proportion

	Households	Proportion	Sample HH	Households (%)
Warokolobo	822	0.05486	45	23.44
Offolle dawe	776	0.05486	43	22.39
Korti	1131	0.05486	62	32.29
Kata Adi	771	0.05486	42	21.88
Total	3500	0.05486	192	100

Source; Dedo District agricultural and rural development office

3.4 Methods of Data Analysis

Two types of analysis, descriptive statistics and econometric analysis were used to meet the objectives of the study. The justification behind using both descriptive and econometric analysis is because of its importance for the reality of the research and to check the effects of independent variables on dependent variable. The data which was collected from sample small holder farmers was entered by using SPSS and was analyzed by using STATA version 14 software.

3.4.1 Descriptive Analysis

Descriptive analytical tools such as mean, standard deviation, percent, and frequency, minimum and maximum were used to describe household demographic characteristics, resource ownership, access to institution services and other factors. T-test and chi-square test were also; used to capture the existence of percentage and mean difference between market participants and non-participants based on assigned explanatory variables.

3.4.2 Economics Analysis

In econometric estimation method, ordinary least square model/ linear regression model was employed to estimate factors affecting quantity of maize produced and probit and Henchman second model was used to identify the factors affect the probability of farmer's market participation decision and volume of maize market supplied respectively.

3.4.2.1 Econometric Model Specification for Production Model

Ordinary least square (OLS) model was used in order to identify the factors affecting maize production is a continuous dependent variable which measured in quintal and all sampled households was producers of maize. Following Guajarati (2006), the model is with classical linear model assumption, that is estimators of OLS are with BLUE (Best linear unbiased Estimators) property. Relating with this, different individuals like Bihon (2017) Richard (2016) and others had used OLS model in dealing with similar issues. Its specification is;

$$y=\beta O+\beta 1x1+\beta 2x2+\beta 3x3+\ldots+\beta KxK+ui \quad \ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Where; y=is the dependent variable, x=vector of explanatory variables, β=the parameter to be estimated E or ui=the error term. In Eq.(3.1) $\beta 1$ is the intercept term. As usual, it gives the mean or average effect of all the variables excluded from the model, although its mechanical interpretation is the average the value of Y when x2 and x3 are set equal to zero the coefficients b2 and B3 are called the partial regression coefficients (Gujarati ,2004) then ,the functional notation of the dependent and independent variables is ;maizeqant $=\beta 0+\beta 1$Age$+\beta 2$ Gender $+\beta$ 3EDUCA$+\beta 4$ Farm size$+\beta 5$Land$+\beta 6$ Oxen $+\beta 7$Extn$+\beta 8$ plotdis $+\beta 9$ Fsystem $+\beta 10$ rain $+\beta 11$ croprot $+\beta 12$ pest $+\beta 13$ Credtacc $+\beta 14$ off-farm $+\beta 15$ soil+ui

3.4.2.2 Econometric model specification for market participation model

Many pervious experimental/empirical studies on their analysis of the smallholder farmers' market participation decision and extent of participation have used different analytical models base on the nature of their data. Among the analytical models, Heckman sample selection model, and Double hurdle models were frequently used ones. Selecting the type of the model for assigned objectives depends up on the nature of the data and the assumptions of the models.

Based on the justification under the analytical framework, this study used Henchman model proposed by cragg (1971) to analyze factors which affect smallholder farmer's maize market participation decision and volume of maize marketed supply. The model consists of two- stage decision- making process. According to Cragg (1971) the Henchman model deals with the assumption that farmers face two stages on agricultural activities which require making two decisions separately, in this research as farmers made decision regarding whether they participate or not to participate in maize output market and about the volume of sale, each of which was determine by a different set of explanatory variables and expected signs. According to Cragg (1971) at diverse latent variable was used to model each decision process, probit model was applied to find out factors affecting farmers market participation in the first stage of the model and truncated regression model was applied to determined the volume of maize quantity sale in the second stage.

The Henchman model was specified as a two step decision process as follow:

First for market participation decision:

$ri = Zi\beta + vi$

$$ri = \begin{cases} 1 \text{ if } di^* > 0 \\ 0 \text{ if } di^* \leq 0 \end{cases} \qquad vi \sim N(0,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.2)$$

Second for volume of maize marketed supply:

$ti = Wi' \delta + ui, \qquad ui \sim N(0,2) \ldots\ldots\ldots\ldots\ldots\ldots (3.3)$

$$ti = \begin{cases} 1 \text{ if } yi > 0 \text{ and } di > 0) \\ 0 \text{ if } yi \leq 0 \text{ and } di \leq 0 \end{cases}$$

Where, ri is a latent or unobservable variable describing i^{th} households' decision to participate in the maize output market as seller (ri), ti is a latent or unobservable describing i^{th} household volume of maize marketed supply, ti is the observed variable or actual quantity of maize supplied by household (i), w1 and xi are vector of variables explaining the participation decision and volume of maize marketed supply respectively, β and δ are vectors of parameters to be estimated, vi and ui are respective error terms assumed to be independent and normally distributed.

In specific terms, the probit model In stage one of the estimation is stated as:

p(participation) $= \beta 0+\beta$iwi+e……..……..……..……..……..(3.4)

where, p(participation) is the probability of a farmer making a decision to participate in maize product market or not: where marketing decision= 1 if a farmer participates in marketing and o otherwise; β I is the vector of parameters to be estimated, wi is the vector of exogenous explanatory variables expected to affect the participation decision probability and e is the error term.

In specific term, truncated model in stage two of the estimation is stated as:

Truncated regression analysis was used to test the effect of hypothesized factors on the market supplied decision which was measured by the quantity of maize output sold. The model is stated as:

R=R*If > 0 and Y=1

R=0, Otherwise

From this, we can specify the reduced form of the truncation model as:

R=β0+βXi+ui----------(3.5)

Where R is the observed quantity of maize output sold, R* is the latent variable which indicates the market supply of maize quantity sell is greater than zero, β is the vector of parementers to be estimated , Xi is the vector of explanatory variables and u is the error term. Data analysis procedures for determinants of smallholder farmer's market participation and quatity of market supplied.

Step1: Maize market participation equation

Market participation=$\beta^{\circ}+\beta$1EXP+β2Gender+β3Educa+β4Famsize+β6Caltlandn +β7Tlu+β8 Offarm+β8price+β10Markinfo+β11Distma+12 other Crop+$\beta 13 Tranm + e$

To detect commonly appearing problem in regression analysis that is multicollinearity or correlation of independent variables. Two tests were used variance Inflating factor (vif) and contingency coefficient (CC). The Variance inflation factor (VIF) shows how the variance of an estimator is inflated by the presence of multicollinearity in continuous variables. With increased multicollinearity, the VIF approaches infinity and in the absence of multicollinearity, vif will be equal to 1.

To detect the degree of association between dummy variables, contingency Coefficient (cc) was used. Contingency coefficient values, which ranges between 0 to 1, measures the degree of correlation between discrete variables based on chi- square measure of association. Contingency coefficient value with 0.75 or more shows a strong degree of association between discrete variables; CC value close to zero indicates absence of series association between discrete variables (Healy, 1984).

3.5 Definition of and description of hypothesized Variables

In order to identify factors which affect maize output produced, market participation decision and volume of marketed supply of maize, exploring which factors significantly influence and how these factors are related with the dependent variables are required hence, the following dependent and independent variable and it takes a value of 1 if the farmer participates in maize output market as a seller and, 0 otherwise. Marketed supply (Maize supply)= it is the continuous variable and it represents the quantity of maize actually supplied to market measured in quintal and takes positive value for those farmers who supplied maize.

3.5.1 Description of independent variables used in maize production

The independent variables which are hypothesized to affect quantity of maize produced are the following:

Age: is a continuous variable measured in number of years of the household head. The age of farmer is expected to have a positive effect on quantity of maize produced because of the accumulated experience of older farmers they become more dedicated in their maize farming. Also older persons are more averters for the risk so that they produce in density and diversify of their production. Older farmers are more experienced in farming activities and are better to assess the risks involved in farming than younger farmers (Rebecca, .2011). As a result, age of household head contributes positively to technical efficiency. This implies that as age of the decision maker increases, technical efficiency and producing in amount will increase. Zalkuwi (2010) identified that older farmers in maize production are more cost efficient than younger ones.

Gender of the household head (Gender): is a dummy variable, which takes a value of 1 if the household head is male; 0= otherwise, male- headed households have more access to productive assets such as land, labor and capital and have relatively better advantage to attend production training, which helps them to increase their production capability hence; a positive relationship was expected from the model output (Endale , 2011).On average, male headed households sell more maize as compared to female headed households. This shows that in the study area females are not in the position to produce more for market due to lack of awareness lack of basic assets and production materials. Another reason could be most of the time female household heads are more concerned about feeding their families rather than taking their production out to the market. The result is consistent with the findings of (Aman *et al*, 2014; Benjamin *et al,* 2014 and Olwande and Mathenge, 2012). They argued that males are more accessible to land and are able to cultivate large plots of land as compared to their female counterparts. Also, males often receive more support on their farms more than the females do. Moreover, most of the female headed households widowed with less economic and physical power to farm intensively.

Education level of the household head (education): it is a categorical variable and measured by status of sample household head education level. Educated households are expected to have better exposure to information, egger to accept new technologies for their production, make better use of their viable resources which enhance their maize production. Education improves the distribution ability of decision makers by allowing them to think critically and use information sources efficiently. Producers with more education should be conscious of more sources of information, and more efficient in assessing and interpreting information about innovations than those with less education. Education was found to positively affect adoption of improved maize varieties in West shoa, Ethiopia (silvanus ,2014). Aman *et al,* (2014) states that education increases the ability of farmers to get and analyze relevant market information which would improve the managerial ability of the farmers in terms of better formulation and execution of farm plans, and acquiring better information to improve their marketing performance. It is also in conformity with (Enete and Igbokwe, 2016) who argued that education will endow the household with better production and managerial skills which could lead to increased participation in the market.

Family size (family size): this is a continuous variable measured in number of family members by adult equivalent. Having large and productive family size could increase crop production through proper labor division, on time weeding sand harvest. Besides, small and efficient family size could increase crop production by devoting all their time for farm activities as well as by employing agricultural input. Household size plays an important role in maize production and most farmers depend mainly on family labor. So, that it is expected to have a positive effect in quality of maize production (Richard, 2016).

However, according to Essa, (2011) household with a large family size needs more resource to satisfy its energy and food requirements and study results imply that there is a negative relationship between household size and technical efficiency. Therefore, to meet these needs, resources will be exploited more extensively that leads to expansion to marginal lands leading to environmental degradation, implying a decline in productivity and the household size considered as indeterminate factor for maize production.

Total land owned by the household (farm size): is continuous variable measured in hectare and it was expected to affect the household participation decision and volume of maize production and supply positively because the average land possessed by smallholder farmers is 1.5ha. Farmers with bigger cultivable land were found to participate more because of their ability to produce bigger volumes that ensured marketed surpluses. Hauwa (2017) found farm size to be an influential asset that leads to higher production volumes and positively influences farmers' market participations. It was also in conformity with abera (2014)who noted that the larger the total farm size, the larger the area allocated to the crop production thereby increasing the quantity of produce available for sale and thus the per unit transaction costs will be lower due to the economics of scale. The result is in line with; Rebecca (2011) states that land plays an important role in farming as one of the most available resources one can use efficiently and Endrias (2013) stated land size is highly significant for positively affecting the technical efficiency of smallholder maize producers.

The extension contact (extension contact). It is continues variable measured in a number of days that development agent give farmers technical advice on maize production and related issues

in a given production season/ year. Those farmers' who are frequently visited by extension worker are believed to be informed about different, original, modernized inputs and technologies such as high yielding varieties and other new farming practices, which encourage them to produce more and information used to increase and double their production. Extension service is expected to impact positively on production information because it is through extension services that farmers are able to acquire better skill and knowledge on production. Therefore, positive effect was expected from the final regression analysis (Wondimagegn, 2011).

Soil fertility status of the land (soil): this is a categorical variable which was measured as high-quality if the soil fertility of the land of the household is good, medium if the land possesses soil which is fertile to some extent and poor if the soil of the land is highly poor and not appropriate for crop production. Fertile soil able to provide the crop under cultivation the required and essential minerals and nutrients and serve as the support and foundation of the crop due to this positive relation was expected between soil fertility status and maize output produced (Bihon , 2017).

Other factor that affects maize production is Soil acidity and is one of the factors limiting maize production in some parts of Kenya notably in Uasin Gishu County. Regular annual dressings of Sulphate of ammonia fertilizer brought about a substantial decrease in topsoil pH within a very short time (Astewel, 2013). Farmers lack storage facilities thus maize gets destroyed due to humid, theft and exposure to unworthy conditions. Maize production also affected due to the decrease in land since population increase is on the rise thus land for cultivation is being encroached (Farm management Hand out, 2007).

Farmers' off/ non- farm activity participation(off-farm): it is a dummy variable that shows whether any of the household members participates in non- farming activities or not , which take a value of 1 if the household members participate in any off- farm activities and 0 otherwise . The income that obtained from off- farm activities May strength farming activity to produce maize production to generate money from the sale of those rather than getting income from non farming activities. Oppositely farmers those who have additional income source may fail to properly engage in their maize production and unable to regularly follow up their maize

production. Hence, getting income from non farming activity is assumed to positively or negatively affect quantity of maize produced (Richard, 2015).

Applying crop rotation (Crop rotation): this is a dummy variable which shows sowing different crops with different production season to maintain the soil fertility status of the land under cultivation. It takes a value of 1 if the household head diversify his or her production with the same plot of land within different production season and takes 0 if otherwise. Smallholder farmers cultivate the land and producer at one season and prepare for another crop on the same land at different production period to keep soil fertility. This variable was proposed to affect maize production positively because rotating different crops on the same plot overtime is believed to increase soil fertility and by this increase crop production of the land under cultivation. So, that farmer applying crop rotation is expected to get a higher production (Berihun, 2014).

Access to credit (credit): This was coded as a dummy variable taking a value of one if the household had access to credit and zero otherwise. This variable was expected to influence the marketable supply of maize producers positively on the assumption that access to credit improves the financial capacity of maize producers to buy more improved production inputs. The result is also in line with Martey (2012)found that access to credit from both formal and informal sources had a positive effect on smallholder maize and cassava farmers in Ghana.

Number of oxen owned (oxen): this is a continuous variable that refers to the number of oxen the household owned. An ox is the most important animal used for land cultivation in rural areas and is one of the major key assets for farm households in Ethiopia. The more the households 'posses' oxen, the more they produce maize. Thus, it was expected that the number of oxen available to the household positively enhances the production of maize and encourages in predicting a significant amount (Astewel , 2017).

Condition of rainfall (Rain): This is a dummy variable which takes a value of 1 if the rain is optimal within the given production year and 0 if there is a shortage of rainfall. This is to show that, certain smallholder farmers can produce by using irrigation system. This variable is because of most farming activities within the country mainly rain feed. So, that, the condition of the rain

within the given production season or year has the potential to affect the overall production of the famer. The expected relation was positive or negative because if the farmers produce their maize production at optimal rain condition they get a good output while if they produce at shortage of rain they obtain small production or they may loss their overall production, other studies also hypostasized the condition of the rain similarly (Bihon, 2017).

Plough method (Tillage): it is dummy variable which takes a value of 1 if the household plough his/ her land through tractor and takes 0 if the land is prepared by using Ox- plough. The method and process that the farmer uses for preparation of land has its own contribution on product and productivity of smallholder farmers in maize output. Land preparation is an initial and essential activity of crop production relating with this the method of land preparation play a significant role in improving the output obtained. So, that the positive relation was proposed between land preparation method and the maize output obtained. This is because if the farmers have access and apply a tractor for their land preparation, they highly increase their production because it minimizes the effort they must divot to plough their land by using oxen (Justin, 2015).

Occurrence of pest (pest): This is a dummy variable that is measured in terms of whether different insects or pests occur during he given maize production year and takes a value of 1 if the household head did not face pest related problems in his / her production and 0 otherwise.

Occurrence of pest or insects can harm maize under production which leads the farmer to loss his/ her production and remaining without any output during the production season. As a result, of this negative effect was expected from the model estimation (Berihun, 2014).

Plot distance (plot dist): this is a continuous variable which is measured by average walking time (24 in minutes) taking to reach different plots of land at different location by the household members. In the study area farmers possess different plots of land which locates in different locations. Some of their land may near to their home as the other also far and very far from their homestead. Then, the expected effect of average plot distance was negative on maize production this is because mostly farmers went for instance to reach their plot of land and taking their time in walking instead to devoting their time on their maize production (Menale , 2014 and Bihon, 2017). It is in line with Mukundi *et al.*, (2013) and Martey*et al*, (2012) that increased distance to the market will lower the level of market participation as a result of increase in marketing costs,

and output market is not only a function of the proximity to the terminal market but also the existing road infrastructure that link major production areas with the major consumption sites.

3.5.2 Description of hypothesized independent variables on market participation

Age of the household head (AGH): Age was measured in years as a continuous variable. Previous studies report mixed results on the relationship between age and market participation. According to Mathenge *et al*,(2010), age of the household head had a positive and significant effect on market participation of marginalized and poor smallholders in Kenya. This may be due to the fact that older farmers have more experience than young farmers in participating in markets or as the farmer gets older s/he may be able to sell more of her/his produce as compared to younger farmers due to social networks fomented over a period of time. In contrast, Tshiunza *et al*, (2001) found a negative association between age and market supply in cooking banana marketing in Nigeria. Therefore, the expected effect of age on market participation and extent of market participation in this study was deemed indeterminate.

Gender of the household (Gender): it is dummy variable taking a value of 1 if the household head is male and 0 otherwise. Musah *et al*,(2014)found that male headed households in West Africa had better access to resources and hence were more likely to produce a surplus and participate in the market and that high crop yields were significantly associated with higher market participation. Male households have better access to information which would provide them better ability to manage their farms and produce more surpluses for market as compared to female headed households, due to this being male positively affect market participation decision and volume of maize marketed supply (Egbetokun *et al*, 2017).

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

Households who have better experience in maize production and marketing is assumed to acquire knowledge and ability through continuous learning which help them to actively participate in marketing of maize and produce more amount to maize ton supply to the market than those with less experience. Therefore, farming experience in maize production was expected to give positive relation with market participation decision and volume of marketed supply (Yallew, 2016).

Education level of the household head (education): This was measured as a continuous variable denoting the number of years of formal schooling of the household head at the time of the survey. Household heads with more years of formal education were expected to have a higher ability to accept new ideas and innovations, and therefore would be more willing to produce and supply the product for sale. Thus, education was hypothesized positively to influence market participation and the extent of participation.

Educated farmers are expected to have better skill, have better abilities to negotiate and to acquire more information than those with a low level of education. Thus, it was assumed that the education level of household heads would have a positive impact on determining both market participation and volume of market sales among smallholder farmers. Previous studies also hypothesized education level similarly (Yaynabeba and Tewedroys,2013 and Tadele *et al* , 2017). Gani and Adeoti, (2011) found that in Nigeria, farmers‟ market participation decision was positively influenced by the level of education.

Family size: - it is a continuous variable and states to the total number of family members (adult equivalent) in the household. The larger the household size, the smaller the market surplus because larger families require greater food consumption because an increase in family size may also increase in the number of in need of family members which in turn lower the potentials of maize production and unequal volume of production; later contribute to a decrease in the market participation and level of market participation. Asfaw *et al* (2012.), also found that household size negatively affects market participation, as larger families consumed much of farm output. This could have also been an indication of the inefficiency of smallholder farm labour. Due to this a negative effect was expected from fine model estimation (Cazzuffi and Mckay, 2012 and Aman , 2014). Agete,(2014) found that marketed surplus of buffalo milk in Haryana to be negatively

affected by family size. In this study therefore, family size was expected to have negative relationship with market participation and the extent of participation in the red bean market in household head size.

Access to credit (ACIR): This was coded as a dummy variable taking a value of 1 if the household had access to credit and zero otherwise. This variable was expected to influence the marketable supply of maize producers positively on the assumption that access to credit improves the financial capacity of maize producers to buy more improved production inputs, thereby increasing maize production, which would also increase market participation. Stephens and Barrett, (2011) originated that households with access to credit are more likely to transact in the food grains market.

Boughton *et al*, (2007) underlined that the policy implications for credit's role in market participation are that more attention needs to be given to policies and programs that address missing rural financial markets. Credit can be useful when farmers are attempting to start a new project or simply expand their operation where there are many upfront costs. An example of where credit could make a considerable impact is highlighted in Kenya. Alene *et al*, (2008) found that limited access to credit constrains farmers‟ ability to buy agricultural inputs, which in turn reduces farmers‟ market participation in Kenya.

Cultivated land for maize (Cultivated land); The size of land allocated for maize production was a continuous variable measured in hectare and it was expected to affect the household participation decision and volume of maize marketed supply positively this is because farmers who allocates a large area of land under maize produced supply positively this is because farmers could obtain high product which cover their home consumption and remain a surplus for a market by this the probability of market participation and volume of marketed supply is higher than the household who allocate small area of land.

Total farm size allocated to maize was expected to positively influence the quantity of maize marketed and therefore the probability of market participation. Mussema and Dawi , (2012) found that as land allocated to red pepper increased in Alaba Special District the amount of pepper marketed also increased. Martey *et al*, (2012) also found that maize and cassava market

participation increased as farm size increased. This was because increase in farm size provides opportunity to increase surplus production, which is critical in improving market participation. A study by Pilile, (2015) found a significant positive relation between market participation decision and proportion of land allocated for maize. Efa *et al*, (2016) have also found positive and significant relationship between extents of teff marketed surplus and land allocated for teff. Osmani and Hossain (2015) found that farmers with larger farm sizes were more likely to participate in the market in Bangladesh as they produced more output. Furthermore farmers who reported high crop incomes in previous years had more incentive to produce and participate in the market.

Frequency of extension contact (extension): this is a continuous variable measured by number of visits by extension agents at a given product period. Extension can be very useful in order to inform and teach farmers about new technologies or production practices. Extension efforts can increase a farmer's production knowledge to help them increase their marketable surplus. Extension agents can also serve as a channel of information about market locations, prices, and potential buyers/sellers. Farmers those contact with extension workers frequently will have better access to information and could adopt better technology as well as they are more likely to know the advantage of marketing that would increase their market participation and volume of maize marketed supply.

Farmers who have contact with extension agents are more likely to have knowledge about production, quality, and price of inputs and information on markets and output prices of poultry (Zeberga, 2010). It was observed that number of extension visits by an extension agent had significant and positive effect on quantity of milk marketed in Ethiopia. In this study, therefore, number of contact with extension workers was expected to have a positive relationship with market participation decision and the extent of participation. According to Tekalign, (2014), extension service was found to enhance farmer skills and knowledge and develops their production and market participation because it helps in availing the information regarding the market. Hence, this is hypothesized to affect maize market participation decision and volume of maize marketed supply positively. It was hypothesized that farmers who receive extension

services especially those related to marketing would be more likely to participate in the market (Maponya *et al* , 2015).

The ownership of Livestock in Unit / Quantity: This is a continuo's variable and refers to the total number of livestock household owns in relations to total livestock unit. The effect of this variable on famers' market participation decision and volume of maize marketed surplus was indeterminate which is either positive or negative. This is because it is assumed that households with larger livestock would have better economic strength and financial position to purchase and use sufficient amount of inputs that would help to improve his/ her production, able to purchase working capital like buying transportation animals and get an income to cover information gathering cost. Oppositely farmers may tend to reduce this market participation and level of crop market participation if they have alternative income from livestock production.

In a study by Boughton (2007) on market Participation by rural households in a low-income country, the authors used an asset-based approach to study patterns of household market participation in Mozambique. The authors found that private household assets especially land, livestock and farm equipment positively affected crop market participation.. The study further found that households with larger livestock endowments produced and sold more crop produce.

Mobile phone: Mobile phone ownership was measured as a dummy variable that took a value of 1 if the farmer owned a mobile phone and 0 if they did not. It was hypothesized that farmers who owned mobile phones would be more likely to participate in the market as better off farmers tend to produce more (Tadesse and Bahiigw, 2015).

Off / non – farm activity (Off-farm): It is a dummy variable which takes the value of 1 if the household head participate in – off- farm activities and 0 otherwise. This variable represents non-farm income obtained from other activities other than agricultural production. Engagement in off-farm activities endows households with additional income. This additional income may improve the household's financial position that in turn supports to fulfill their basic needs and enhance their agricultural production. This is because, households who have other source of income able to purchase different farm inputs which improve their production. Likewise, the more the participation of households in off- farm activities reduces agricultural production by reducing

time required for management of agricultural activities that will in turn reduce their marketed surplus. Therefore, this variable was expected to have indeterminate influence on probability of market participation and volume of maize marketed supply, Different works also hypothesized off- farm income similarly (Goitom, 2009).

Perception of lagged market prices of maize (price): it is binary variable that measure perception or expectation of the households about former year maize price. It takes a value of 1 if the households' perception was good and 0, if it was bad. If former or previous year maize price was good in the market, farmers would be interested to produce and supply more. Therefore, if the household's perception on lagged price of maize was good, positive relation was expected with probability of market participation and volume of marketed supply. Different works also hypothesized perception on legged market price of maize similarly (shewaye, 2014 and Yallew, 2016).

Production of other crops (Crop): it is a dummy variable which the takes a value 1 if the farmer produce other crops beside their maize production within the given production year and 0 otherwise. The production of the other crop can be considered as hindering factor in supplying maize product to the market. Therefore, it is assumed that the more the household is engaged in producing other crops the less the household will sell maize. This is because the households will satisfy their cash needs by selling other crops while using maize for consumption. So the hypothesized effect is negative on both participation decision and volume of marketed supply (YallewMangistu, 2016 and Ayele, 2018).

Access to market information (information): Access to market information was included as a dummy variable which takes a value of 1 if the household received information on the market related issues and 0 otherwise and was expected to influence positively market participation decision. Access to market information is important because it enables farmers to make more appropriate decisions on which market to sell and when to sell the commodity. Farmers need comprehensive market information to be able to make the right decision on the amount of product to market and which price to receive. Agete, (2014) found that better information significantly raises the probability of market participation among potential selling households. Therefore, this

study hypothesized that accesses to market information positively influence the decision of farmers to participate in the market and volume of maize marketed supply (yaynabeba and Tewodros, 2013). In Nigeria, Gani and Adeoti, (2011) found that access to market information positively and significantly influenced farmers‟ market participation decision.

Distance to the nearest market: This is continuous variable represented by walking time from home to the nearest market place. Proximity to market centers motivate farmers to produce market oriented cops through making easy access to inputs and market related accesses such as transportation and price information. While located far from the market place discourage farmers because in order to reach market places they must incur different marketing costs. DSMK was hypothesized to be negatively related to market participation and the extent of participation. Mussema and Dawit, (2012) found that market participation among smallholder pepper producers in Silte and Aalaba in Ethiopia was negatively associated with distance to the market. Martey, (2012) in Ghana found distance to nearest market to be significantly associated with a lower level of cassava sales and every additional kilometer reduced the extent of market participation by 0.4 percent. In Ethiopia, it was reported that smallholder households who were away from market centers had lower market participation (Gebremedhin and Jaleta, 2014). Due to this distance to the market is expected negatively influences the market participation decision of households and volume of maize marketed supply. Different works also hypothesized Distance to the nearest market place similarly (Goitom, 2009 and Yallew, 2016).

Ownership of transport means (OSTM): Ownership of transport means was treated as dummy variable taking a value of 1 if the household owns any of transport equipment and, 0 otherwise. Specifically, carts and transporting animals would be used to measure the availability of transportation facilities by households. So, in this study, ownership of own transportation means was expected to influence maize market participation and volume positively. Masuku *et al*, (2001) found that ownership of transportation means significantly enhanced probability of market participation of households in Swaziland. According to Efa *et al*, (2016), Ownership of transport equipment such as donkeys and animal cars have positive impact on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to

the market. Accordingly, positive relationship was expected between probability of market participation and volume of maize marketed supply and ownership of transport equipment.

Table 2: Description of the variables used in the analysis

Variables	
Dependent variable	**type and Measurement**
Quantity of maize produced	continuous, Quintal
Market participation	Dummy (1-yes, 0=no)
Marketed supply	Continuous, volume of sale in quintal
Independent variable	
Age of the household head	Continuous, year
Gender of the household head	Dummy 1=male, 0= female)
Education level	Categories, educational level
Farming experience	Continuous, Farming year
Total livestock holding	Continuous Number
Family size	Continuous, Number
Participation in other crops	Dummy (1= yes , 0=no)
Cultivated land under maize	Continuous , number
Access market information	Dummy (1-yes, 0=no)
Participation on –off – farm activities	Dummy (1= yes , 0=no)
Number of oxen owned	Continuous, Number
Distance to the nearest market	Continuous, walking time
Lagged market price perception	Dummy (1=good, 0=bad
Farming system	Dummy (0=oxen, 1=tractor)
Maize seed Varity	Dummy (1=yes, 0=no)
Cop Rotation Practice	Dummy (1= yes, 0=no)
Occurrence of pest	Dummy (1= yes , 0=no)
Soil fertility status	Categorical (1 = good, 2 = medium, 3 = poor)
Rainfall Condition	Dummy (1=optimal , 0= shortage)
Plot distance from homestead	Continuous, walking time
Ownership of transport equipment	Dummy (1=yes, 0= no)

CHAPTER FOUR

4. RESULT AND DISCUSSION

In this chapter, the main findings of the study are presented and discussed. First 192 questionnaires were prepared and addressed to respondents and all questionnaires (192) collected. In the first case descriptive results including demographic characteristic of sample households, resource ownership, access to institution services, access to information, farming practices and environmental factors in the study area are presented. In the second section, econometric results to test the effects of explanatory variables or independent variables (factors affecting smallholder's maize production, market participation decision and volume of marketed supply) was presented and discussed and the results were interpreted.

4.1. Descriptive Statistics

Descriptive results for different aspects of sampled households were significant in giving insights and an overview about the overall characteristics of certain issues under Analysis of the study. Hence, important characteristics of sample households and variables used in analysis were described.

4.2. Demographic characteristics of sample respondents

The descriptive result for demographic characteristics of the respondents (table 3) shows that Majority 82.8% of the sample households' head were married. Also the majority 89.1% of sample households were male. Similarly the majority 85.84% of market participant Household's was male and there is a significant percentage difference between market Participant and non participant based on their gender at 1% significance level. this is because female headed Households face different challenges in their participation on agricultural production related activities when we compared them with their male headed counterparts due to their Engagement in dual activities (homemaking and farming), beside this less resource ownership And less accesses to resources would likely lead them to face different frequent economic and Social problems that contribute towards to decrease their engagement on farming, productivity And market participation.

Table 3: Demographic characteristics of sample households for dummy variable

Characteristics		total sample (192)				participant (113)		non participant (79)		x2-value/ p-value
		N	%	Mean	SD	N	%	N	%	
Marital Status:	married	159	82.8	1.32	0.74	99	87.61	60	76	2.26
	other	33	17.2			14	12.39	19	24	(0.368)
Gender	female	21	10.9	0.78	0.43	16	14.16	5	6.33	6.7***
	Male	171	89.1			97	85.84	74	93.67	(0.003)

*** implies statistically significance at 1% level of significance. Source: own survey result, 2020

Based on table (4) Regarding education; education is an important means to improve the labor quality and activities carried out in farming and marketing by improving managerial skill which leads to merest the productivity and probability of farmer's engagement in marketing. According to the survey result from the total sample households' 7.29% of the household heads are illiterate, where as 64.58%, 11.46% and 16.67% of them are attended formal education and categorized under primary, secondary and above respectively. And 7.96% of market participants and 6.33% of non-market participant's farm households are categorized under illiterate, in which there is significant percentage difference among the two groups.

In this study, out of the total sample, 53.13% of the households perceived that lagged market price of maize were good. Among participants, 82.3% of the households perceived as lagged price of maize were good, while out of non-participants, only 11.39% of the households were perceived lagged price of maize as good. Statistically significant percentage difference was observed between the participants and non-participants in terms of perception on lagged market price of maize from chi-square test at 1% level of significance

Table 4: Demographic characteristics of sample households for dummy variable

Characteristics	total sample (192)				participant (113)		non participant (79)		x2-value/ p-value
	N	%	Mean	SD	N	%	N	%	
Education: illiterate	14	7.29	5.39	2.81	9	7.96	5	6.33	26.65***
Primary	124	64.58			71	62.84	53	67.10	(0.000)
Secondary	22	11.46			15	13.27	7	8.86	
Above	32	16.67			18	15.93	14	17.71	
Price good	102	50.8	0.73	0.67	93	82.3	9	11.39	14.961***
Perception bad	90	49.2			19	17.7	71	88.61	(0.000)

*** implies statistically significance at 1% level of significance. Source: own survey result, 2020

Table(5) below discusses that average age for sample household's head was 41 years with average farming experience of 7 years. While, the Average farming experience for market participate was 7 years and non participant 16 years in which there is a significant percentage different between them at 1% of significance level. Further analysis of demographic characteristics under table 4 revealed that the average labor force of the total sample households' on the study area were 5.57 members on adult equivalent while average family size for market participant and non participant was 3.67 and 3.27 members respectively in which there is a significant mean difference among them at 1% level of significance. From this discussion it is possible to conclude that as farming experience increases the probability to participate to the market decreases. This implies that farmers may engaged in off-farm activates or store their produce rather than selling to the market. The second points is that farmers having large number of labor force can participate to the market since their production increases due to having a number of labor force

Table 5: Demographic characteristics of sample households for continues variable

	Total		min	max	participant		non-participant		t-value
Characteristics	sample (192)				(113)		(79)		p-value
	Mean	SD			Mean	SD	mean	SD	
Age of HH	41.15	8.70	9	63	44.25	14.11	37.54	9.43	65.57*** (0.000)
Farm experience	6.66	3.81	1	34	7.45	4.27	16.8	8.6	24.23* (0.0000)
Labor force	5.57	1.63	1	10	3.67	1.48	3.27	1.51	47.35** (0.000)

*** implies statistically significance at1%, level of significance. Source: Own survey result, 2020

4.3. Resource ownership of sample of the respondent

This branch shows that resource ownership of sample maize producer's household in the study area. Different physical resources like **land, livestock, oxen, off-farm** income, and ownership of transportation means and production of other crops were among the resources owned by households. **Land** is one of the most important factors of production for Smallholder farmers in many rural areas of the country as a whole and the study area in particular. Most of the **land** smallholder farmers used for their crop production in Ethiopian farming production is highly related to the land resource because much of the increment in production is related with the expansion of the land cultivated and it is impossible to expand production without increment of land for cultivation.

Analysis of the survey shows that the average total land owned by the farmers in the study area was **3.04 ha. With 0.5 Ha and 12 ha** of minimum and maximum land holding size. Similarly livestock are important assets for households in the study area. They have diverse functions for the livelihood of farmers and this is because farmers obtained food and non- food items. In addition, livestock's has been an important source of cash income and served as a wealth store and play a meaningful role within the community as a social status. The Descriptive result signifies sample households on average **own 4.9 livestock** while **3.7** Livestock and 1.2 livestock had owned by market participant and nonparticipant respectively.

Table 6: Resource ownership of sample households

Total Sample Characteristics	(192)				participant (113)		non- participant (79)		t-value/ p-value
	Mean	SD	min	max	mean	SD	mean	SD	
Total land	3.04	1.96	0.5	12	1.8	1.13	1.264	0.78	21.49*** (0.000)
Total livestock	4.9	2.64	0	14	3.7	2.92	1.2	2.44	25.709*** (0.000)

*** implies statically significance at 1% level of significance. Source: own survey result, 2020

Based on table (7)Resource ownership consists of many factors, but important resource owned by sample households were oxen, this is because they are sources of grip power, in the study are on average **2.9** oxen were owned by total sample households with minimum of not having oxen and maximum of **8 oxen**. This implies that on average one farmer has a pair of ox which is not enough to achieve self subsistence production rather than market participation. The table (7) above also shows on average 1.5 ha of land is allocated for maize production by sample households in the study area, while market participants and non-participants Households on average allocate 1.7 ha and 1.2 ha of land respectively for their maize Production. There was a significant mean difference between participants and non-participants at 1%level of significance. This implies that market participant households had on average allocated large Size of their land for maize production and by this they produce large quantity of maize. Therefore, they have surplus production which enables them to participate in maize market than non-participants.

Table 7: Resource ownership of sample households

Characteristics	Total Sample (192)				participant (113)		non- participant (79)		t-value/ p-value
	Mean	SD	min	max	mean	SD	mean	SD	
Number of oxen	2.9	1.95	0	8	1.7	2.86	1.2	2.35	1.92*** (0.000)
Land for maize	1.5	0.08	0.5	4	1	0.75	.5	0.5	5.06*** (0.000)

*** implies statically significance at 1% level of significance. Source: own survey result, 2020

According to table (8) some of the farmers in the study area are engaged in various off/non-farm activities in line with the main farming activities. This may be due to the need to get additional returns for different purposes because the income **substantiate** to the low income that is usually obtained from farming activities. In this study, **36.46%** (+)of sample households were engaged in off-farm activities during the given production year while among market Participants **46.01** % of the farm households were participates in off-farm activities and from Non-participants **22.78** % of them participant on different activates to generate income from non-farming activities. According the chi2 result there was a significant percentage difference between participants and non-participants based on their participation on off-farm activities.

Table 8: Resource ownership and off-farm activity of sample households

Characteristics	total sample (192)				participant (113)		non participant (79)		x2-value p-value
		N	%	mean	SD	N	%	N	%	
Off- farm activity	yes	70	36.46	0.37	0.43	52	46.01	18	22.78	24.62***
	no	122	62.8			61	53.99	61	77.22	(0.001)
Transport means	yes	65	33.85	0.81	1.35	41	36.28	24	30.38	8.36***
	No	127	66.15			72	63.72	55	69.62	(0.000)
Other crops	yes	82	42.71	0.64	0.48	52	46.02	30	37.97	
	No	110	57.29			61	53.98	49	62.03	18.25 *** (0.000)

*** implies statistically significance at 1% level of significance. Source: own survey result, 2020.

Out of the total sample households, 33.85% of them had their own transportation means which includes donkey, car and bicycle, whereas out of market participant, 36.28% of households had their own transportation means, while out of non-market participant, 30.38% of household owned

transportation means. And there was a significant percentage difference between market participant and non-participant households in terms of ownership of transportation means at 1% significant level. 42.71% of sample farmers in the study area produce other crop like sesame, sorghum the like beside their maize production. Whereas 46.02% of market participants and 37.97% of non participant were produce other crop. And there is significance statistical difference between them.

4.4. Access to institutional service, distance to the market and plot distance

Access to institution services like extension service is a critical determinant of farmers maize production and marketing status. In the study area in order to give effective extension services there are extension workers and development agents assigned in that area, however there is difference in number of visiting farmers, that is some of that farmers visit frequently and others may not. Those who frequently visited by extension workers have the highest probability of producing more maize and participating in markets than those who are less frequently visited by extension workers. According to the result of table (9) the total sample households in study area on average visit **1.47** days within the given production year or season by extension workers. There is a significant mean difference between market Participant and non-participant based on extension service at 1% level of significance .in which those market participants on average visit **2.39** days in their production season, while those non-participants visit **1.43** days.

Table 9: Access to institutional service, distance to the market and plot distance

Characteristics	total Sample (192)		participant (113)		non-participant (79)		t-value P- value
	Mean	SD	mean	SD	mean	SD	
Distance to the nearest market	26.4	3.2	31.3	3.63	45.56	2.24	49.3*** (0.000)
Plot distance	24	7	15.42	8.5	22.7	5.78	10.6*** (0.000)
Frequency of extension contact	1.47	1.26	2.39	1.21	1.43	0.68	16.37 (0.000)

*** implies statistically significance at **1%** level of significance. Source: own survey result, 2020

Nearness to market centers play a meaning full role on farmers maize production and marketing, this is because farmers did not incur high marketing costs to reach marketing places if they locate near to the market place. Sample households in the study area on average walks **26.4** minutes to reach the nearest market. While the average minutes to reach the nearest market for market participant households is **31.3** minutes and **45.56** minutes were for non-participants. And there is a significant mean difference between participants and non- participants at **1%** level according to their distance to the nearest market. Besides this the mean plot distance from the homestead for the total sample households was **24** minutes. The nearer the plots distance from the homestead, the serious and on time follow up, of the production activities.

From the total sample households about **28.12** % of them had access to market information through different means of communication while, for market participant and non participant households it was **33.63%** and **20.25%,** respectively. According to the chi2 result it was observed the existence of significant percentage difference between market participant and non Participant at 1% level of significance.

Table 10: access to market information by sample households

Characteristics	total sample (192)				participant (113)		non participant (79)		x2-value/ p-value
	N	%	mean	SD	N	%	N	%	
Mark information yes	54	28.12	47.4	0.5	38	33.63	16	20.25	13.19***
No	138	71.88			75	66.37	63	79.75	(0.000)

*** implies statistically significance at 1% level of significance. Source: own survey result, 2020

4.5. Farming practice and environmental factors

As indicated in the table (11) the majority **54.69%** of the respondents did not use improved maize seed. The average improved maize seed utilization of the sample farmers were 45.31%. Regarding utilizing improved Varity of maize, whether farmers have interest to take it but not at a regular manner; and this is because they take once and apply for the next season what they produce from their pervious production and it is mix with the local one and loss its improvidences. Whether farmers in the study area have less understanding about the crops that must have rotate around 38.54% of them were apply this farming practice. Out of a total sample **51.04**%of sample households hand faced occurrence of pest that really cause a serious damage on their maize crop. More particularly, different most **disastrous** insect would occur in their maize production within the give production year.

Table 11: Environmental factors on maize production and marketing

Variable	levels	N	%	means	SD
Seed Varity	improved	87	45.31	0.42	0.49
	Local	105	54.69		
Crop rotation:	yes	74	38.54	0.44	0.58
	No	118	61.46		
Occurrence of pest:	yes	98	51.04	0.45	0.53
	No	94	48.96		

Source: own survey result, 2020

Regarding rain the fall condition around **63.02 %** of sample farmers did not get enough rain that enables them to produce more. Mostly the rainfall condition in the study area was becoming untimely in which early entry and exists. As it can be seen below (12), 63.54% of the respondents do have a land which possesses a good fertile soil that could produce a lot in normal circumstances while the reaming **28.13%** and **8.33%** of sample farmers own a **land** with medium fertile soil and poorly fertile soil respectively. Regarding their farming system **76.04%** of sample households prepared their land by using oxen, while the reaming **23.96%** of them have access to prepare their land by using tractors. This implies that the majority of smallholder farmer's uses traditional means farms which not suitable for surplus production and market participating.

Table 12: Farming practice on maize production and marketing

Variable	levels	N	%	means	SD
Rain:	shortage	121	63.02	0.55	0.51
	Optimal	71	36.98		
Soil fertility:	good	122	63.54	1.4	0.34
	Medium	54	28.13		
	Poor	16	8.33		
	Tillage oxen	146	76.04	0.4	0.37
	Machinery	46	23.96		

Source: own survey result, 2020

The table above (13) reveals the distribution of maize producer farmer households on their Position in maize output market participation. Out of 192 households in the survey, 58.85% Were maize output market participant while the remaining 41.15 % were non-participant. This implies that more than half of the producers are market participants regardless of the level of their

participation, but in order to sustain good living standard and achieve economic development this is insignificant.

Table 13: Sample households market participation percentage

Description	frequency	% of participant farmers
Market participant	113	58.85
Non-participant	79	41.15
Total	192	100

Source: own survey 2020

4.7 Factors affecting smallholder farmers maize production in the study area

In this part factors affecting maize production were presented and discussed which helps for understanding of the potential determinants of maize production. The model F-test shows that the overall goodness-of fit of the model was statistically significant at 1% level of probability, which indicates the usefulness of the model to explain the relationship between the dependent and independent variables. R-square values indicate that the independent variables included in the regression explain 63% of the variations in maize production. As it can be seen below (Table 14), quantity of maize produced was significantly determined by eleven of the fifteen variables used in the analysis. These determining factors are such as: age, education level of the household hand, family size, extension service, and total land, farming system, crop rotation, and distance from the market, off-farm activities, farm experience and other crop production. Except the eleven variables statistically significant, the rest of variables used in the regression statistically insignificant which are proposed as variable affecting maize production.

Table 14: Factors affecting smallholder farmers maize production in the study area

	Coefficient	Std. Err.	t	P> t
AGE	.0036845 **	.0015009	2.45	0.015
GENDER	-.0869715	.0549178	-1.58	0.115
EDUC	.0419455 ***	.0073817	5.68	0.000
FSIZE	-.0280296***	.0071111	-3.94	0.000
FEXP	.003695 **	.0015676	2.36	0.020
LANDSIZ	.0688787 ***	.0198458	3.47	0.001
M.DISEASE	-.0017595	.0059202	-0.30	0.767
OFFARM	-.0727628***	.0269859	-2.70	0.008
DISMK	-.0028207 **	.001222	-2.31	0.022
EXCON	.0851648 **	.0401883	2.12	0.035
FSYSTEM	.0237226 *	.0138644	1.71	0.089
TRNSPO	.0146315	.0127052	1.15	0.251
OXEN	.0040499	.0065768	0.62	0.539
AIOCP	-.1222984 ***	.0378066	-3.23	0.001
CROPRO	.0991975**	.0442616	2.24	0.026
Constant	.395891	.1397743	2.83	0.005

Number of observation = 192 F(15, 176) = 19.61 Probability > F = 0.0000
R-squared = 0.6257 Adj R-squared = 0.5938 Root MSE = 0.23073

***, ** and * implies statically significance at 1, 5 & 10% level of significance respectively. Source: model result, 2020.

- The following result discussion is based on the table (14) above:-

Age of the household head: age of the household head positively and significantly affect maize production at 5% significance level. This implies that when household heads age increase by five year the quantity of maize produced increases by 0.004 quintal. The implication is that, as the age of the household head increases farmers are able to exercise new technology. Also it is believed that as the farmers' became older they have tendency to increase their production and produce more maize product for market than the younger producer.

Education level of the household head: education level of the household head found to be positively and significantly influence quantity of maize production at 1% level of significance. This implies that when a household head education level increase by one year maize production increase by 0.042 quintal. The result shows that there is a strong positive relationship between education and maize production because education enhances the farmers' ability to taking up of new ideas and modern production system for their maize production. In line with this the more the

household head is educated the higher will be the level of understanding and reception of information and implementation of modern technologies.

Extension service: - the frequency of days at which households contacts development agents or other consultants about farming system usage positively and significantly affects households' maize production at 5% level of significance. An increase in number of days to contact development agents and professionals to get advice increases the probability of farmers maize production by 0.09 quintal This implies that if a household frequently contact the development agents and gets support such as training and make smooth relationship, the more they can engage themselves in maize production.

The land possessed by household heads: the total farm land the farmer own has a positive and significant effect on maize quantity produced at 1% level of significance. Thus, the result implied that one Hectare additional land possessed would increase households maize production by 0.069 quintals, other factors remain constant. This is because owning more farm land encourages farmers to produce more maize by allocating more hectares of land for their maize production.

Farming system: the farming system was found to be positive and significant influence on quantity of maize produced at 10% level of significance. The positive relationship shows continence preparation of the land through modern means of plough significantly increase maize production by 0.024 quintals, other factors remain constant. The reason is that the households those having access to Tractor to plough their land and produce more maize. This is because the time and effort they divot on land preparation will increase and able to prepare large areas of land repeatedly.

Crop rotation: crop rotation practice had a positive influence on the maize production at 5% level. This implies that as the respondent farmers apply crop rotation frequently the quantity of maize production would increase by 0.1 quintals compared to farmers who do not apply it. This may due to the fact that farmers who had applied this practice have the chance to improve the soil fertility status of the Land.

Family size: family size affected maize production negatively and significantly at 1% level of significance. This implies that an increase in number of family reduces maize production by 0.028 quintal. This result shows that the because of land fragmentation among the number of the household heads will decrease the size of land allocated for maize and the output obtained also decreases.

Farm experience; farm experience is positively related with maize production and it is statistically significant at 5% level of significance. Accordingly, as a stallholder farmers experience increases by year, maize production will by 0.004 quintal. This is because as the HH experience increases from one pair to another the amount to be produced increases from 0.004 to more than that, other variables remain constant.

Participation on off-farm activities: it was indicated that participation in off-farm activities have negative impact on maize production by smallholder farmers because the income obtained from off-farm activities may decreases the farming participation and make the household unwilling to depend on maize production to get money. Therefore, the result of the model revealed that participation in off-farm activities had a negative significant impact on the farmers' decisions to produce at 1% significant level. This implies that if the household participate in alternative activities to generate off farm income, they are less likely to involve in maize production thereby reducing the household's engagement in maize market.

The marginal effects suggest that if a household involves in alternative off-farm activities, their probabilities of maize production decrease by 0.073 quintal. This finding indicates that households who participate on off-farm activities are in lined to be non-participants in maize production because they tend to generate cash from off- farm activities like charcoal selling, tea and coffee marketing. This Finding in line with the finding Rebecca (2018) who find a negative effect of off-farm activity on farmers' output market participation.

Other crop production: other crop production has a negative effect on the probability of farmers maize production decision and statistically significant at1% level of significance. The result shows that as the household engaged in other crop production the probability of their maize

production will decreases by 0.12 quintal. Another possible explanation for this result could be that, farmers those having the accessibility of other crop product has rare chance to produce maize.

Distance from the market : it was indicated that distance from the market have negative impact on maize production by smallholder farmers because the cost of transportation discourages farmers and may decreases the farming participation and make the household unwilling to depend on maize production to get money. Therefore, the result of the model revealed that an increase in distance from the market had a negative and significant impact on the farmers' decisions to produce at 5% significant level. This implies that if the place where the household home far apart from the market by 5% decreases the farmers maize production by 0.003 quintal.

4.8 Factors affecting market participation decision in maize market

The result of first stage Henchman model (probit) for the factors affecting market participation decision of farmers are exist in table 15 below. From the analysis out of fifteen variables used in the Henchman model, eight variables were significantly affect market participation decision of households in the study area (table 15). These variables are; farming experience, age of HH, education level of HH, land allocated for maize, frequency of extension contact, participation on off- farm activities, , assess to market information and ownership of transportation equipment.

Table 15: Factors affecting smallholder farmers for maize market participation

	Coefficient	Std. Err.	z	P>z
AGE	.0507374***	.0164336	3.09	0.002
SEX	.1300068	.3137838	0.41	0.679
EDUC	.1808371**	.0759454	2.38	0.017
LFSIZE	.0628195	.0674813	0.93	0.352
FEXP	.2857269***	.0696358	4.10	0.000
LANDSIZ	.4379069***	.1204791	3.63	0.000
CRACC	-.1078158	.3705518	-0.29	0.771
PRCPER	-.7394926	.5746882	-1.29	0.198
DISMK	-.2243606	.1589204	-1.41	0.158
EXCON	.5816584*	.3218115	1.81	0.071
AIOCR	-.0558443	.4064278	-0.14	0.891
TRNSPO	.419021*	.2263049	1.85	0.064
TOTLIVS	-.0177733	.0279466	-0.64	0.525
MRKINFO	.9091178***	.2056496	4.42	0.000
OFFFARM	-.8773073***	.3188113	-2.75	0.006
Constant	-8.019293	1.576248	-5.09	0.000

Number of observation = 192 LR chi2 (15) = 161.02 Probability > chi2 = 0.0000
Log likelihood = -49.550372 Pseudo R2 = 0.6190

***, ** and * implies statistically significance at 1, 5 and 10%, level of significance respectively.
Source; model survey result 2020

- All of the following result discussion depend on the (table 15) above:-

Age HH: The model output indicates that age of the household head significantly and positively related with households market participation decision at 1% significant level. The marginal effect on probability of market participation decision shows that an increase in one year age of house hold increases the market participation and more products produced; as a result market participation of the household to the market increases by 5%. This result implies that an increase in age of HH increases on maize production and maize marketing enhance the participation of the household maize market participation and this indicates the importance of age on enhancing farmers' market participation.

Farm experience: as the result of the regression indicates farm experience of the household head significantly and positively related with households market participation decision at 1% significant level. The marginal effect on probability of market participation decision shows that as an increase in number of years of the house hold experience in farming the more products produced; as result when farm experience increase in one year market participation of the household increases by 29%. This result implies that an increase in experience on maize production and maize marketing enhance the participation of household maize market participation and this indicates the importance of enhancing farmers' market participation.

Land allocated for maize: the size of land allocated for maize production was positively and significantly affects farmers' market participation at 1% significant level. This estimated result showed that for additional one hectare of land allocated for maize the probability of farmers market participation increase by 44%. This implies that the more the households allocated their land for maize crop the more marketable surplus they have due to increase in the production of maize. This result is in agreement with the finding of Tariku (2018) which show that amount of land allocated for output production positively affected market participation of farmers. This is because land is one among the critical production factor which has a direct impact in maize output obtained.

Extension contact: the frequency of days at which households contact development agents or other consultants about extension package usage positively and significantly affects households' market participation decision at 10% level of significance. An increase in ten days to contact professionals to get advice increases the probability of farmer's market participation decision increases by 58%. This implies that if a household frequently contact the development agents and gets support such as training and smooth relationship the more they can participate in maize market.

Education level of the HH: education level of the HH affect the probability of farmers' market participation positively and significant at 1% level of significance. Education level of the households on maize market participation is important in altering marketing decision of the farmers. This is because education level of HH has positive impact on maize on market

participation for households to produce a surplus product by allocating their available resource: in order to participate in maize market. Accordingly, the higher level of education the household head has the more, the more quantity of maize they produce and the higher the probability of the households' market participation. As the value of the marginal effect, the probability of farmers' market participation increases by 8% due to increase in level of education from one stage to another stage.

Ownership of means of transportation: ownership of transportation equipment positively and significantly affects the probability of households' market participation decision at 10% level of significance. Thus, as a result of increase in 10% of owning transportation equipment the probability of households' market participation increases by 42%. This is because farmers after having surplus production may not participate in market due to lack of transportation means and constrained by transport cost. But households who own transport equipment would participate in output market and sell more as a reduction of transportation cost. In general ownership of transport equipment such as donkeys, donkey cart and bicycle have positive impact on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to the market.

Participation on off-farm activities: it was indicated that participation in off-farm activities have negative impact on market participation of smallholder farmers because the income obtained from off-farm activities may decreases the farming participation and make the household unwilling to depend on maize production to get money. Therefore, as shown in table (4.12) the result of the model revealed that participation in off-farm activities had a negative significant impact on the farmers' decisions to participate in the output market at 1% significant level. This implies that if the household participate in alternative activities to generate off farm income, they are less likely to involve in maize production thereby reducing the household's engagement in maize market.

The marginal effects suggest that if a household involves in alternative off-farm activities by 1%, their probabilities of market participation decrease by 88%. This finding indicates that households who participate on off-farm activities are in lined to be non-participants in maize market because

they tend to generate cash from off- farm activities like charcoal selling, tea and coffee marketing. This Finding in line with the finding Rebecca (2018) who find a negative effect of off-farm activity on farmers' output market participation.

Market information: market information has a positive effect on the probability of farmer's maize market participation decision positively and statistically significant at1% level of significance. The result shows that as the household engaged in searching information increases at 1%, the probability of their market participation will increase by 91%. Another possible explanation for this result could be that, farmers those having the accessibility of market information for supply of maize to the market, increases in probability of market participation.

4.9 Factors affecting volume of maize marketed surplus in the study area.

The results of the second henchman model for volume of maize marketed supply, indicates that out of fourteen variables used in the regression, seven variables significantly affected volume of maize marketed supply in the study area at different level of significance (table 16). These variables are farm experience, gender, education, land size, credit accessibility, distance from the market, and off-farm activities. Out of these variables gender, credit accessibility, distance from the market and off-farm activities negatively and significantly influence maize supply while the three variables affect maize supply positively and at significant level. The value of Wald ch-square indicates that the alternative hypothesized independent variables significantly and strongly explain the variation of farmers' volume of maize marketed supply.

Table 16: Factors affecting volume of maize marketed supply

	Coefficient	Std. Err.	z	P>z
GENDER	-.4838301*	.2478497	-1.95	0.051
EDUC	.0553665**	.0220786	2.51	0.012
FSIZ	.011785	.0513726	0.23	0.819
FEXP	.0567484***	.0181218	3.13	0.002
LANDSIZ	.2141293***	.0749478	2.86	0.004
CRACC	-.4430968*	.2485068	-1.78	0.075
PRCPER	-.3873398	.3213513	-1.21	0.228
DISMK	-.2871737 ***	.0960021	-2.99	0.003
EXCON	.3365173	.2269505	1.48	0.138
OTHCRPRO	-.2791266	.3023489	-0.92	0.356
TRNSPO	.1128185	.0898566	1.26	0.209
TOTLIVS	-.026056	.0207987	-1.25	0.210
MRKINFO	.3814174	.2890022	1.32	0.187
OFFFARM	-.7793882***	.2279044	-3.42	0.001
Lambda	-3.271663	1.578359	-2.07	0.038

Number of observation = 192 Censored obs = 79 Uncensored obs = 113
Wald chi2 (14) = 183.17 Probability > chi2 = 0.0000

***, **, and * implies statically significance at 1%, 5% and 10% level respectively. Source: model result, 2020.

- All the result discussed below is based on the table (16) above:-

Gender of the HH: Gender of the household negatively and significantly affect volume of maize marketed supply at 10% significance level. This implies that an increase in male household heads by 10% decreases female HH of the volume of maize supply to the market by 0.48 quintal. The implication is that, as the male of the household head increases in volume of maize supply the female household's volume of maize supply decreases and this decreases the amount of maize supply to the market and affects the cultural and societal relationship in living standard.

Education level of the HH: -the education level of the HH positively and significantly affects the probability of households' maize market supply at 5 % significant level. Thus, as a result of increase 5% in education level of the HH the probability of households' volume of market supply increases by 0.06 quintal. This is because as farmers gets formal education or training within a particular time the amount of the product supplied also increases. Education is important to

implement the instruction provided by development agents and professionals of the sector properly.

Farm experience: farm experience owned by households positively and significantly affects the volume of maize marketed supply by smallholder farmers at 1% significance level. This implies that when the household has one year of farm experience he/she expand the production which is supplied to the market and this leads to an increase in maize quantity supplied to the market. The result shows that for having one additional year of farm experience volume of maize marketed supply increase by 0.06 quintal.

Land allocated for maize production: - land allocated for maize production was positively and significantly affects the marketed supply of maize output at 1% significant level a one hectare increase in cultivated land under maize production increase volume of marketed supply by 0.21 quintal. This shows that the larger the cultivated land size which allocated to maize production the higher the quantity produce and thereby increasing the volume of the maize output supplied to the market. The result that is in agreement with the finding of (shewaye, 2014; Alemu G, 2015) which shows that the proportion of allocated for output production positively affected marketable surplus of outputs. This is because land is one among the critical production factor which has the direct impact in maize output obtained.

Credit accessibility: - credit accessibility for smallholder farmers affect volume of maize market supply negatively and significantly at 10% significant level. This implies that when household heads get access of credit increases by 10%, this in turn decreases the producers' volume of maize supply to the market by 0.44 quintal. The implication is that, when producers get credit they can store maize than supply to the market and reduce maize supply.

Distance to the market supply: the furthest distance to the market maize supply of the household negatively and significantly affect volume of maize marketed supply at 1% significance level. This implies that when household heads distance from the market increases by one hour, volume of maize supply to the market decreases by 0.29 quintal. The implication is that, the more producers get closes to the market, the more they can supply maize product to the market.

Additionally when farmers live nearest to the market the amount of product supplied to the market increase, thereby increases their income and it is better means of technology adoption to improve their produce further.

Off-farm activities: it was expected that engagement in off-farm activities affect volume of maize supply negatively and significantly at 1% significant level. The income obtained from off-farm activities reduces the farmers' supply of maize to the market in surplus amount and makes the household unwilling to depend on maize production to get money. Therefore, as shown in table (16), the result of the model revealed that participation in off-farm activities have a negative significant impact on the farmers' decisions to supply in the output market at 1% significant level. This implies that if the household engage themselves as alternative activities to generate off farm income, they are less likely to involve in maize market participation and thereby reducing the household's position in maize volume supply to the market. The marginal effects propose that if a household involvement in alternative off-farm activities increases by 1%, their probability of volume of maize supply to the market decrease by 0.78 quintal. This finding indicates that households who participate on off-farm activities are more in lined to be non-suppliers in maize market because they tend to generate cash from off-farm activities rather than from agrarian commodities like maize in the study area.

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY AND CONCLUSION

This study was aimed on factors affecting smallholder farmers maize production and market participation. The study was apply **cross sectional data** collected from 192 randomly selected households through a two stage random sampling technique and probability proportional to size in Dedo district for 2018/2019 production and marketing year. The study has used descriptive and inferential statistics t-test and chi2 test to analysis different factors towards households maize production and market participation. OLS and Henchman model was employed in order to identify factors affecting households maize production, market participation decision and volume of maize marketed supply respectively based on revised literatures and the natures of the data at hand.

The result of descriptive analysis revealed that out of total sample maize producers 89.1% of them are male headed households. The average age of sample maize producer were 41.15 year with the average family size of 5.57. Based on the descriptive result the average land holding size is 1.5 ha. Regarding frequency of extension contact and off- farm participation the farmers within a production season on average visited by extension workers for 1.47 days and 36.46% of them are off- farm activity participant. Besides this the descriptive result shows that 58.85% (113) of households were in maize output market. The t-test of mean difference and chi- square of test proportional difference showed that existence of statistically significant difference between market participants and non- participants in terms of farming experiences, education level, family size, gender, participation on off- farm activities, lagged price perception of maize, ownership of transportation equipment, access to market information, land allocated for maize, frequency of extension contact, maize quality produced and distance to the nearest market.

Analysis of model indicates that household maize production, significantly affected by education level, total land owned, farming system, age of the HH, family size, farm experience, distance to the nearest market, other crop production and crop rotation positively and significantly. According the Henchman model estimation household market participation decision positively and significantly affected by gender, farming experience , education level, land allocated for maize, extension contact, market information and transportation equipment. Participation on off

farm activities negatively and significantly affected the probability of market participation. Besides this volume of maize market supply positively and significantly affected by gender, education level, farm experience, land allocated for maize, credit accessibility, and distance to the nearest market and off-farm activities where as gender, credit accessibility, off-farm income and distance to the nearest market negatively and significantly affect volume of maize market supply. Improving farmers crop productivity and market participation taken as a high priority for development workers and policy makers as a tool of reduction of poverty and boosting economic growth through different options of policies which incorporate transformation of the subsistence of agriculture to market oriented one, reducing problems which affect farmer's crop production and market participation. Therefore, transformation of the overall chains of the system of the sector from subsistence to modern and market oriented one is essential to improve the contribution to the country's development.

Based on the above results factors those improve farmers maize production are education level of the household, total land owned, farming system and farming experience : while off-farm activities and distance from the market play a role in reducing farmers maize production. Besides this the probability of household market participation decision enhance by having more farming experience by frequently visit by extension workers by allocating high proportion of land for maize, access to market information, and ownership of transportation equipment, while participation on off-farm is responsible for decrease of probability of farmers market participation decision. Likewise, the amount of maize marketed supply enhance as a result of education, the proportion of land allocated for maize and by having farm experience; while off-farm activities and distance to the nearest market leads to a decline of the amount of maize marketed supply.

5.2 RECOMMENDATION

Based on the finding, the study recommends the following as a means to enhance smallholder's farmers maize production and maize output market participation in the study area. Household's education level was positive and significant factor affecting households maize production and volume of maize marketed supply. This implies the significance of education as it leads the households with having knowledge and managing ability that help farmers making appropriate and optimal decisions. Thus, the regional and district government should work in strengthening the system of formal and informal rural education provision and focus on encouraging farmers to attain adult education by facilitating opportunities for farm household to attain it besides their farming activities.

Total land holding and land allocated for maize was affect smallholder farmers maize production, market participation decision and volume of maize market supply respectively. Therefore, the government and concerned bodies focus on farmers train in order to intensify the farming practice through proper land management on time application of the required inputs follow and apply production packages like expansion of FTC practices proper application of other extension packages and about efficient allocation of their land for their maize production. Therefore, this enhances their maize production, probability of market participation and volume of marketed surplus.

The land farming experience used by farm household has positive and significant effect on quantity of maize produced. This show that the importance of repeatedly conducting farm for proper land preparation. In the study area there is some good starting by the government and some by making farmers to exercise application of modern means of farming.Off-farm activities were negative and significant factor affecting probability of maize market participation decision. This shows that the highest the degree the households participate to off –farm activity the lower the chance to engage themselves into maize marketing.. Therefore, in order to increase farmer's market participation the district agricultural office and extension workers should take the lion share by providing and updating farmers with maize production and related information and marketing condition.

Access to market information was a factor which affects positively and significantly market participation decision This shows that market participation decision and volume of marketed supply requires market oriented production and market oriented production requires information about markets. However, smallholder farmers often face information asymmetry in input and output markets which force them in to produce for subsistence. Therefore, government intervention in provision of communication facilities infrastructure and improving the existing one to avoid information asymmetry should be given prior attention.

Frequency of extension contact had positive and significant effect on household's probability of market participation. This is because a technical advice provision for farmers on marketing related issue of maize has the potential to enhance farmer's market participation. Therefore, if well organized and jointly planed trainings and continuous advices is provided by development agents and agricultural experts about over all marketed related issues it helps to improve the probability of farmer's market participation.

Distance to the nearest market and off-farm activities had negative and significant effect on volume of maize marketed supply. Therefore, the government should be given attention to rural infrastructural development as whole and road and transformation system particularly. By this the amounts of maize output supplied into the market by farmers who are far from the market place enhance the production and market participation of the smallholder farmers.

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Appendixes

Appendixes 1: Contingency correlation of Dummy independent variables test

	Gender	Pest	Off-farm	extension contact	transport	other crop production
crop rotation						
Gender	1.0000					
Pest	0.1072	1.0000				
Off-farm	0.0368	-0.0706	1.0000			
Extension	0.0220	-0.2210	-0.0712	1.0000		
Transport	0.0255	0.0615	0.0594	-0.0525	1.0000	
Other crop p	0.0813	0.1452	0.0590	-0.0685	-0.0411	1.0000
Crop R	-0.0403	-0.0839	-0.0592	0.0243	0.0034	0.3100	1.0000

Appendixes 2: Factors affecting smallholder farmer's maize production econometric analysis.

Number of observation	= 192
F(15, 176)	= 19.61
Probability > F	= 0.0000
R-squared	= 0.6257
Adj R-squared	= 0.5938
Root MSE	= .23073

	Coefficient	Std. Err.	t	P>|t|	[95% Conf.	Interval]
AGE	.0036845	.0015009	2.45	0.015	.0007224	.0066466
GENDER	.0869715	.0549178	-1.58	0.115	-.1953535	.0214106
EDUCA	.0419455	.0073817	5.68	0.000	.0273775	.0565135
FAMISIZE	-.0280296	.0071111	-3.94	0.000	-.0420636	-.0139955
FEXP	.003695	.0015676	2.36	0.020	.0006013	.0067888
LANDSIZE	.0688787	.0198458	3.47	0.001	.0297122	.1080451
PEST	-.0017595	.0059202	-0.30	0.767	-.0134433	.0099242
OFFARM	-.0727628	.0269859	-2.70	0.008	-.1260205	-.0195051
DISMK	-.0028207	.001222	-2.31	0.022	-.0052323	-.0004091
EXCON	.0851648	.0401883	2.12	0.035	.0058518	.1644779
FSYSTEM	.0237226	.0138644	1.71	0.089	-.0036391	.0510844
TRNSPO	.0146315	.0127052	1.15	0.251	-.0104425	.0397056
OXEN	.004049	.0065768	0.62	0.539	-.0089297	.0170296
OTHRCRP	-.122298	.0378066	-3.23	0.001	-.196911	-.0476857
CROPRO	.0991975	.0442616	2.24	0.026	.0118457	.1865493
CONSTANT	.395891	.1397743	2.83	0.005	.1200416	.6717403

Appendixes 3: Factors affecting smallholder farmer's maize market participation decision econometric regression result.

Number of observation = 192
LR chi2 (15) = 161.02
Probability > chi2 = 0.0000
Log likelihood = -49.550372 Pseudo R2 = 0.6190

	Coefficient	Std. Err.	z	P>z	95% Conf	. Interval
AGE	.0507374	.0164336	3.09	0.002	.0185281	.0829468
GENDER	.1300068	.3137838	0.41	0.679	-.4849982	.7450118
EDUC	.1808371	.0759454	2.38	0.017	.0319868	.3296874
FSIZ	.0628195	.0674813	0.93	0.352	-.0694413	.1950804
FEXP	.2857269	.0696358	4.10	0.000	.1492432	.4222105
LANDSIZ	.4379069	.1204791	3.63	0.000	.2017722	.6740416
CRACC	-.1078158	.3705518	-0.29	0.771	-.8340839	.6184523
PRCPER	-.7394926	.5746882	-1.29	0.198	-1.865861	.3868756
DISMK	-.2243606	.1589204	-1.41	0.158	-.5358389	.0871176
EXCON	.5816584	.3218115	1.81	0.071	-.0490805	1.212397
OTCPROD	-.0558443	.4064278	-0.14	0.891	-.8524282	.7407396
TRNSPO	.419021	.2263049	1.85	0.064	-.0245284	.8625704
TOTLIVS	-.0177733	.0279466	-0.64	0.525	-.0725477	.037001
MRKINFO	.9091178	.2056496	4.42	0.000	.506052	1.312184
OFFFARM	-.8773073	.3188113	-2.75	0.006	-1.502166	-.2524487
Constant	-8.019293	1.576248	-5.09	0.000	-11.10868	-4.929904

Appendixes 4: Factors affecting smallholder farmer's volume of maize market supply econometric regression result.

Number of observation = 192
Censored observation = 79
Uncensored observation = 113
Wald chi2 (14) = 183.17
Probability > chi2 = 0.0000

	Coefficient	Std.Err	Z	P>Z	95% Conf	Interval
GENDER	-.4838301	.2478497	-1.95	0.051	-.9696065	.0019463
EDUC	.0553665	.0220786	2.51	0.012	.0120933	.0986397
FSIZ	.011785	.0513726	0.23	0.819	-.0889036	.1124735
FEXP	.0567484	.0181218	3.13	0.002	.0212304	.0922665
LANDSIZ	.2141293	.0749478	2.86	0.004	.0672342	.3610243
CRACC	-.4430968	.2485068	-1.78	0.075	-.9301612	.0439676
PRCPER	-.3873398	.3213513	-1.21	0.228	-1.017177	.2424971
DISMK	-.2871737	.0960021	-2.99	0.003	-.4753344	-.099013
EXCON	.3365173	.2269505	1.48	0.138	-.1082974	.7813321
ocprdu	-.2791266	.3023489	-0.92	0.356	-.8717197	.3134664
TRNSPO	.1128185	.0898566	1.26	0.209	-.0632972	.2889341
TOTLIVS	-.026056	.0207987	-1.25	0.210	-.0668207	.0147088
MRKINFO	.3814174	.2890022	1.32	0.187	-.1850165	.9478513
OFFFARM	-.7793882	.2279044	-3.42	0.001	-1.226073	-.3327038
Lambda	-3.271663	1.578359	-2.07	0.038	-6.365189	-.1781361

Appendix I: Questionnaire

Jimma University College of Business and Economics Department of Management

Masters of Business Administration Post Graduate program

Research Questionnaire

Title: Factors affecting smallholder farmers in maize production and market participation, in case of Dedo woreda, jimma zone, oromia regional state, Ethiopia.

The purpose of this survey is to collect data about **factors affecting maize production and market participation from maize producer smallholder farmers in Dedo district, oromia regional state**. The information you provide is important for successfully accomplishment of the research. For this sake, I can really confirm you that all the data will be used for academic purpose and will be analyzed anonymously. Hence, because of your provision, you will never expose to any harm. I am thanking and appreciating your kind cooperation and I need to say thank you.

General instruction:

1. Please, encircle your answer for the multiple questions.
2. To open ended questions, please, write your responses on the space provided.

   Name the enumerator _____

   Phone number _____ date _____

1. District/woreda : Dedo

2. Kebele: A) warokolobo B) kata Adi C) korti D) offole Dawe

General information about the respondents

Age of the house hold head_____

A) 21-30

B) 30- 40

C) >41-

1. Sex of the house hold head : A) male B) female
2. Marital statuses of the household head? A) married B) single C) widowed D) divorced
3. Educational level of house hold head? _____

A. Illiterate

B. grade 1 – 12

C. TVET and above

4. Main occupations of the household head?

A) Agricultural self- employed

B) Causal laborer

C) Handicraft

D) Fishing and above

A) Maize production

5. What is the] size of land that assigned for maize production?

A) 0 - 1 ha B) 1.5 – 3 ha C) 3 – 5 ha D) above 5ha

6. Would you use improved seed? A) yes B) No

7. From where you can get improved seed?

A) Agricultural office and Own production B) research center C) cooperative union 4) local market and others _____

8. Does the type of soil or the status of soil fertility can affect maize production?

A) Yes B) No

9. Production location from home or distance can determine maize production?

A) Yes B) No

10. Did you apply fertilizer in your maize production in 2011 E.C production period?

A) Yes B) No

11. If you did not apply fertilizer in your maize production, what factors can hinders you?

A) Lack of supply at time B) lack of money C) lack of awareness

D) requirement or existence

12. Do you think that the number of labor can influence the amount of product to be produced? A) Yes B) No

13. The cost of production can affect the amount of maize to be produced?

A) Yes B) No

14. Which problem producers regularly encounter from year to year?

A) Non availability of input on time B) expensiveness of input C) shortage of input supply D) shortage of cash to buy input

15. Which kind of natural problem of the production problem majorly influence in average maize production? A) diseases (pests and drought causing virus) C) others

16. Participation in off-farm activity is important for maize production?

a) Yes B) no

17. Would you get extension services from FTC or development agents?

a) Yes B) no

18. Do you think that using different means of farming is important for maize production?

a) Yes B) No

19. The number of means of transport you use in maize production for transportation?

B) 0 C) 1 D) 2 E) above 3

20. Having more number of oxen increases maize production?

A) Yes B) no

21. Do you think that production of other crop decreases maize production?

A) Yes B) no

22. Is exercising crop rotation in farming or producing maize increases maize output?

A) Yes B) no

B) Market participation

23. The number of family / household members can affect market participation?

A) Yes B) No

24. Do you think that land size allocated for maize affects maize production?

A) yes B) no

24. If the number of family / household affect market participation, how?

A) Increase as family member decreases

B) Decrease as family members increases

25. If the households sold maize, who was the buyer of maize produce?

A) Farmers & urban maize traders B) maize consumers in urban area &rural maize traders C) intermediaries &other groups

26. The major means of transport to supply to the market is?

A) Using animals B) by themselves C) by using car

27. If you supply maize product by using car, what is the average cost of transportation?

A. Less the fifty birr B) 50_ 100 birr C) 101 _ 200 birr D) > 201 birr

28. Did you have experience in maize selling years? A) yes B) No

29. What is the distance from the market to the nearest market in minutes of walking?

A) Less than 1hr B) 1- 2hr C) more than 2hr

30. Did you get market information before you decided to sell the product? A) Yes B) No

31. From where you can get market information?

A) From fellow farmer B) from extension agents C) Observation in market

32. What are factors affecting maize market participation?

A) Distance from the market B) farm experience C) transportation D) others

33. What is the contribution of credit accessibility on maize market participation?

A) Positive B) negative

34. The effect of Perception of lagged price on maize market participation is?

A) Positive B) negative

35. The frequency / regularly extension contact on maize market participation is important ?

A) Yes B)

36. Would you get credit services? A) yes B) no

37. Do you participate in off –farm activity? A) yes B) No

C) Volume of maize supply

- Answer the following questions according to the extent of supply.

  (1 = very low, 2 = low , 3 = medium , 4 = high , 5 = very high in ownership of the resource or services to supply product to the market)

	1	2	3	4	5	idea
38. The extension service you get						
39. The land you allocate for maize in ha						
40. Your involvement in off-farm activity.						
41. Market information you have						
42. Farm experience you have						
43. Number fo family you have						
44. Lagged price perception you have						
45. The number of means of transport you use						
46. Distance of market from your home						
47. Availability of credit service						