

**DETERMINANTS OF COMMERCIALIZATION OF SMALLHOLDER ONION
PRODUCERS IN HARAMAYA DISTRICT, EAST HARARGHE ZONE, OROMIA
REGION, ETHIOPIA**

MSC. THESIS

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NOVEMBER, 2017

HARAMAYA UNIVERSITY, HARAMAYA

**DETERMINANTS OF COMMERCIALIZATION OF SMALLHOLDER
ONIONPRODUCERS IN HARAMAYA DISTRICT, EAST HARARGHE ZONE,
OROMIA REGION, ETHIOPIA**

A Thesis Submitted to the School of Agricultural Economics, and Agribusiness.

Postgraduate Program Directorate

HARAMAYA UNIVERSITY

**In partial Fulfilment of the Requirements for the Degree of
MASTER OF SCIENCE IN AGRICULTURE ECONOMICS**

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November, 2017

Haramaya University, Haramaya

DEDICATION

I dedicate this thesis manuscript to my father Olani Fida, and my mother Damma Nagasa, for nursing me with love and affection.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation.

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BIOGRAPHICAL SKETCH

The author was born in 1989 in Gidda Ayana *Woreda*, Eastern Wellega Zone, Oromia Regional State, from his mother Damma Nagaasa and his father Olani Fida. He attended his elementary and junior secondary education at KIRAMU Primary and Junior Secondary schools respectively. He also attended his high school education and Preparatory School in Gidda Ayana Secondary and Preparatory Schools respectively. In 2008, he joined Haramaya University and graduated with B.A. degree in Accounting on June 30, 2010.

Soon after graduation the author was employed in International Child Support Organization called Compassion International Ethiopia as a manager on its assisted project in Eastern Hararghe at Haramaya Town. After serving for three years in the project, he joined Haramaya University, School of Graduate studies in October 2015 to pursue his M.Sc., degree in Agricultural Economics.

ACKNOWLEDGEMENTS

I am indebted to different individuals for their help and encouragement while conducting this study. First, I would like to express my deepest gratitude to my major advisor, Dr. Jema Haji, and Co-advisor Mr. Mohammed Aman, for their continuous advises from their immense knowledge, intellectual, stimulation, professional guidance, and encouragement from proposal write up and questionnaire development up to submission of the final Thesis.

Secondly, I would like to thank my beloved and best friend Mr. Megersa Debela, who supported me throughout the entire process of my study and this Thesis work. I would also like to extend my thanks to my friends Daniel Wendimu, Ebbisa Iddosa, and Ebbisa Belay, who shared me their precious time during the data collection.

Finally, I would like to extend my appreciation to Haramaya Woreda administration offices and Haramaya Woreda Agriculture and Rural Development offices for their permission, and cooperation to use the available data from Woreda offices and all sample respondents for their patience to respond to the lengthy questionnaire.

LIST OF ACRONMYS AND ABBREVIATIONS

CDF	Cumulative Distribution Function
CSA	Central Statistical Agency
EIA	Ethiopian Investment Agency
ETB	Ethiopian Birr
FDRE	Federal Republic of Ethiopia
FTLP	Fast Track Land Policy
GDP	Gross Domestic Product
GOZ	Government of Zimbabwe
GTP	Growth and Transformation Plan
HCI	Household Commercial Index
HWARDO	Haramaya Woreda Agriculture and Rural Development Office
IMR	Inverse Mills Ratio
KM	Kilometres
KWOoARD	Kombolcha Woreda Office of Agriculture and Rural Development
MOARD	Ministry of Agricultural and Rural Development
MoFED	Ministry of Finance and Economic Development
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
TLU	Tropical Livestock Unit

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**DETERMINANTS OF COMMERCIALIZATION OF SMALLHOLDER ONION
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ABSTRACT

Eastern Hararghe Zone of Oromia region has the potential comparative advantage of producing vegetables. Despite this potential the farmers in the study area rarely utilize this opportunity to improve their livelihood. This study was undertaken to identify the determinants of smallholder farmers' participation in onion market and level of commercialization in Haramaya District of East Hararghe Zone. Both primary and secondary data were used to achieve objective of the study. A multi-stage random sampling technique was used to select 156 farm household heads from six sample kebeles in the study area. Structured survey schedule was used to collect data from sampled farmer household head. Descriptive statistics and econometric methods were used to analyse data. Heckman two stage model was applied to analyse the determinants of farmer household's decision to participate in the onion market and level of commercialization. The first stage of Heckman model result revealed that irrigation, and fertilizer positively affected the decision to participate in onion market. The second stage indicted that, education of farmer household head, and extension services negatively affect level of commercialization. Furthermore, fertilizer positively affects level of commercialization. Thus, intervention mechanisms that help farmers get access to sustainable and adequate fertilizer, and irrigation that boost smallholder onion market participation and commercialization should be pursued.

Keywords: Commercialization, Market participation, Onion, Heckman two Stage, Smallholder farmers, Haramaya, Ethiopia.

1. INTRODUCTION

1.1. Background of the Study

Agriculture commercialization refers to the process in which farmers increase their productivity by producing more output per unit of land (and labour) produce greater surpluses which can be sold in the market and thus increase their market participation with beneficial outcomes of higher incomes and living standards (Jayne and Haygblade, 2011).

Most of the world's poor live in rural areas of developing countries and agriculture is the backbone of many of these economy, especially in the sub-Saharan Africa, which depend on agricultural production for income and food security. However, increased urbanization trends in these countries have also increased demand for fresh produce, food security and development of agricultural markets which puts a demand on the smallholder farmers. Therefore, commercialization of the smallholder resource poor farmers is important in realizing higher productivity, greater specialization, and higher incomes in the rural communities. However, farmers in these developing countries are being challenged by different factors. For instance, in the Kenya, majority of the smallholder farmers, because they are poor, are adversely vulnerable to factors such as weather, pests, plant and livestock diseases, changes in prices for farm products and inputs besides politics and hence are unable to effectively engage in commercialization (Chesoli, 2013)

Agricultural commercialization can significantly increase the incomes and welfare of smallholder farmers as well as contribute to economic growth and poverty alleviation (Zhou, 2013). Similarly OECD (2010), reported that agricultural development has potential to generate growth by two to three times than non-agricultural sector developments, especially for the bottom quartile of poor people in SSA. More specifically as most farmers in developing country like Ethiopia (above 85%) farm on less than 2 hectares of land and the possibility of increasing holding size is unthinkable, improving productivity of smallholders will be the catalyst for achievement of growth (Tesfaye *et al.*, 2012; Tekalegn *et al.*, 2014).

While Southeast Asia and parts of Latin America are rapidly moving towards commercialization; the countries of East Asia are at the high end of the agricultural commercialization pathway,

South Asia and much of Sub-Saharan Africa are at the lower end of the commercialization pathway. While the speed of commercialization differs substantially across continents and countries they are all moving in the same direction. Agriculture contributes the lion share to the national GDP and labor employment in Ethiopia. It is mainly characterized by small scale farming. Being one of the emerging fast growing economies in the world, maximizing this potential necessarily requires increasing the level of smallholders' agricultural productivity which is not existed at base level due to several socio economic bottlenecks. For instance, lack of adequate technological option coupled with diminishing productivity of cultivated land, low level of technological adoption and institutional failures are among the main problems that add to lower smallholders' agricultural productivity (Abdi, 2016). This lower smallholders' agricultural productivity in turn is reflected in the lower smallholder commercialization.

As review of Filho (2017), during 1970 to 2015, garlic, onions, potatoes, tomatoes and watermelons accounted for 66.5% of the total production of the world. Like garlic, onion also has its origins in Asia, but in the region of Pakistan and Iran. Onion world production in the period was 84.2 million tons, but only 0.47% was traded on the world market. Also, its world production increased significantly (64.0%) in these periods. Yield grew by 52.3% and contributed 88.8% to the growth of world production. During the indicated periods, the six-major onion producing countries were, China (produced 26.4% of the global onion production), India (21.2%), USA (4.3%), Iran (2.7%), Russia (2.45%) and Brazil (1.8%) respectively.

In Ethiopia smallholder farmers who operate farm are mainly cereals growers both for own – consumption and sales on less than 2 hectares per households. Albeit physically small when seen separately, as a group covers 96% of total area covered by crop and contribute 97% of total crops, out of which 76.3%, is vegetables during the 2009/2010 (Alemayehu *et al.*, 2011; MoFED, 2010).

Ethiopia has a great potential to produce Onion every year for both local consumption and export with an average yield 13.3 tone/ha (CSA, 2011/12). Farmers living in the Oromia region produce Large amount of Onion bulbs every year. For instance, in 2011/12 production year the region contributed 1,282,129 quintals onion bulb. Thus, Haramaya District is one of the place where onion produced largely (HWARD, 2016).

Given this condition, the study focused on onion, which is produced for income generation and consumption in the study area. This study aimed to examine factors that affect smallholder farmers' decision to participate in onion output market and level of commercialization among smallholder farmers in Haramaya district.

1.2. Statement of the Problem

Examining the determinants of market participation of smallholder farmer is needed because it is getting priority in the developing world in general and Ethiopia in particular. This prioritization of smallholder farming has been reflected in the policy agenda of many developing countries. Given the agricultural-led industrialization strategy for development and the dominance of smallholder farmers need to be transformed from the subsistence-based production to market-oriented production system (Leykun and Jema, 2014).

A prior study by Aman (2014), identified household level determinants of the output side commercialization decision and level of commercialization, but he did not distinguish the decision to commercialization from the decision to participate in output market. Also, the same study showed that the determinants of market participation decision and level of commercialization are not necessarily the same in different areas. In another way, the factors that determinants of the level of smallholder commercialization may or not determine smallholder's decision to participate in different areas. This calls for studies in different areas to allow generalization about determinants of the decision to participate in output and level of commercialization in Ethiopia. However, there are scarce studies in Ethiopia, particularly in Eastern Hararghe Zone. Thus, this study addresses this gap.

Eastern Ethiopia, especially Eastern Oromia has a comparative advantage of producing vegetables due to its high domestic and proximity to export markets (Chanyalew *et al.*, 2011). That is eastern Ethiopia has access to export markets in Djibouti, Hargeisa, Wuchale, Bosaso and domestic markets in Harar, Dire Dawa, Jigjiga, etc. As the report of KWOoARD (2012), revealed potatoes and cabbages are major vegetable crop produced by most farmers in Eastern Hararghe, Kombolcha, Jarso, and Haramaya districts supply sufficient quantity of carrots, beetroots and cabbages and these commodities are not supplied from other sources. About 94%

of the vegetables marketed in Kombolcha were exported to Somalia. Despite this potential, the farmers in the area rarely utilize the opportunity to improve their livelihoods (Aman, 2014).

In the study area, vegetables such as beetroots, carrots, pepper, garlic, onion, tomato, cabbages, and some other leafy vegetables are grown (HWARDO, 2016). From these, particularly onion is contributing substantially to the national economy apart from overcoming local demand. Ethiopia has high potential to benefit from onion crop and it is one of the most important cash generating crops for farmers and large amount of onion produced every year in Oromia region (CSA, 2011/12). However, many of the farmers in study area did not use properly this potential to increase their income.

Although there is a wealth of literature on smallholder commercialization in Ethiopia, it is mainly on grain crops and livestock and livestock products. However, the market participation of the smallholder vegetable crop farmers in the country is still limited. Therefore, improvements in market participation are necessary to link smallholder farmers to markets to expand demand for vegetable products as well as set opportunities for income generation. Also, in Eastern Hararghe there are few studies (Kumilachew, 2016; Chanyalewet *al.*, 2011), on smallholder farmers' commercialization which did not include all vegetable crops which are grown in the region and highly practiced. They focused either on potato or cabbage, and that there is no study on smallholder commercialization of onion in the study area.

Thus, this study investigates factors determining decisions to participate in onion market, and level of commercialization among smallholder farmers in Eastern Hararghe Zone of Oromia Region.

This study tries to answer the following research questions:

1. What factors determine onion producers' market participation decision?
2. What are the determinants of the level of commercialization of onion at household level?

1.3. Objectives of the Study

The general objective of this study was to examine the determinants of commercialization of smallholder onion producers in Haramaya District, East Hararghe zone, Oromia Region, Ethiopia.

The specific objectives of the study were:

- To examine the determinants of smallholder farmers' decision to participate in onion market in Haramaya District.
- To identify the determinants of level of onion commercialization in the study area.

1.4. Significance of the Study

The study analyzed the commercialization behavior of onion farmers and provide information on determinants of the smallholder farmers' market participate decision in onion and level of commercialization among smallholder farmers.

The information generated can help producers and several organizations such as research and development organizations, traders, policy makers, extension service providers, government, and non-governmental organizations to assess their activities and redesign their mode of operations and it ultimately helps to promote the design and implementation of policies and strategies to enhance smallholder commercialization of vegetable crops. The study can also be used as reference for further research study.

1.5. Scope and Limitations of the Study

This, the research focuses on onion, which is highly produced in the Haramaya District. This means that other types of vegetable crops were not included. This study is designed to identify demographic, socioeconomic, physical, and institutional factors explaining smallholder farmers' decision to participate in onion market and level of commercialization among the market participant in Haramaya District.

1.6. Organization of the Thesis

The remaining portion of this thesis is organized into four parts. The second chapter presents the related literature review including theoretical review, concept and definitions conceptual frame work of smallholder commercialization and empirical review on smallholder farmers' decision to participate in selling output and level of commercialization. The third chapter includes the methodology part including description of the study area, sampling techniques, method of data analysis and definition of variables and hypothesis. The final part of the thesis presents summary of the findings of the study, and conclusion with recommendations.

2. REVIEW OF LITERATURE

In this chapter, theoretical review such as concepts and definitions, and empirical review which reveal strength, weakness, and gap of the previous studies are presented.

2.1. Definition and Basic Concepts

There are issues related to how commercialization is conceptually defined and measured. Perhaps the most common definition of agricultural commercialization is the degree of participation in the (output) market, with the focus very much on cash incomes. Also, Commercialization defined as increasing engagement with markets. It is about increasing fractions of crops and animal product being destined for sale. More inputs may be bought from the market –machinery and tools, seed, fertilizer, crop protection chemicals, veterinary drugs, animal feed, etc., as well as buying in technical advice and market information. It can be about using the market to obtain other additional factors of production, most notably hired labour, land, and borrowing funds for investment and working capitals from banks and other financial agencies (Wiggins *et al.*, 2011). A study by Hlongwane *et al.*(2014), showed that commercialization of subsistence agriculture implies increased participation, or an improved ability to participate in output markets. In the developing areas of south Africa, like in other developing countries, small-scale farmers find it difficult to participate in outputs markets because of arrange of constraints and barriers reducing the incentives for participation, these may be reflected in hidden costs that make access to markets and productive assets difficult. Also, he reviewed that even if the contribution of smallholder agriculture to social is recognized in various development strategies, smallholder farmers` participation in commercial agriculture is low despite the envisaged benefits of market-orientation, as well as favourable trends in drivers of commercialization.

Moyo (2010) reviewed that market participation can be described as an individual's or household's economic transactions with others, in cash or kind and a low proportion of products exchanged in the market reflects limited market participation

Commercialization entails increasingly market-oriented patterns of production and input use, and the separation of household production and consumption decisions. However, households may produce marketable products but use them for own consumption in which case market orientation may not necessarily translate into improved market participation. On the other hand, households who enjoy surplus production originally intended for household consumption due to favorable conditions could participate in markets despite the lack of market orientation. Thus, market orientation reflects production decision based on market signals, while market participation is a decision to sell produce into the market (Abafita *et al.*,2016).

Most of the literature considers market orientation and market participation as synonymous and thus most of the analysis of the determinants of smallholder commercialization is based on the analysis of the determinants of output market participation. Also, the literature on commercialization of smallholders makes little distinction between market orientation and market participation but when we define the market orientation means agricultural production destined for market based on market signals when market participation is produce offered for sale and use of purchased inputs, even the determinants of market orientation and market participation are not the same (Berhanu and Moti 2010a,).

According to the aforementioned studies level of commercialization, it is simple binary distinction of whether the farm sells any of its crop output. While simple, such a measure would treat most farms as commercialised since there are few that do not sell something, even if a small part of their output. A more refined approach is to grade commercialization by the absolute amount sold, either by volume or value, there by producing acontinuum of degrees of commercialization. Still more refined is to consider the percentage of crop production marketed by a farm or household.

Commercialization in agriculture refers to the progressive shift from household production for auto-consumption to production and input decisions are based on profit maximization, reinforcing vertical linkages between input and output markets. Increasing the extent of commercialization among sub-Saharan Africa's generally semi-subsistence, low-input, low productivity smallholder farmers is playing a crucial role in poverty alleviation (Olwande, 2015).

According to Aderemi *et al.*, (2014), meeting the challenge of improving rural incomes in Africa will require some form of transformation out of the subsistence, low-input, and low-productivity farming systems that currently characterize much of rural Africa. World Bank (2010), argue that the contribution of smallholder farms as the engine of rural growth and livelihoods improvement, however depends on their level of transformation from subsistence oriented to market oriented production system.

Jayne and Hayblade (2011), notes that smallholder commercialization is a crucial feature of the structure of transformation process considered by most development economists to be the major pathway from a semi-subsistence agrarian society to a more diversified and food secure economy with higher general living standard.

Thus, the key premise of commercialization as a development strategy is that markets provide increased incomes to household consumption in ways that are more efficient than subsistence production (Asuming-Brempong *et al.*, 2013).

Typically, commercialization is measured at household level as either in terms of gross or net sales measured as the ratio of percentage value of gross marketed output to total farm production (Mather *et al.*, 2013).

According to Leykun and Jema (2014), a farm household is assumed to be commercialized; it is producing a significant amount of cash commodities, allocating higher proportions of its resources to marketable commodities, or selling considerable proportion of its agricultural outputs. The meaning of commercialization goes beyond supplying surplus produces to markets. This shows that it should consider both input and output sides of production and decision-making behaviour of farm households in production, and the marketing simultaneously.

Thus, smallholder's commercialization occurs when a farmer participates in agricultural markets either as a seller or buyer. This can be achieved when a portion of the agricultural produce from the farmers is marketed and /or when part of the inputs is acquired from the agricultural markets (Osmani and Hossain, 2015). Agricultural commercialization can, therefore, be viewed from either the input or output side.

On the output side, farming household can become commercialized by increasing their marketed produce. On the input side, they become more commercial by increasing their usage of purchased agriculture inputs. Many subsistence farmers use very little purchased inputs, but as they gradually shift from subsistence farming towards market orientation, they start to increase their investment. Hence, smallholder commercialization also increases the backward and forward linkages of the rural economy with other sectors within the economy. Furthermore, commercialization is not only of cash crops (example, cotton, tobacco, paprika) but also refers to the increased production and marketing for profit of crops that are traditionally grown for home consumption, such as food crops (example, maize, rice, grain legumes (example beans, groundnuts) as well as vegetables and fruits (Klasen, 2010).

Jennifer and Tina (2014), consider commercialization as constructed of two indices, which include the number of food crops produced and cash crops produced that allows production diversity, with cash crops such as chat, coffee, cotton, enset (false bananas), hops (gesho), sugar cane, tea, tobacco, and sisal.

Given that fact that it is hard to strike a balance between population, food production and economic growth, the government seeks to ensure the country's continued ability to sustain food self-sufficiency, increases in agro-industrial production and productivity, improvement in employment opportunities and increasing access to markets are area of the key elements in its strategy to increase incomes of rural households enhance food security and facilitate further expansion of the economy (MoFED, 2011).

Commercialization of smallholder farmers, especially in developing countries, could impact positively not only towards performance, but also on livelihood generation. For instance, Zimbabwe, as a country has recognized the importance of smallholder commercialization as evident in the Medium-Term Plan (2011-2015) policy on agriculture, which reflects sustainable agricultural productivity and competitiveness as its priority areas (GOZ, 2011). This priority area covers the increased agricultural commercialization within the smallholder sector as its outcome. Smallholder farmers are players for economic growth and employment creation, especially in agricultural markets. Specifically, the fast track land reform policy (FTLRP) gave rise to new smallholder farmers, because of defragmentation who were expected to boost agricultural production in the country (Kabiti *et al.*, 2016). As to Abu (2015), smallholder commercialization

requires more than just well-functioning output markets, but also efficient and low-cost factor markets that truly reflect opportunity cost of farm inputs. Such conditions are usually problem in the poor regions especially in Africa, where by smallholders may not be able to purchase inputs due to liquidity problems or higher transaction costs and malfunctioning markets (Latruffe and Dejeux, 2014).

Most smallholder growing vegetables in East Africa market their produce domestically. It is an important source of income for many poor smallholder households and those involved in the vegetable value chain. Hence most smallholders market their produce locally or regionally. Marketing vegetables are therefore an important source of income for many smallholder households as well as many poor people involved in the value chains. A strong horticulture sector is not only essential for nutrition and health but is also an engine for economic growth (Lenne, 2010). Ethiopia has a good year around climate of sunshine and has well agro-ecological zones which are conducive to various agricultural activities. Most fruits and vegetables are still grown regionally, with the major production areas to the south and west of Addis Ababa. Thus, the efficiency of commercialization for fruits and vegetables in Ethiopia has been a significant concern in the recent years (EIA, 2012).

In Ethiopia, due to resource constraints and low productivity many rural producers mainly produce for subsistence consumption, with only a minority marketing their surplus production. This entails that policies and strategies that aim to increase market incentives as a means of achieving agricultural commercialization exclude most rural smallholder producers. With the majority of the population in Sub-Saharan Africa engaged in primarily agricultural production, it is commonly argued that there is no viable alternative to smallholder-led growth and it is believed that the process of commercialization is accompanied by economic growth, increase incomes, increase urbanization, increase welfare, greater linkages between farmers and service providers, and the gradual withdrawal of labour from the agricultural sector (Jayne and Muyanga, 2011).

According to Quan (2011), in addition to producing staple crops for domestic markets, smallholder market produces large shares of traditional in developing countries. This shows how the economy of many developing countries is still reliant on smallholder-based agriculture. In

East African countries like Kenya, Ethiopia, Uganda, and Tanzania, for example, smallholder farming accounts for about 75% of agricultural production (Salami *et al.*, 2010). Particularly in Ethiopia, about 11.7 million smallholder farmers cultivate approximate 95% of the total area cultivated and produce more than 95% of the total output (MoARD, 2010). It is this figure that accounts for 41% of the country's GDP and covers more than 90% of the country foreign currency earnings (EIA, 2012).

In short, as the overall economy of Ethiopia depends on the agriculture sector development, the entire movement of the agriculture sector depends on what is happening in the smallholder sub-sector. It is in the regard that the government of Ethiopia through its different policy and growth strategy, including the current Growth and Transformation Plan (GTP), positions smallholder farmers as a principal source of agricultural growth, and agriculture as the main source of overall economic growth. Thus, the Growth and Transformation Plan (GTP), launched for the period 2010/2011-2014 /2015, the Ethiopian government attempts to promote the production and marketing of high-value agricultural products with a view of increasing competitiveness in domestic, regional, and international markets. In addition, the shift in the paradigm of strategy from food production oriented to improving food access through improving household income and promoting market-oriented production has opened the window for engagement of smallholder farmers in market-oriented production (MoFED, 2010). Also in the current GTP of Ethiopia, which is launched in 2016, agriculture development is remaining as the major development sector.

Transforming the subsistence-oriented production systems to market-oriented production system to increase the smallholder farmer's income and reduce rural poverty has been in the policy spotlight of many developing countries including Ethiopia. Now a day, horticulture crops are becoming attractive for many poor farmers around the world. Thus, horticulture crops play a significant role in developing the country, for improving income and nutritional status. Farmers involved in horticultural production usually earn much higher farm income as compared to cereal producers, and per-capita, farm incomes have been reported up to five times higher. In Ethiopia, particularly Eastern and Western Hararghe zones have good potential in horticultural crop production for which smallholder farming has diversified from staple food subsistence production into more market-oriented and higher value commodities. Despite this, production

potential and importance of horticultural crops for the country as well as the study area, there is limited study regarding the status and level of smallholder commercialization of horticultural crops and the implications of the challenges on the decision making (Aman, 2014).

In most irrigable lands, horticultural crops in general and vegetables in particular, play an important role in contributing to the household food security. Higher profits can be achieved by increasing the production of vegetables through the year when efficient irrigation system is used (Rehima and Dawit, 2012).

In his review, Debela (2013), noted about onion particularly from vegetables that the primary center of origin of Onion is center central Asia with secondary center in Mediterranean region and has spread widely to many countries of the world. Also he reviewed that, currently the crop is produced in different parts of the country for local consumption and for export of flowers to European markets.

In Ethiopia, vegetable crops are produced in different agro-ecological zones through commercial as well as smallholder farmers, both as a source of income and food (Kumilachew, 2014).

Several factors related to the technological, institutional, organizational, and political situations influence the competitiveness of Onion marketing is essential for the design of any strategy or policy that has been the objective of intervention.

Abundant intake of fruit and vegetables is clearly the appropriate solution for problems of poor diet quality in the developing world. Fruit and vegetables are relatively cheap sources of essential micronutrients. They are a cost effective way to prevent micronutrient deficiency and protect against chronic disease, the main killers in the world today. To improve the poor feeding behavior and benefit advantages from consumption of the crop problems associated with production, marketing and consumption should be addressed. Enhancing the smallholder's production system into a commercialized production target to raise the smallholder farmer's income and decrease rural poverty has been in the strategic focus of many developing countries, including Ethiopia, particularly in the potential areas of fruit and vegetable production (Wondussen, 2014).

2.2. Empirical Review

Studies carried out in different parts of Ethiopia have revealed some of the determinants of commercialization (Birhanu and Moti, 2010; Abu, 2015). However, these determinants differ within and across countries due to the heterogeneous conditions faced by the smallholder farmers. A study on the commercialization of rice in Nigeria for example, level of education, farming experience, farm size and use of modern technology as major determinants (Falola *et al.*, 2014).

Afewerk and Endrias (2016) identified eight major determinants of smallholder farmers' commercialization in Ethiopia. These include population growth and demographic change, technologies, institutions, risks, markets and their integration, transaction costs, asset holdings of the households and policy aspects.

The study of Geremew (2012), in the Eastern Wollega Oromia Region in Diga District, identified the determinants of sesame crop smallholder commercialization. The findings from the probit model regression showed that the number of family labours, the number of oxen owned, the size of farm land owned, family food availability, access to credit service centres influences the decision probability of farmers to produce sesame in the study area, positively and significantly.

In the study by Leykun and Jema (2014), the findings from the multinomial logistic regression analysis revealed what factors influence the probability of being commercial farmers. Accordingly, age, being a male urea application, labour expenditure, and land size cultivated had a positive sign and significantly affect the probability of being a commercial farmer. Nevertheless, use of improved seed, several oxen owned, and water harvesting had an unexpected negative sign, but they are statistically insignificant. Also, the important determinants of commercialization such as land size, the gender of household head, livestock assets, ethnicity, education, and location were identified (Rahut, 2010).

The study of Berhanu and Moti (2010a), analyse the commercial transformation of smallholder agriculture that requires analysis of market orientation and market participation. The study identified factors such as access to and ability to process information, productivity factors (household labour supply, land quality, and rainfall), and transportation cost advantage due to ownership of equines or nearness to all-weather road, and technical efficiency advantage due to

involvement in extension programs all increase market orientation of households. Higher domestic consumption requirements due to larger family size and location in higher altitudes detract from market orientation.

Also, according to Berhanu and Moti (2010b), information advantage due to literacy, ownership of traction power, and cost advantage due to proximity to markets, increasing market participation while cost advantage due to ownership of equines, and proximity to marketplace and all-weather road are important determinants of higher crop input market participation. Ownership or availability of factors that are likely to be complementary to external inputs is also important to enhance crop input market participation. These results imply that in addition to market and transport infrastructure development, interventions to promote input market participation may need to address the problem of availability of complementary inputs. Market orientation is strongly translated into higher output market participation, but not into higher market participation. The study also concluded that the determinants of market participation and market orientation are not the same. According to Abafita *et al.*, (2016), no prior study made a distinction between market participation and market orientation before Berhanu and Moti (2010a). Moreover, Aman (2014), identified and concludes that determinants market participation and level of smallholder commercialization may not be the same. Thus, there are empirical reviews on the determinants of on determinants of the decision to participate in output and smallholder level of commercialization separately as follows.

2.2.1. Empirical reviews on smallholders' market participation decision

Studies showed that there are different factors that hinder the successful participation of smallholder's farmers in commercialized agriculture (Moyo, 2010; Kirsten, 2013; Ohen, 2013). These different factors are categorized into four key areas which include socioeconomic characteristics of the smallholder producers, lack of access to sufficient agricultural support services, transaction costs and institution factors as lack of appropriate agricultural and developmental infrastructure. Thus, Farm household's decision to participate in a market can be affected by different factors in the context of different developing countries. As per to the study by Berhanu and Moti (2010b), smallholder farmer's the market decision to take part in the market is influenced by many socioeconomic and farm specific characteristics.

The study by Sebatta *et al.*, (2014), on smallholder farmers' decision and level of participation in the potato market in Uganda showed that the failure of farmers to access information on the markets through long distances and lack of access to village market arrangements seemed to lock out many of them from making decisions to enter to the potato market to sell. The results also revealed that once smallholder farmers decide to enter the market to sell, household characteristics and farmer endowments are the key factors that influence how much will be sold into the market. Factors like gender, membership to farmers' group or cooperative come out to significantly influence the level of market participation in form of how much is sold.

Siziba (2011), observed that extension training, participation in research, off-farm income, and ownership of farm equipment's were highly affect the market participation. Barret (2011), Showed that the public asset variables have also been found to have a positive relationship with market participation, especially with respect to access to credit and insurance.

According to Egbetokun (2012), the major determining factors influencing farmer's participation in the market are age, marital status, sources of labour farming experience, farm size. The probability of participating in outputs market depends on household size, distance to the marketing channel, the price of the commodity and the sex of the farmer (Onaja, 2012). Moreover, the study of Osmani and Hossain (2015), also identified as that farm size, household labour, and income from livestock that affect the smallholder farmers' decision to participate in the output market. These findings suggest that the smallholder farmers would participate increasingly in the output market if farm size, household labour and farm income are increased in one hand income and income from livestock is decreased on the other hand.

2.2.2. Empirical reviews on smallholder level of commercialization

The study by Aman (2014), revealed that household education, household size, access to irrigation, cultivated land, livestock, and distance to the market were the key determinants of the smallholder level of commercialization. Wondussen (2014) also, identified that household education, household size, access to irrigation, cultivated land, and distance to the nearest market were the key determinants of the level of commercialization. Moreover, the determinants of the level of commercialization were identified by other study. Ele *et al.* (2013), found that total quantity of food crops produced, farming, experience access to agricultural extension service, the

size of land used for cultivation, membership in cooperatives and household family size are important factors determining the level of commercialization of smallholder farms.

Analysis of the factors affecting the market Participation decision of smallholder farmers would help to design appropriate policy instruments, institutions, and other interventions for their sustainable economic development. The degree of market participation of smallholder farmers depends on many factors, including the age of household heads, household size, food security, access to fertilizers and benefits derived from participation in farmer organization (Chirwa and Matita, 2012). Therefore, the analysis of both determinants of both decisions to participate in output and smallholder level of commercialization having recommendation was needed for designing appropriate intervention mechanisms factors which will be mentioned to improve the smallholder farmers of vegetable commercialization.

2.3. Methodological Review to measuring commercialization

There are different types of indices that measure commercialization at household level which were formulated by different authors at different time. von Braun and Kennedy (1994) formulated three types of indices to measure commercialization. The first index measures proportion of agricultural output sold to the market and input acquired from market to the total value of agricultural production. The second type, commercialization of the rural economy is defined as the ratio of the value of goods and services acquired through market transactions to total household income. Thirdly, the degree of household integration to the cash economy is measured as the ratio of the value of goods and services acquired by cash transaction to the total household income. For each type, the author formulated these indices to measure the extent of household commercialization.

In measuring household-specific level of commercialization Govereh *et al.* (1999) and Strasberg *et al.* (1999) used a household commercialization index (HCI), which is a ratio of the gross value of all crop sales per household per year to the gross value of all crop production.

Gabre-Madhin *et al.* (2007) on another hand used four approaches to measure the level of household commercialization: sales-to-output and sales-to-income ratios, net and absolute market positions (either as a net buyer, net seller or autarkic/self-sufficient household), and income diversification or level of specialization in agricultural production. Accordingly, the

sales-to-output ratio measures the gross value of all agricultural sales by a household as a percentage of the total gross value of its agricultural production. The total sales-to-income ratio is the ratio of the gross value of total sales to total income from crop production. The market position of a household is evaluated using the ratio of volume of sales and volume of purchases to the total volume of stock: the sum of storage from the previous production year and production in the current year. The specialization index tries to capture to what extent farm households are specialized in their production to capture the benefits from comparative advantages: producing what they can efficiently produce and buying what they cannot. This index measures the proportion of the value of purchased agricultural products not produced by households to the gross value of agricultural production.

2.4. Conceptual Framework of the Study

Smallholder commercialization be virtuous cycle in which farmer's intensify their use of productivity enhancing technologies on their farms, achieve greater output per unit of land and labour expanded, produce greater farm surpluses (or transition from deficit to surplus producers), expand their participation in markets, and ultimately raise their participation in markets, and ultimately raise their incomes and living standards (Jayne and Muyagna, 2011).

Transformation of subsistence agriculture depends on both the determinants of market orientation and the determinants of market participation in crop output market, and the determinants of market orientation and market participation may not be the same, because a household may produce marketable commodities but use them for home consumption if the household-specific endogenous prices lie between the markup selling and buying prices (Berhanu and Moti, 2010b). Also, determinants of the smallholder farmers' decision to participate in output and level of smallholder commercialization is not the same, because decision to participate in output is only one picture of smallholder commercialization since decision to commercialization is composed of decision to production, decision to buy input and decision to sell output (Aman, 2014; Abafita *et al.*, 2016). This framework is developed based on different literature on smallholder commercialization such as Berhanu and Moti (2010a, 2010b), Chirwa and Matita (2012), Aman (2014), and others literature reviewed in this study. In developing this conceptual framework, in the first smallholder commercialized is showed that it is composed of

market orientation (production decision issue) and market participation (decision to buy input and sell output).

Based on the existing literature, how the level of smallholder commercialization may be affected by different factors in both directions is indicated (Berhanu and Moti, 2010b; Agwu *et al.*, 2013; Abafita *et al.*, 2016).

Hence, in this study, the level of smallholder commercialization measured by using household commercialization index (HCI) which is the ratio of gross value of crops sales by household to all crops produced by the household, because it provides the level of commercialization for every household separately (Osmani *et al.*, 2014). The decision of household to participate in output market is binary response whether household participates or not participate (Osmani and Hossain, 2015).

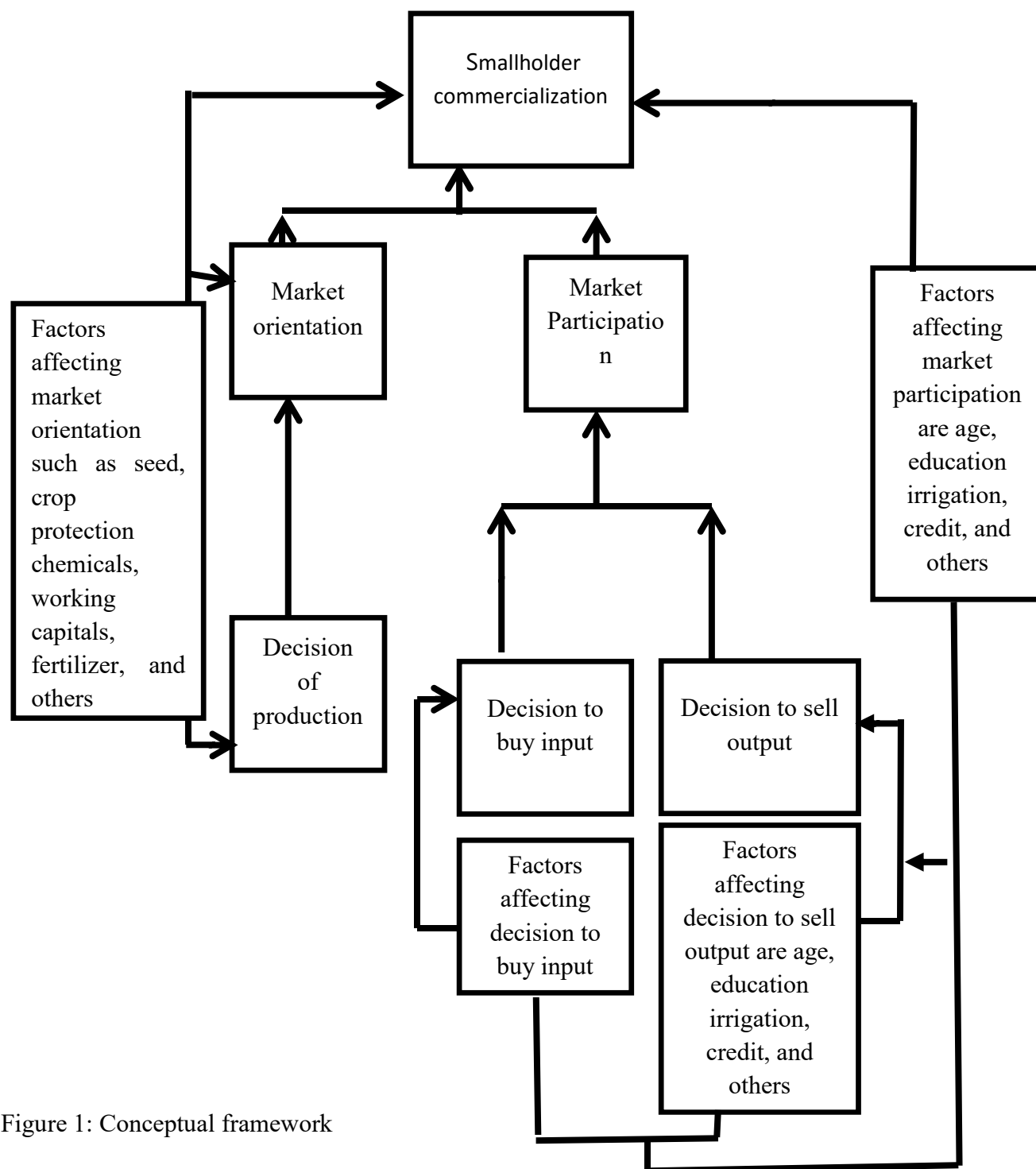


Figure 1: Conceptual framework

Source: Adapted from literatures (Wiggins *et al.*, 2011; Berhanu and Moti, 2010b; Agwu *et al.*, 2013; Abafita *et al.*, 2016).

3. RESEARCH METHODOLOGY

In this chapter description of the study area; data types, sources, and methods of data collection; sampling techniques, and sampling size; method of data analysis; and definition of variables and hypothesis are presented.

3.1. Description of the Study Area

The study area was conducted in Haramaya district, Eastern Hararghe, Ethiopia. Haramaya is one of the woreda in the Oromia region of Ethiopia. It is named after the administrative centre, Haramaya part of the Eastern Hararghe zone.

Haramaya is geographically situated between 42°3'E longitude and 9°26'N latitude with its altitude ranging from 1400 to 2340 meters above sea level. It is bordered by Kurfa Chale in the south, by Kersa to the north by Dire Dawa, to the east by Kombolcha, and by the Harari National region state to the southeast (HWARD, 2016; Nigussie *et al.*, 2014).

The woreda is part of the Ethiopian highland system and lies in the semi-arid tropical belt of eastern Ethiopia and 518 km away from the capital city of Ethiopia. It is, therefore, representative of a sub-humid mid –altitude agro-climatic zone. Rainfall is bimodal, and the mean annual rainfall received ranges from 600 to 1260mm. The short season (Badheessa), rain usually starts in March and ends in May, and the long season (Ganna) rainfall occurs between June and September. Relative humidity varies between 60 and 80% Minimum and Maximum annual temperatures range from 6°C to 12°C and 17°C to 25°C respectively (HWARD, 2016).

From the total land area, 36.1 % arable or cultivable, 2.3 % is in the pasture, 1.5 % is forest, and the remaining 60.1% considered built –up, degraded or otherwise unusable. From population projection of Ethiopia for all regions at woreda level from 2014-2017 depending on CSA (2013), the woreda has the estimated total population, 352,031, from this 178,848 are male and 173,183 are female. The farms households living in the rural area are about 40,448 or the total population living in the rural area are 275,048 (CSA, 2013).

Different types of vegetables and cereals are grown in the district. The most commonly grown are potato, cabbage, garlic, onion, carrot, beetroots, peppers and among the cereals sorghum and maize are dominant. Chat is one of the intensively grown crops in the area. Onion is one of the

major vegetables grown for income generation and consumption in the district (HWARDO, 2016; Nigussie *et al.*, 2014).

The woreda has 34 kebeles from these fourteen kebeles produce vegetables and six kebeles namely Damota, Ifa Bate, Addallee Waltawaa, Amummaa, KurroJalala, and Finkillewere selected randomly (HWARDO, 2016).

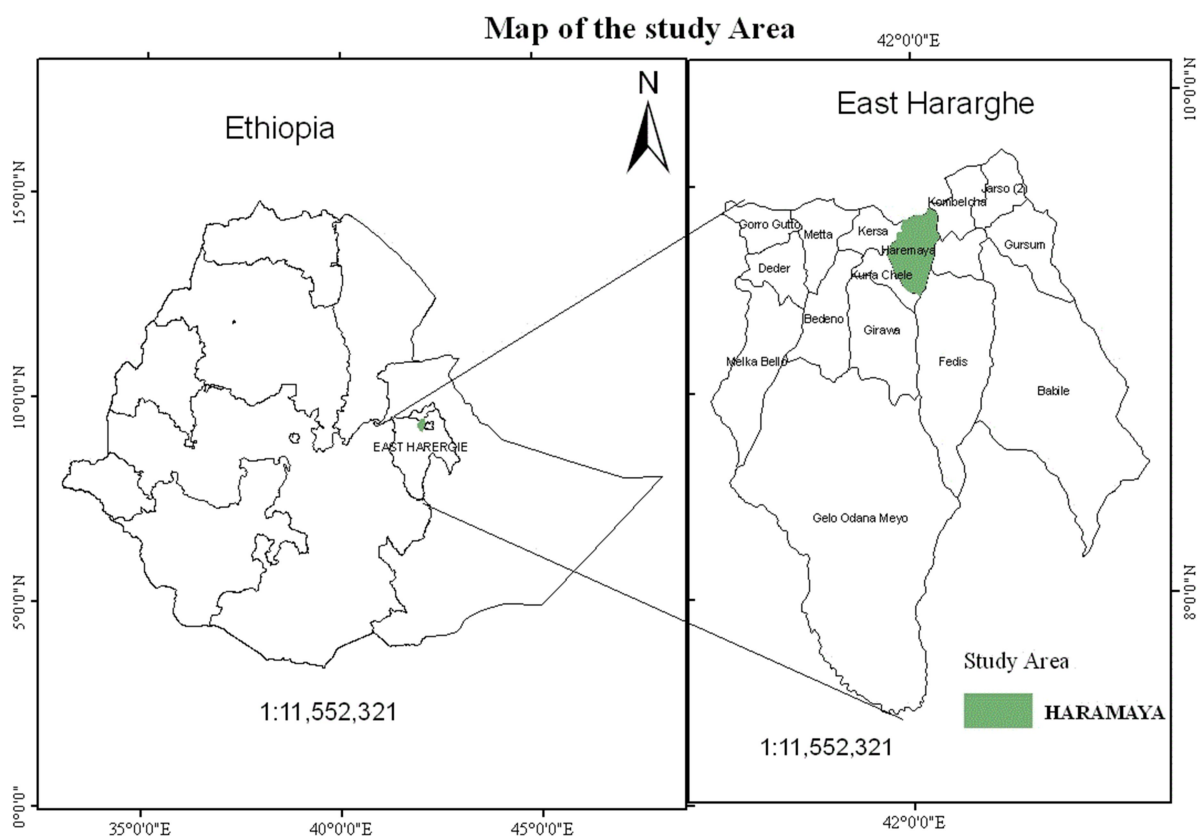


Figure 2: Map of the Study Area

Source: Serda *et al.*(2015)

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

For this study, both primary and secondary data types were used. Primary data were collected from smallholder onion producer's household head in Haramaya District. The primary data collected from the households include information on the demographic characteristics, economic characteristics, agricultural production, and onion production and market participation of the

households. Secondary data from books, articles, government reports and other were used. The structured interview schedule was used to collect primary data from smallholder farmer household heads.

3.3. Sampling Techniques and Sample Size

A multistage random sampling technique was used to select representative *kebeles* and sample household heads. In the first stage 14 *kebeles* from 34 *kebeles* where onion production is practiced were selected purposively. In the second stage, since the fourteen *kebeles* are homogeneous six *kebeles* namely *Damota*, *Ifa Bate*, *Addallee Waltawaa*, *Amummaa*, *Kurro Jalala*, and *Finkille* were selected randomly. In the third stage, 156 sample households were drawn from the six *kebeles* randomly and proportionately to size of the *kebeles*.

Sample size of the should be determined by considering the nature of population, the number of classes proposed, the nature of study, type of sampling, precession level required, availability of finance, and other considerations (Kothari, 2004). Accordingly, if the population is, heterogeneous, the study requires many class groups, high precision level, and there is plenty of finance large sample is advisable. However, in this study area, Onion producers share same agro ecological climate and market. That is the smallholder farmer in the study area are homogenous, and it requires random sampling technique. In addition, there is lack of finance. Thus, considering these issues the formula provided by Yamane (1967), was chosen to determine the sample size (given in equation 1 below).

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

Where n is sample size; N is population size, and e is the level of precision which equals to 8%. Given the formula, and household size in the rural area of the woreda, depending on projection of CSA (2013),

$$n = \frac{38547}{1 + 38547(0.08)^2}$$

$$n = 155.6487 \sim 156$$

Table 1: Sample size distribution

Kebeles	Household Size	Sample
Kurro Jalala	1239	24
Finkile	1328	26
Ifa bate	1276	25
Damota	1483	29
Addalle Waltawa	1291	25
Amummaa	1328	26
Total	7945	156

Source: HWARDO calculation depending on CSA (2013).

3.4. Methods of Data Analysis

Both descriptive and econometric methods of data analysis were used to achieve the objectives of the study.

3.4.1. Descriptive statistics

Simple descriptive statistics like percentage, minimum, maximum, averages, t-test statics, χ^2 - test were used to analysis the general overview of the sample respondents.

3.4.2. Econometric method

The empirical model will be divided into model for determinants of smallholder farmers' market participation decision in onion output side, and model for determinants for the level of smallholder commercialization among market participant.

Following Greene (2003), Heckman sample selection model was employed to analysis data. To examine the determinants of smallholder commercialization Heckman two-step maximum likelihood model was used. The multiple linear regressions can be used for the parameter estimation for continues dependent variable. But, some of our respondents may not participate in the market during the last 12 months, so some dependent variable observations will be missing or observed zero. For a dependent variable with several zeros and missing observations, multiple linear regressions produce inconsistent and biased parameter estimates. Censoring model that is Tobit model can be used for a dependent variable with several zero observations. Tobit model is

however not appropriate for missing data, means which are unobservable factors. It also assumes that same factors determine both probability and intensity of the commercialization. Commercialization will be observed for farmers who participate in onion market during the survey. Therefore, Tobit fails to capture selection bias and produces inconsistent and biased estimates of parameters.

Double hurdle model can be also used to analyse determinants of commercialization. Double hurdle model assumes that decisions to participate in market and decision how much to sell are independent. Farmers, however, may simultaneously decide to participate in the market and sell their output in the market. Thus, Heckman two-step model, that assumes interdependent decisions to participate in the market and how much to sell was used in this study.

In Heckman two-step estimation model, there were two equations of interest that should be modeled. These were the selection equation (onion market participation), and the response (outcome) equation. In the selection equation, the probability of participating in the onion market is modeled conditional on some relevant observable covariates using probit regression. Heckman two-step maximum likelihood estimation was used to model intensity of commercialization. The first step of the two-step approach runs a probit model of the probability of participating in the onion market using all the observations.

Thus, in a first step of the Heckman, the probit regression model for identifying the factors that affect market participation decision of households was formulated in the following way.

$$Y_i = X_i' \beta_i + U_i \quad (2)$$

Where Y_i refers to market participation decision by a household ($Y=1$ if farmers participate in market and $Y=0$ otherwise); $X_1, X_2 \dots X_{14}$ are explanatory variables that affect the market participation decision; $\beta_0, \beta_1 \dots \beta_{14}$ are parameters to be estimated; and U_i is the stochastic disturbance term.

The probit regression model adds the condition of normally distributed variables that can be formulated as;

$$P(y = 1/x) = F(Li) = 1/\sqrt{2\pi} \int_{-\alpha}^{li} e^{-z^2/2d} \quad (3)$$

Where, $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{14} X_{14}$ = Utility index (latent Variable);

$P(Y=1/X)$ = the probability of market participation; Z = the standard normal variable and

$F(.)$ = the standard normal CDF.

Gujarati (2003), explains the behaviour of a dichotomous dependent variable as we need to use a suitable CDF (cumulative distribution function). The CDF is a function, which can be used in the regression model where the dependent variable is dichotomous taking the value of 0 or 1.

That is, CDF of a random variable x is simply the probability that takes a value less than or equal to x_0 , where x_0 is some specified numerical value of x . The estimating model that emerges from the normal CDF is popularly known as the probit model, although sometimes it is also known as the normit model. Basically, in the selection equation that is, the probit model, the dependent variable is a dichotomous variable 'participation decision in the output market' (represented as 1 when a household participates in the market and 0 otherwise).

The estimates of γ from this probit model were then used to construct consistent estimates of the Inverse Mills Ratio (IMR) which was first developed by (Mills, 1926), and became popular by Heckman (1979).

$$\lambda_i(-z'\gamma) = \frac{f(z_i'\gamma)}{F(z_i'\gamma)} \quad (4)$$

Where $f(.)$ is the probability density function of a standard normal variable, $F(.)$ is the cumulative distribution function of a standard normal distribution and $\lambda_i(.)$ is the Inverse Mills Ratio.

In the second stage, outcome equation (HCI_i) is estimated by ordinary least squares where the outcome equation includes both the original variables (X_i) whose coefficients are the parameters of the population commercialization equation and the constructed value of the Inverse Mills Ratio, which is:

$$HCI_i = \beta X_i + \theta \lambda_i(-z'\gamma) + e_i \quad (4)$$

This step is carried out only for the uncensored observations and provides consistent and asymptotically normal estimators for β and θ . With the Inverse Mills Ratio (IMR) included, the coefficients on the X represent consistent estimates of the population commercialization equation. The coefficient on the Inverse Mills Ratio term estimates $\rho_{ev}\sigma_e$. Because σ_e is greater than 0, by definition, the sign of this coefficient is the same as the sign of ρ_{ev} . The sign of ρ_{ev} is often substantively useful information, as it indicates the correlation between the unobservable in the selection and outcome equations. The standard t-test of the null hypothesis that $\theta = 0$ is a test of the null that there is no selection bias, conditional on the assumptions of the model. For standard errors, we must consider the additional variance that results from the generated regressors—namely the Inverse Mills Ratio term; and if there is indeed selection, then there is heteroskedasticity. Thus, Heckman (1979), includes a consistent variance estimator that deals with these problems, and “STATA” software package produces the correct standard errors automatically.

3.5. Definition of Variables and Hypothesis

3.5.1. Dependent variables

Decision to participate in market: In this study decision of the household to participate in output market was the dependent variable that takes a value of 1 if household sell onion, and 0 otherwise.

Level of commercialization: Level of commercialization among smallholders was also dependent variables measured by commercialization index that ranges between 0 and 1 inclusive (i.e. if nearest (0), it is for subsistence producers and if nearest to 1 for fully commercialized).

To achieve the stated objectives, the present study tries to assess the level of or extent of commercialization by calculating the household commercialization Index (HCI), that it provides the level of commercialization for every household separately. Therefore, the measuring the levels of commercialization for the smallholder farmers in the study areas, a commercialization index is used as per to Goverehet *et al.* (1999) and Strasberg *et al.* (1999), and following to the recent studies of Osmani *et al.*, (2014), and Agwu *et al.*, (2013), commercialization index (HCI)

can be computed as the ratio of the gross value of all farmers' products sale over gross value of all production multiplied by hundred.

$$HCI_i = \frac{\text{Gross value of sold onion hhi year}_j}{\text{Gross value of onion production hhi year}_j} * 100 \quad (5)$$

Where; HCI_i refers to the extent of i^{th} household's commercialization level.

In this study, the index measured the ratio of the gross value of onion sales by household i in year j to the gross value of onion produced by the same household i in the same year j expressed as a percentage. That is, it measures the degree to which a household sells its output to market. If the index is zero, it would signify a totally subsistence oriented household and if the index is to 100, it would signify the higher degree of commercialization.

3.5.2. Independent variables

There are different factors affecting the household decision to participate in output and level of commercialization. In what follows definitions of the independent variables and their expected sign are presented. Also, the expected sign for the respective dependent variables are presented in the Table 2 and Table 3.

Age of household head: is a continuous variable measured in years, was taken as one of the explanatory variables to influence decision to participate in market and level of commercialization. Aman (2014) concluded that age of household head influenced market participation decisions negatively. Osmani and Hossain (2015), also concluded that as age of household increase, the probability of decision to participate in market decreases. This implies that younger households are more likely to participate in selling crops and sell more amounts when they do participate. But, Debela (2013) indicated that the age of household head has positive influence on the decision of market participation. Debela assumed that as household gets older they could acquire skills and hence produce much and develop skills to participate to market. Hence, it is expected that age of household head would have either positive or negative effect the market participation.

Sex of the household head: It is dummy a variable that takes a value 1 if the household head is male and 0 otherwise. The study by Abafita *et al.* (2016), found that being male headed had

influenced on the market participation positively, while Aman (2014), analysed that female headed had positive influence on the level of the commercialization and result showed that sex of the household head has no significant effect on commercialization in output side. A study by Mammo and Dagnet (2012), also showed that sex of household head is a determinant factor that positively affect the market participation. Furthermore, the study made by Dawit (2010), discovered that sex of the household head is one of the factors that affect positively market participation. Thus at the end of this study positive effect of sex on market participation and level of commercialization is expected.

Education of the household head: It is a continuous variable that is the household head's schooling level. It is believed that if a farmer attained formal education of any level there is a possibility as they have better technologies that will help them increase production and supply that may increase the farmers' market participation and volume of sales. There are many studies that show the relationship between education and quantity supplied to market. For instance, Yeshitila (2012) has indicated that there is there is appositve relationship between education and vegetable marketing. Also, educational attainment enhances the farmers' ability to appreciate the essences of credit, new technologies and information disseminated from extension agents which impacts positively on commercialization (Tolno *et al.*, 2015).

These findings concur with those of A mare (2013) and Kumar and Vipin (2015) found highly educated farmers to be more involved in marketing in output markets with level of commercialization. The study of Mathenge (2012), analysed, that education was one of the most significantly affect the market participation and had positively relationship to increase the smallholder commercialization. However, the result of Osmani (2014) showed that the education had positive relationship with smallholder commercialization.

Astewel (2010) also found that if paddy producer gets educated, the amount of paddy supplied to the market increases, which suggests that education improves level of sales that affects the marketable surplus. Debela (2013) showed that those households who had formal education determine the readiness to accept new ideas and innovations, and easy to get supply, demand, and price information and this enhance farmers' willingness to produce more and increase

volume of sales. Therefore, formal education is hypothesized to influence market participation and level of commercialization positively.

Family size: It is continuous variable that is measured by the total number of family. Abafita *et al.* (2014) showed that family size has negative and significant effect on the amount of sale. Aman (2014) also indicated that household size negatively and significantly influences the sales value of horticultural crops. Ele *et al.* (2013) finds that family size is one of the factors that negatively affecting the levels of commercialization of smallholder farms and decision of participation, and Osmani (2014), showed that family size has positive influence on market participation. This is due to larger family size can provide a major source of labour (Chanyalew *et al.*, 2011). The study conducted by Fantahun and Admasu (2010), also indicated that large family size has an effect in decreasing the supply of malt barely in Amhara Region. Another study, by Gezahagnand Ayalench (2010), also showed that family size has positive effect on the household market participation.

Farm size: It is a continuous variable that amount of land in Hectare (Ha.) under cultivation of farm household. Martey *et al.* (2012) indicated that farm size influences the level of agricultural commercialization in Ghana. Olwande (2012) observed that farm size has positive effect on market participation of various agricultural commodities. Chanyalew *et al.* (2011) showed that farm size has a significant and positive impact on decision to participate in of potato market.

Household labour: It is a continuous variable that shows the number of active number of family members working on the family farm (aged 15-64 years). Osmani and Hossain (2015) showed that household labour has positive effect on the market participation.

Credit: It is a dummy variable that takes as a value of 1 if the household head has get credit and 0 otherwise. Barrett (2011), showed that credit is one of the significant factor, and has positive relationship with market participation. Also, Abafita *et al.* (2016), analysed that getting credit enhanced the market participation. Barrett (2011), indicated that, farmers who have taken credit would increase their financial capacity as it assists to make proper decision regarding purchasing of modern input to increase his market participation and level of commercialized. Studies indicated that if producers of potato (Mahlet *et al.*, 2015), pepper (Alemnew, 2010), teff and wheat (Muhammed, 2011) have taken credit, the amount to be supplied to the market would

increase. Hence in this study hypothesized that taking credit has positive influence on the level of sales and market participation.

Market information: is a dummy variable that takes a value of 1, if market information used and 0 otherwise. Chanyalew *et al.* (2011) having market information was found to be one of the significant factors affecting extent of market participation of farmers in Kombolcha woreda. He recommended that even if, the smallholder farmers can get information from sources traders, neighbours' and relatives residing in towns, there should formal institutions providing information about prices, seasonal price variations and demand of the commodity to farmers to increase their decisions to participate in market.

Also, Geremew (2012) reviewed that having information is an important variable in any marketing because price information highly influences the commodity prices, and hence has a significant impact on income earned.

Distance nearest to Market: This is a continues variable measured by distance in Km from farmers' residence to the nearest market. Farmers who lives near to the market are likely to have more market participation (Chanyalew *et al.*, 2011; Germew 2012;) .

The study by Mahilet (2013), stated the analysis of value chain of malt barely also indicated that if the proximity from the farm to market increase, the volume of malt barely supplied to the market decreases. In this study ,the variable is expected to have a negative relationship with farmers decision to participate and level of commercialization in onion output side.

Irrigation: It is when irrigation used by household and dummy variable that takes value one, if household has used irrigation and zero otherwise (Chanyalew *et al.*, 2011). It is one of the most important inputs for potato production in the study area where producers have a chance to produce more than one time per year.

The study by Tadesse (2011), shows that the farmers, who have and use irrigation are using if for production of high value cash crops in west Hararghe Zone. This showed that the variable has positive relationship with participation in potato market.

Also, Kumilachew (2014), analysed that have and using irrigation has positive influence on market participation and refers to the physical availability or limitations of irrigation water. Where irrigation is practiced, it allows the extension of the farming season beyond the rainy season. This means farmers who have to use irrigation have opportunities to grow potato throughout the year and the produce would be over and above home consumption. This in turn results in farmers having access to irrigation can be bring higher proportion of produce. Hence an increase in irrigated area will increase the proportion of market participation.

Extension services: It is a dummy variable that takes a value of 1 if the household head has access and got extension service and 0 otherwise. The result of Ayelech (2011), showed that extension contact affected positively the marketable supply of fruits in Gomma district.

Debela (2013), also argued that the extension influence positively the market participation of onion. Obviously, as farmers learned more and knew much it would be obvious that they would produce much and ultimately participate in a market.

Furthermore, the study by Namazzi *et al.*, (2015), analysed that number of extension visits in the past year negatively and significantly influenced the level of participate in grain amaranth markets. His possible explanation was because of the information disseminated during these visits to be inclined more on the utilization and nutrition aspects of the crop and less on the marketing hence his reduces the volumes supplied to the market in favour of utilizing the crop for nutritional purposes. Therefore, not specific sign would be expected from the result.

Livestock number: It is continuous variable that show the number of livestock owned by household in terms of tropical livestock unit.

Households that have high TLU are expected to have a better wealth status in the society. Livestock holding in a household is useful as it increases fertility states of the soil because of organic manure and as a source of income from sale of livestock and its products. Hence the variable creates an opportunity for a household to use organic manure in addition to in organic fertilizer to increase potato production and level of commercialization (Mahletet *et al.*, 2015).

Households' livestock ownership is important resources, that it provides multiple products and services and has positive influence on market participation decisions (Chanyalew *et al.*, 2011).

However, Kumilachew (2012), showed that increasing of livestock relationship with participate in potato commercialization.

Fertilizer: It is a dummy variable that takes value of 1 if household use fertilizer and 0 otherwise.

Chirwa and Matita (2012) showed that getting fertilizer one of the factors which significantly influence the level market participation. Also, Abafita *et al.*, (2016), found that fertilizer has positive impact on market participation. It is hypothesized that fertilizer use affects commercialization positively.

Off/Non-farm income: It is continuous variable that show the total income earned from non-farm activities. Wondussen (2014) and Berhanu and Moti, (2010a) found that off-farm income is one of the highly significant variables that affect the market participation (Chanyalew *et al.*, 2011). Abafita *et al.* (2016), defined it as the income from non-farming activity as income obtained from non-farming activities by the household. This income may strength farming activity or reluctant to produce onion to generate money from onion rather than getting income from non-farm activities. Therefore, getting income from non-farming activity is assumed to have a positive relation with market participation and marketable surplus.

As per Olwande (2012), showed that socio-economic characteristics such as, age, farm size, ownership of some assets and output have positive effect on market participation. Public asset variables have also been found to have positive relationship with especially with respect to access to credit and insurance (Barret, 2011; Berhanu and Moti; 2010a). Aman (2014), identified that female in gender, extension, farm size, education, household labour, access to irrigation, non-farm income and off farm income have positive relationship, when distance nearest to market and market information have negative effect on decision to participate in output.

Moreover, Osmani and Hossain (2015), observed that off-farm income, ownership of farm equipment's, number of livestock have positive effect on decision to participate in output and oppose to the other studies he observed that access to information has positive relationship when number of livestock and non-farm income has negative relationship with decision to market

participation. The expected effect if off/non-farm income on the market participation is indeterminate.

Table 2: Definitions and hypothesized effect of variables on decision of market participation

Variable Name	Variable Type	Variable definition and measurement	Hypothesized Effect
Age (age)	Continuous	Age of the household (years)	-/+
Sex (sex)	Dummy	1 if the household head is male, 0 otherwise.	+
Education (edtn)	Continuous	Years of schooling of household head.	+
Family size (fmlsize)	Continuous	Total number of family	+
Farm size (frm)	Continuous	Amount of land in Ha. under cultivation of farm household	+
Household labour (hlbor)	Continuous	Number of active Family members working on the family farm (aged 15-60 years)	+
Credit (credt)	Dummy	1 if took credit and 0 otherwise	+
Market information (mktinfo)	Dummy	1 if has market information and 0 otherwise	+/-
Distance nearest to market (dmkt)	Continuous	Distance in k.ms to walk from residence to the nearest market	-
Irrigation (irrg)	Dummy	1 if has irrigation and 0 otherwise	+
Extension (extn)	Dummy	1 if has extension service and 0 otherwise.	+
Livestock (lvstok)	Continuous	Total number of livestock owned by household	+/-
Fertilizer (fertilzr)	Dummy	1 if use fertilizer and 0 otherwise.	+
Off/Non-farm income (off/nonfrm)	Continuous	Total income earned from non- farm activities	+/-

Source: Definitions adapted from literatures.

Table 3: Definitions and hypothesized effect of variables on level of commercialization

Variable Name	Variable Type	Variable definition and measurement	Hypothesized Effect
Age (age)	Continuous	Age of the household (years)	-/+
Sex (sex)	Dummy	1 if the household head is male, 0 otherwise.	-/+
Education (edtn)	Continuous	Years of schooling of household head.	-/+
Family size (fmlsize)	Continuous	Total number of family	+
Farm size (frm)	Continuous	Amount of land in Ha. under cultivation of farm household	-/+
Household labour (hlbor)	Continuous	Number of active Family members working on the family farm (aged 15-60 years)	-
Credit (credt)	Dummy	1 if took credit and 0 otherwise	+
Having Market information (mktinfo)	Dummy	1 if has market information and 0 otherwise	+
Distance nearest to market (dmkt)	Continuous	Distance in k.ms to walk from residence to the nearest market	-
Irrigation (irrg)	Dummy	1 if has irrigation and 0 otherwise	+
Extension (extn)	Dummy	1 if has extension service and 0 otherwise.	-/+
Livestock (lvstok)	Continuous	Total number of livestock owned by household	+
Fertilizer (fertilzr)	Dummy	1 if used fertilizer and 0 otherwise.	+
Off/Non-farm income(off/nonfrm)	Continuous	Total income earned from non-farm activities	-

Source: Definitions adapted from different literatures.

4. RESULTS AND DISCUSSION

In this chapter, descriptive and econometrics analysis are presented. In the descriptive analysis characteristics of the respondents are outlined. In the econometrics analysis determinants of market participation and level of commercialization are presented. According to data collected the smallholders who has taken credit was only one, as the result the credit variable not included during running the Heckman two stage model.

4.1. Descriptive Statistics

Age: The mean age for the sample respondents is 40 years with a minimum and maximum range of 20 years and 80 years respectively.

Education: It was found that the average schooling year for sample respondents is about 3 grades with maximum of attending 13 years of schooling. That means the maximum level of their education was grade 10 completed and level three completed in Technical and vocational training education. This indicates that the statuses of household education in the study area are very low, even the descriptive result showed that there are households who have zero education years.

Family size: The descriptive result revealed that the average the family size of sample respondents is 6 persons per with a minimum and maximum ranges of 1 and 12 persons respectively.

Household labour: The mean of household labour for the sample respondents is 3, while the minimum and maximum household labour is 1 and 8 persons respectively.

Farm size: The mean of total cultivated land for the sample respondents is 0.28 hectare while the minimum and maximum cultivated land is 0 and 1.5 hectare respectively. This showed that the land for cultivation owned by household is very small in the study area.

Distance to the nearest market: The mean average of distance from residence to nearest market is for the sample respondents is 8.45km while the minimum and maximum distance to the nearest market is 2 kms and 16 kms respectively.

Livestock number: The descriptive result indicates that the mean value of TLU (Tropical Livestock Unit) for the sample respondent is 1.74 while minimum and maximum is 0 and 11 respectively.

Off/non-farm income: The mean value of the off and/ non- farm income for the sample respondents is 741ETB while the minimum and maximum is 0 and 18000 ETB respectively. This shows that in the study area smallholders' income is highly dependent on farm.

Table 4: Descriptive statistics of continuous variables used in the empirical analyses

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	156	39.9	9.67	20	80
Edtn	156	2.77	3.57	0	13
Fmlsze	156	5.9	2.32	1	12
Frm	156	0.28	0.31	0	1.5
Hlbor	156	2.9	1.48	1	8
Dmkt	156	8.45	4.03	2	16
Lvstok	156	1.74	1.85	0	11
off/nonfm	156	741.03	2503	0	18000
Comindex	43	88.88	12.11	50	100

Source: Own computation (2017).

Sex of household head: the descriptive result indicates that 94 % of the sample household are male headed and the rest that is 6 % of the sample respondents are female headed. This imply that in the study area almost all households are male headed.

Market information: The descriptive result showed that 77% of the sample respondents have market information while 23% of the sample respondents have no access to market information.

Extension services: The descriptive result indicates that 50% of the respondents have extension service while 50% of the respondents have not got extension services.

Irrigation: The descriptive statistic result indicates that out of the total sample respondents 33% of them have used irrigation while 67% of the don't have used irrigation.

Fertilizer: From the sampled respondents 55% of them use modern fertilizer while 45% of the do not use modern fertilizer.

Onion market participation: Out of the sample respondents 28% of them participate in onion market. That means 72% of them do not participate in the onion market in the study area.

Table 5: Descriptive statistics of dummy variables used in the empirical analyses

Variable	Definition	Number	Percentage
Sex	Male	146	94
	Female	10	6
Mktinfo	Have market information	120	77
	Have not market information	36	23
Extn	Have extension service	78	50
	Have not extension service	78	50
Irrg	Have irrigation	52	33
	Have not irrigation	104	67
Fertilzr	used fertilizer	86	55
	No used fertilizer	70	45
Mktprtn	Yes	43	28
	No	113	72

Source: Own computation (2017).

The t-test statistics indicated that there is significant difference between onion market participant and non- participants in terms of education level, farm size, and livestock. Mean education level of the participants is greater than the mean education of non-market participants. The mean difference of farm size between market participant and non-market participant is 0.35 hectare. Also mean of livestock owned by market participant is greater by 0.68 (Table 6).

Table 6: t-test for market participants and non-participants for continuous variables

Variables	Mean (Market participation)		Pooled	Mean Difference	SD	t-value
	No	Yes				
Age	40.31	38.81	39.90	1.50	9.67	0.86
Educn	2.16	4.37	2.77	-2.21	3.57	-3.59***
Fmlsze	5.70	6.42	5.90	-0.72	2.32	-1.74
Frm	0.18	0.54	0.28	-0.35	0.31	-7.37***
Hlbor	2.80	3.19	2.90	-0.39	1.48	-1.47
Dmkt	8.20	9.10	8.45	-0.90	4.03	-1.25
Lvstok	1.55	2.24	1.74	-0.68	1.85	-2.08**
Offnonfrm	695.58	860.47	741.03	-164.89	2503.05	-0.37

Source: Own Computation (2017), ***, ** and * significant at 1%, 5% and 10% significance levels, respectively.

The χ^2 -test statistics indicated that there is strong association between onion market participation and access to market information in the study area. Also access to irrigation and fertilizer has strong association with decision to participate in selling onion in the study area (Table 7).

Table 7: χ^2 -test test for market participants and non-participants for categorical variables

Variables	Category	Market participation		Total	χ^2 -test
		No	Yes		
Sex	Female	8	2	10	0.31
	Male	105	41	146	
MKTINFO	Have not market information	35	1	36	14.40**
	Have market information	78	42	120	
Irrig	Have not irrigation	98	6	104	74.23**
	Have irrigation	15	37	52	
EXTN	Have not extension services	60	18	78	1.57
	Have extension services	53	25	78	
FERTLZR	Not used fertilizer	64	6	70	22.94**
	Used fertilizer	49	37	86	

Source: Own Computation (2017), ***, ** and * significant at 1%, 5% and 10% significance levels, respectively.

4.2. Econometrics Analysis Results

In this study, factors that influenced farmers' decision to participate in onion market as well as those which influence level of commercialization through sales volume were determined using the Heckman two stage maximum likelihood models. The Heckman two stage procedures were used since the volume to be supplied to the market will be preceded by a farmer decision of whether to participate or not to participate in the markets. In the first stage, the probit model was estimated to identify factors affecting the decision to participate in onion market. Using Ordinary least square the factors effecting level of commercialization were identified, where the inverse mills ratio variable generated from stage one of Heckman model is added as one of the explanatory variables to check whether selection bias was reduced by using the two stage Heckman regression models.

While fitting important variables in the models a test for multicollinearity problem among variables is necessary. However, the model by itself drops the variables that do not pass the test. Accordingly, market information is omitted from the regression due to the multicollinearity. In estimating the preferred model, robust method was employed to correct the possible problem of heteroscedasticity. The model chi-square tests applying appropriate degrees of freedom which indicate that, the overall goodness-of-fit of the model are statistically significant at less than 1% level of significance. In what follows, the determinants of household commercialization decision, and the determinants of the level of commercialization are presented.

4.2.1. Determinants of smallholder farmers' decision to participate in onion market

The first stage that is probit model estimation was used to analyse the determinants of the household market participation decision (onion sale decision). The decision to participate in the onion product market was estimated using maximum likelihood method.

Access to irrigation positively and significantly affects households' likelihood of selling onion product at 1 % significance level. This implies that using irrigation increases the probability of participating in onion output sale. This finding may be explained in such way, using irrigation increases the productivity and production of the household. As consumption of onion by individual household is limited in quantity, it is a rational to sell other. Due to this fact,

households that use irrigation may have higher probability to participate in onion product market than the households do not use irrigation (Table 8).

Fertilizer is also found to be positive and significant in influencing farmers' likelihood to participate in onion market at less than 1% level of significance. The result implies that households that use modern fertilizer use have higher probability of participating in onion market. In the study area, land size is very meagre; in this case use of modern fertilizer is very important. To raise production on these meagre land household, needs to use any mechanism that increases the productivity and production. Therefore, it seems that from this perspective that households that use modern fertilizer have higher probability of participation in onion product market (Table 7). Other studies have also showed that fertilizer significantly influence the level of market participation (Chirwa and Matita, 2012; Abafita *et al.*, 2016).

4.2.2. Determinants of smallholders' level of onion commercialization

This section deals with the second stage Heckman regression model estimating the determinants of the level of commercialization that was measured in percentage of sold onion output. At this stage only, farm households who sell onion product are considered in this analysis and inverse mills ratio (IMR) is considered as independent variable. Results showed that, the model was statistically significant at 1% level indicating the goodness of fit of the model to explain the relationships of the hypothesized variables, in terms of at least one covariate. The estimation results also showed that, level of onion output commercialization was influenced by, education of the household head, and extension services (see Table 5).

The education of the household head was found to affect negatively the commercialization level of onion output significantly at less than 1% level of significance. Education of household head is negatively related to level of commercialization in the study area, which is directly contrasted to result of Aman (2014). This is may be because many of educated household resorts to other alternative occupation like employment in governmental and non-governmental office, production of other cash crops like *Khat*, other vegetables.

Extension also negatively and significantly determines commercialization level of the onion. This finding is related with that of Aman (2014) and Namazzi *et al.* (2015), who found that extension has negative relationship with level of commercialization. This result may be because

extension service would make shift household's attention to increase his ability on how to increase his level of commercialization in other product. Thus, those who have access to extension service focuses on the other products that are more profitable than onion based on the advice from the extension workers.

Fertilizer use positively and significantly associated commercialization level of onion crop at less than 1% level of significance. This result confirms the result of Aman (2014), and Chanyalew *et al.* (2011). This is expected since fertilizer is a critical to increase production of onion that increases the level of commercialization.

Table 8: Results of Heckman two stage maximum likelihood regressions

	Variable	Coefficient	Standard error	Z -value
Comindex	Age	-1.130	-0.678	1.67
	Agesqr	0.011	0.006	1.76
	Sex	10.037	7.332	1.37
	Edtn	-1.264	-0.482	2.63***
	Fmlsze	0.957	1.049	0.91
	Sqrtfrm	8.585	7.855	1.09
	Hlbor	-0.013	-1.305	0.01
	Dmktsqr	0.015	0.025	0.59
	Extn	-11.197	-2.895	3.87***
	Irrg	11.229	7.314	1.54
	Sqrtlvstok	-2.801	-1.971	1.45
	Fertlz	15.142	4.718	3.21***
	Offnonfrm	0.000	0.000	0.61
	-Cons	84.133	17.987	4.68***
Mktprtn	Age	-0.188	-0.121	1.55
	Agesqr	0.002	0.001	1.45
	Sex	-0.255	-0.584	0.49
	Edtn	0.011	0.044	0.26
	Fmlsze	0.040	0.094	0.42
	Sqrtfrm	1.675	1.001	1.67
	Hlbor	-0.048	-0.107	0.45
	Dmktsqr	-0.000	-0.002	0.15
	Extn	-0.069	-0.346	0.20
	Irrg	2.064	0.333	6.18***
	Sqrtlvstok	0.218	0.227	1.02
	Fertlzh	1.271	0.377	3.34***
	Offnonfrm	0.000	0.000	0.99
	_cons	0.529	2.400	0.22
Athrho	_cons	0.093	0.390	0.27
Lnsigma	_cons	2.13	0.116	19.83***
Wald chi2(13) = 51.59 Prob > chi2 = 0.0000 N 156				

Squared variables: The reason for those variables took the form of square was to avoid problem of heteroscedasticity.

Source: Own computation (2017), ***, ** and * significant at 1%, 5% and 10% significance levels, respectively.

4.2.3. Marginal effects of explanatory variables

In Table 9 the marginal effects of the explanatory variable are presented. Accordingly, as education of the household head increases by one year the commercialization index decreases by 1.27 units in the study area. This was what overviewed during data gathering as the level of their education increased the household preferred to be employed in different governmental and non-governmental offices, resort to other activities that earn them more rather than participate in onion market participation.

The commercialization index for households who has access to extension service is lower than by 11.20 than that of households those who does not have access to extension services in the study area. This also overviewed that those who were giving extension service not give attention on Onion product that made households shift to other products. Furthermore, the result showed that the commercialization level of those who use fertilizer increased by 15.14 kg than who do not use fertilizer.

Table 9: Marginal effect analysis

Variable	dy/dx	Std. Err.	Z-value	X(mean)
age	-1.13	0.67837	-1.67	39.90
agesqr	0 .01	0.0064	1.76	1684.63
sex*	10.04	7.33205	1.37	0.94
edtn	-1.27	0.48295	-2.63***	2.77
fmlsize	0 .96	1.04924	0.91	5.90
sqrtrm	8.59	7.85585	1.09	0.46
hlbor	-0.01	1.30556	-0.01	2.90
dmktsqr	0.015	0.02517	0.59	87.59
extn*	-11.20	2.8953	-3.87***	0.50
irrg*	11.22	7.31437	1.54	0.33
sqrtrv~k	2.87	1.97179	-1.45	1.09
fertilzr*	15.14	4.71807	3.21***	0.55
offnon~m	0.00	0.00051	0.61	741.03

(*) dy/dx is for discrete change of dummy variable from 0 to 1, Source: Own Computation (2017), ***, ** and * significant at 1%, 5% and 10% significance levels, respectively.

5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Summary and Conclusion

Transforming the subsistence-oriented production system into a market-oriented production system to increase the smallholder farmer's income and reduce rural poverty has been in the policy spotlight of many developing countries, including Ethiopia. Accordingly, there is a need to improve the smallholder commercialization decision as well as the level of commercialization to facilitate stable incomes and sustainable livelihoods. To achieve the goal relevant policy implications that are drawn from the findings of study can help design appropriate intervention mechanisms. And this would help improve the smallholder commercialization behaviour.

This study was conducted to identify household level determinants of the output side commercialization decision and the level of commercialization of onion product. The study was conducted in Haramaya district, Oromia region of Ethiopia which is known by vegetables production. The study analysed that the factors significantly affecting the decision to participate in onion market and level of commercialization. The study considered both market participation and level of commercialization. This is since explanatory variables may or may not simultaneously determine the two variables (i.e. market participation and level of commercialization) in the same area.

The study indicated, an access to irrigation, and fertilizer uses significantly affect smallholder market participation decision. On other hand, education of household head, fertilizer use, and extension services significantly determine the level of commercialisation of smallholder farmer in the study area

5.2. Recommendations

Based on the findings, policy recommendations are proposed; further improvements can be made in the households' market participation and commercialization by taking the following policy measures:

The fact that access to irrigation determines farmer's participation in the marketing of onion product suggests that the role of policies geared toward improving access to irrigation further strengthens onion market participation. This may be ensured by using different technology that use available water resources, and by building infrastructure that helps collect rain water during summer to be used for farming purpose in another season. This will improve the scarcity of water for producing onion and improving onion market participation.

Access to fertilizer to onion producers increase their product, providing fertilizer in reasonable price, and arranging credit mechanism for those who have no financial capability to afford timely fertilizer may increase the participation of marketing as well as level of commercialization. This may improve smallholder income generation which may reduce poverty.

The study showed that as the level of education of household increases the level of commercialization decrease. To benefit households producing onion, specific knowledge about onion production and marketing in terms of the training should be provided.

The study also recommended that extension service provider should consider commercialization of onion to increase the farmers' level of commercialization. They should also provide extension services related to onion should not bias to only some crops. In this case extension services provider should take into consideration what, why farmers are producing onion in providing the service.

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APPENDICES

Haramaya University
Postgraduate Program Directorate
Determinants of Commercialization of Smallholder Onion Producers in Haramaya
District, East Hararghe Zone, Oromia Region, Ethiopia
Survey Questionnaire

Dear respondents, this survey will be used to analyse the **determinants of commercialization of smallholder onion producers in Haramaya district**. your response will be used for academic purpose only. Be sure that it will not be transferred to third person and will be kept confidentially.

I. General Description

1. Name of Interviewer _____ Signature _____, Date _____
2. Name of Supervisor _____ Signature _____, Date _____

II. Demographics Characteristics

- 1) Name of household head (household ID) _____
- 2) Location of the household(Village)_____

No of family	Relation to the head	Age	Sex 1=Male, 0=female	Religion 1=Muslim, 2= protestant, 3=orthodox, other=4	Educational status	Employment status 1=employed, 0=unemployed	Marital status Married=1, Single=2, Divorce=3, Widowed=4
1)	Head						
2)							
3)							
4)							
5)							
6)							

7)							
8)							
9)							
10)							
11)							
12)							

III. Economic and social characteristics

3) How much total **income** does your household get last year from the following items?

S. No	Items	in Birr
1.	Crop production (cereals)	
2.	Livestock sales	
3.	Honey sales	
4.	Milk and butter sales	
5.	Fruit sales	
6.	Vegetable sales	
7.	Trade (from petty trade, weaving, etc.)	
8.	Chat	
9.	Labor selling	
10.	Non-farm activities	
11.	Interest from saving if any	
12.	Remittance	
13.	Other, specify	

4) During the past 12 months, did you or any other member of the household involve in non- farm income generating activities? (1) Yes ☐ (0) No ☐

5) If your answer is “Yes”, how much was earned_____ (in Birr)?

6) What is the distance of your residence to the nearest market centre? _____in KM/____in walking time/minutes/hrs.

7) Do your household participate in *iddir/iqub*? (1) Yes ☐ (0) No ☐

8) What is the total land holdings of the household? _____in hectare.

9) What is the quality of the land of the household? 1) Fertile ☐ 0) Not fertile ☐

10) Are there paved road/rural road in your area? (1) Yes [] (0) No []

11) How many KM do you travel from your home to reach main road? _____ in KM.

12) Do you have access to telephone? (1) Yes [] (0) No []

IV. Onion production and sale

13) Do you produce onion? 1) Yes [] 0) No []

14) If “Yes” How many times you produce last 12 months? 1) Once [] 2) Twice [] 3) Three []

15) Did you participate in selling of onion in last 12 months? 1) Yes [] 0) No []

16) If “Yes”, please fill the amount of onion production and sold to the market during the last 12 months.

Time of sale	Amount produced last year in quintal	Amount of hectare used	Amount that is sold in the market in quintal	Place to sell (where)	Distance to market km (walking in hr)

17) Did you apply fertilizer (DAP, UREA) to your onion production last 12 months? 1) Yes [] 0) No []

18) If “Yes” how many Birr did you spend on fertilizer? _____ (in Birr).

19) Do you use agricultural farm inputs at recommended rate? (1) Yes [] (0) No []

20) Do you use improved onion seed? (1) Yes [] (0) No []

21) How do you prepare your land? 1) Tractors [] 2) animal plough [] 3) by hoe [] 5) others(specify) _____

22) Did you contact agricultural extension workers in relation to Onion production in the last 12 months? 1) Yes [] 0) No []

23) If “Yes”, how often the extension agent contacted you specially for Onion production and marketing purpose in the year 2015/2016. 1) Weekly [] 2) Monthly [] 3) Quarterly [] 4) yearly [] 5) other (specify) [] _____.

24) Did you receive credit in last 12 months? 1) Yes [] 0) No []

25) If “Yes” have you received credit for Onion production purpose? 1) Yes [] 0) No []

26) If “Yes”, how much amount of credit? _____ in birr.

27) Did you have access to irrigation for Onion production? 1) Yes [] 0) No []

28) If “Yes”, area planted? _____ in hectare.

29) Did you get market price information of onion? 1)Yes ☐ 0) No ☐

30) Did you know the market price before you sold your onion in 2015/16? 1)Yes ☐ 0) No ☐

31) Livestock ownership of household (TLU).

Type of livestock	Number owned in 2015/16	Type of livestock	Number owned in 2015/16
Cows		Donkeys	
Oxen		Horses	
Heifers		Mules	
Yearling		Poultry	
Calves		Bee colony	
Sheep		Other specify	
Goats			

32) How much does the household spend on the following food and non-food items? By recalling the last seven days' consumption.

S.No	Items	Expense per (in Birr)		
		Last seven days	Per month	Per year
1.	Food items			
2.	Non-food items			

Annex2. Conversion factor of tropical livestock unit (TLU)

Livestock category	TLU	Livestock Category	TLU
OX	1	Horse	1.1
Cow	1	Sheep (adults)	0.13
Woyefen	0.34	Sheep (young)	0.06
Heifer	0.75		0.13
Calf	0.25	Goat (adults)	0.06
Donky (adults)	0.7	Hen	0.013
Donkey (young)	0.35	Camel	1.23

Source: Storck et al., 1991