GENDER DIFFERENCE AND ITS EFFECT ON AGRICULTURAL PRODUCTIVITY: THE CASE OF YUBDO DISTRICT IN WEST WOLLEGA ZONE OROMIA NATIONAL REGIONAL STATE ETHIOPIA

MSc. THESIS

BY

BACHA GEBISSA NEGERI

OCTOBER, 2018

JIMMA, ETHIOPIA

GENDER DIFFERENCE AND ITS EFFECT ON AGRICULTURAL PRODUCTIVITY: THE CASE OF YUBDO DISTRICT IN WEST WOLLEGA ZONE OROMIA NATIONAL REGIONAL STATE ETHIOPIA

MSc. Thesis

Submitted to the school of Graduate Studies, Jimma University, College of Agriculture and Veterinary Medicine, Department of Agricultural Economics and Agribusiness Management in Partial Fulfillment of the Requirements for the Degree of Master of Science in Agricultural Economics

By

Bacha Gebissa Negeri

Major advisor: Zekarias Shumeta (PhD)

Co-advisor: Guta Regassa (PhD scholar)

October, 2018

Jimma, Ethiopia

DEDICATION

I dedicate this thesis manuscript to my mother Tadalu Deressa for her continues contribution throughout my life journey.

STATEMENT OF AUTHOR

I the undersigned hereby declare that the thesis- Gender difference and its Effect on Agricultural Productivity: The Case of Yubdo District in West Wollega Zone Oromia National Regional State Ethiopia, is the outcome of my own work and all sources of materials used for this thesis have been properly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for MSc. degree at Jimma University and is deposited at the University Library to be available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of the source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or part may be granted by the head Department of Agricultural Economics and Agribusiness Management or the Dean of the School of Graduate Studies when in his/her judgment the proposed use of the material is in the interest of scholarship. In all other instances, however, permission must be obtained from the author.

Name: Bacha Gebissa Negeri Signature: _____

Place: Jimma University, Jimma.

Date of submission: _____

BIOGRAPHICAL SKETCH

The author was born on January 22, 1992 in *Boti Kebele*, Yubdo district of West Wollega Zone, and Oromia National Regional State. He attended his elementary school from grade 1-7 at *Worra Gutu* Elementary School; grade 8 Bako Elementary and Secondary School (9-10) in Bako Secondary School in Bako town. After he successfully passed EGSEC, he joined preparatory school for 2 years at Bako Preparatory School. In October 2012, he joined Wollega University Shambu Campus College of Agriculture and Natural Resource and graduated by Agricultural Resource Economics and Management in June 2015. After his graduation, he employed in Wollega University Shambu Campus as graduate assistant for one year. Then; he joined Jimma University in October 2016 to follow his MSc. degree in Agricultural Economics program.

ACKNOWLEDGMENTS

At the beginning, I would like to praise the perpetual Father and the Prince of love and peace, the Almighty God, who always let the bulk of unfinished work to be completed at a moment.

Next, I am grateful to the invaluable support of my major advisor Dr. Zekarias Shumeta, for his unreserved advice, guidance, and constructive observations starting from the very commencement up to thesis completion. My thanks also go to my co-advisor Mr.Guta Regassa for his valuable and relentless supports with wise enrichments of my research work. Without their encouragement, insightful and professional expertise, the completion of this work would have not been possible.

I would like to express my sincere appreciation and gratitude to Wollega University Shambu Campus for helping to get the opportunity to pursue my further study. Furthermore, I would like to thank agricultural and gender office of Yubdo district for their warm kindness and assistance during data collection. I also express my heartfelt thanks to the male and female headed households who responded to my numerous questions with patience. Thanks are also due to for their friendliness, hospitality and kind supports during the fieldwork and data collection.

I am extremely grateful to all my family, especially my mother Tadalu Deressa for her tolerance and encouragement during my educational status at all level.

Last but not least, I would like to thank JUCAVM for funding me to accomplish my work and all people who assisted me in one way or another during my study period.

TABLE OF CONTENTS

Contents **Page**

DEDICATION ..... **ii**

STATEMENT OF AUTHOR ..... **iii**

BIOGRAPHICAL SKETCH ..... **iv**

ACKNOWLEDGMENTS ..... **v**

TABLE OF CONTENTS ..... **vi**

LIST OF TABLES ..... **ix**

LIST OF FIGURES ..... **x**

LIST OF TABLES IN THE APPENDIX ..... **xi**

ACRONYMS AND ABBREVIATIONS ..... **xii**

ABSTRACT ..... **xiii**

1. INTRODUCTION **1**

1.1. Background of the Study **1**

1.2. Statement of the Problem **3**

1.3.2. The specific objectives 5

1.4. Research questions **5**

1.5. Scope and limitations of the study **5**

1.6. Significance of the Study **6**

1.7. Organization of the Thesis **6**

2. REVIEW OF LITERATURE **8**

2.1. Theoretical Literature **8**

2.1.1. Concept of gender and its roles 8

2.1.2. Gender division of labour 10

2.1.3. Gender differences in access to and control over resources 11

2.2. Measurement of Productivity in Agriculture **14**

2.2.1. Productivity 14

2.2.2. Production functions 16

2.2.3. Gender difference in agricultural productivity 17

2.3. Review of Empirical Findings **19**

2.4. Conceptual Framework **22**
3. RESEARCH METHODOLOGY **24**
3.1. Description of the Study Area **24**
3.1.1. Location 24
3.1.2. Physical features and area coverage 25
3.1.3. Population 25
3.1.4. Economic activities 25
3.2. Type and Source of Data **26**
3.3. Methods of Data Collection **26**
3.4. Sampling Method and Sample Size Determination **27**
3.5. Methods of Data Analysis **28**
3.5.1. Descriptive and inferential statistics 28
3.5.2. Econometric analysis 28
3.5.2.1. Cobb-Douglas production function 29
3.5.2.2. Definition of variables and hypothesis setting 30
3.5.2.3. Estimation techniques 33
3.5.2.4. Testing procedures 35
4. RESULTS AND DISCUSSION **38**
4.1. Characteristics of Sampled Households **38**
4.1.1. Ethnicity and religion of the household headed 38
4.1.2. Family size and level of education of the household head 38
4.1.3. Marital status of sampled households 39
4.2. Farm Characteristics of household head **41**
4.2.1. Land use pattern and use of fertilizer, improved seed and herbicides 41
4.2.2. Cropping pattern 43
4.2.3. Crop yield 44
4.2.4. Livestock Holding 45
4.2.5. Labour utilization 46
4.2.6. Farming experience and number of oxen 47
4.2.7. Sources of farm income 48
4.3. Gender Based Division of Labour **49**

4.4. Access and Control of Resources **51**
4.5. Results of Econometric Models **54**
4.5.1. Estimation of the production function 54
4.5.2. Comparison of productivity of the two groups 55
4.5.3. Marginal value product (MVP) of inputs 59
4.5.4. Source of productivity difference 61
5. SUMMARY, CONCLUSION AND RECOMMENDATIONS **64**
5.1. Summary and Conclusion **64**
5.2. Recommendations **66**
6. REFERENCES **68**
7. APPENDIX **74**

LIST OF TABLES

Table **page**

Table 1. Distribution of sample households by *Kebeles* and sex of household head.....28
Table 2: Summary of definitions of variables and working hypothesis.....33
Table 3. Religion of the households headed frequency and percent (%).....38
Table 4.Average family size by age in man-equivalent and educational level of the households.....39
Table 5. Marital status of sampled household headed 40
Table 6. Reason for being female headed household by frequency and percent (%). 40
Table 7. Land use pattern and use of fertilizer, improved seed and herbicides of MHH and FHH....42
Table 8. Cropping pattern of surveyed households headed 44
Table 9. Yield of major crops qt/ha (quintal per hectare) 44
Table 10. Livestock holding in tropical livestock unit by gender household head.....45
Table 11. Labour shortage among sample households headed by percent (%) 46
Table 12. Labour utilization by sample households headed by percent (%) 47
Table 13. Mean of farming experience and number of oxen of respondents.....47
Table 14. Sources of income for household headed in birr (mean) 48
Table 15. The average number of men and women family member participated in different activities 50
Table 16. Access to and control over resources in the household headed 53
Table 17. Comparison of the overall production parameters of both groups.....55
Table 18. Estimates of production function for pooled sample with dummy gender 56
Table 19. Coefficient of cob-Douglas production function 57
Table 20. Marginal value of product and factor cost of significant explanatory variables.....60
Table 21. Geometric mean of dependent and explanatory variables in the model 61
Table 22. Decomposition of productivity difference between MHH and FHH.....62

LIST OF FIGURES

Figure **Page**

Figure 1: Conceptual framework 23
Figure 2. Map of study area 24

LIST OF TABLES IN THE APPENDIX

Appendix table **Page**

Appendix table 1: Conversion factor for household labour into ME 74
Appendix table 2: Conversion factor of livestock number into TLU 74
Appendix table 3 : Multicollinearity test among explanatory variables 74
Appendix table 4: Linktest for model fitness 75

ACRONYMS AND ABBREVIATIONS

CSA	Central Statistical Agency
EGSEC	Ethiopian General Secondary Education Certificate
FAO	Food and Agricultural Organization
FHH	Female Headed Household
GDP	Gross Domestic Product
GIS	Geographical Information System
Ha	Hectare
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IMF	International Monetary Fund
Kg	Kilogram
Km	Kilometer
Km^2	Kilometer square
MHH	Male Headed Household
MVP	Marginal Value Product
NPC	National Plan Commission
NPS	Nitrogen phosphorus Sulfur
OCSSCO	Oromia Credit and Savings Share Company
OECD	Organization for Economic Co-operation and Development
PA	Peasant Administration
Qt	Quintal
SD	Standard Deviation
SPSS	Statistical Package for Social Science
TFP	Total Factor Productivity
TLU	Tropical Livestock Unit
UNDP	United Nations Development Programme
VIF	Variance Inflation Factor
WB	World Bank
WDR	World Development Report
YDAO	Yubdo District of Agricultural Office
YDEO	Yubdo District of Education Bureau Office

Gender difference and its effect on agricultural productivity: The case of Yubdo District in West Wollega Zone Oromia National Regional State Ethiopia

ABSTRACT

Rural men and women have different access to productive resources which may hinder women's productivity and reduce their contributions to agriculture. This research was conducted to analyze difference in agricultural productivity between male and female headed households in Yubdo district of West Wollega Zone, Oromia National Regional State. The study used cross-sectional data that is collected from a total of 150 sampled respondents. The data were analyzed by descriptive statistics and econometric model using Statistical Package for Social Science. Descriptive statistics such as frequency, mean, percentage, standard deviation, minimum and maximum; and inferential statistics such as t-test and chi-square were used to summarize and compare the information between the two groups. Results of the study showed that male headed households own more of productive resources such as land, livestock, labour and other agricultural inputs as compared to female headed households. Additionally, Cobb-Douglas production function was used to estimate the productivity difference in agriculture between male and female headed households. The result of the study indicated that farm land, inorganic fertilizer, labour, number of oxen and number of extension contact were statistically significant in influencing the productivity of male headed households while farm land, inorganic fertilizer, labour, herbicide and improved were significant variables affecting the productivity of female headed households. The comparison of the marginal value product with the factor cost showed that both male and female headed households could increase productivity using more labour and farm land. The agricultural productivity difference between male and female headed households was about 70.84% in the study area. On the other hand, if female headed households had equal access to the inputs as male headed households, gross value of the output would be higher by 17.6% for female headed households. This may suggest that female headed households would have been more productive than male headed households if they had equal access to inputs as male headed households. Thus accessing female headed households to inputs that increase the productivity of land, labour utilization, usage of herbicide; and introducing technologies that reduce the time and energy of women is essential to improve the agricultural productivity of women and the society as a whole.

Key words: Agricultural Productivity, Cobb-Douglas, Decomposition Model, Gender difference

1. INTRODUCTION

1.1. Background of the Study

In most developing countries agriculture is still the backbone of the economy and plays an important role in the economy of most African countries (Nyamekye and Ntoni, 2016; Olakojo, 2017). Majority of sub Saharan Africa's population depend directly or indirectly on agriculture, and the sector contribute high share to the overall economy and development. Increasing agricultural productivity and production are important avenues to increase food supply and improve the livelihoods of the poor in developing countries (Asfaw *et al.*, 2012; Ghimire *et al.*, 2015).

Ethiopia is one of the developing countries in the world with poverty injured economy and has the lowest incomes per capita (Worldometers, 2018). Agriculture is the major economic sector and the main source of livelihood for the majority of the people and it is the most important sector for sustaining growth and reducing poverty. It accounts over 70% of foreign exchange earnings and 36.3% of Gross Domestic Product (UNDP, 2018). It also makes 73% total employment (UNDP, 2016). Therefore, the overall performance of the Ethiopian economy is highly influenced by the performance of the agricultural sector. Over all enhancing of agricultural productivity and economic empowerment of women is therefore a logical priority of agriculture programs and policies that seek to promote agricultural development (WDR, 2017).

The Ethiopian Government has embraced the Agricultural Development Led-Industrialization (ADLI) to realize the importance of agriculture in the national economy and policy to promote the economic development of the country since the early 1990s. Agriculture has been a central support of the succeeding development plans of the country that included the Sustainable Development and Poverty Reduction Program (SDPRP), which covered the years 2002/03-2004/05 and the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) which ran from 2005/06-2009/10. During these plan periods, the Government invested heavily in agriculture (Davis *et al*., 2010). On the basis of the experiences gained

during the preceding plan periods and the national vision, the Growth and Transformation Plan (GTP) was prepared for the 2010/11-2014/15 period. Lying on the basis of the experiences gained during GTP I the FDRE has commenced the implementation of the House of Peoples' Representatives ratified GTP II which incorporates SDGs. GTP II implementation span covers five years, between 2015/16 - 2019/20. In effect all developments undertaken by every stakeholder in each development sector are drawn from the GTP II which includes SDG. Under the leadership of the FDRE all stakeholders shall remain engaged in implement-ting the SDGs and GTP II in general. The GTP envisages agricultural sector development continue to be the major source of an accelerated economic growth and development (FDRE NPC, 2017).

In many developing countries, women lack the resources and opportunities they need to make the most productive use of their time, and face more severe constraints than men in accessing productive resources, markets and services. Women in the agricultural sector in Ethiopia already face many socio-economic, educational and traditional legal obstacles in realizing benefits of their effort (Tesfaye and Desta, 2017). Women in the rural parts of Ethiopia account for 50% of rural population. About 88% of the country's women live in rural areas, nearly 85% of their labour spent on agricultural activities such as food processing, storage, weeding, harvesting, and marketing of produce, preparing trashing field and caring for animals (Bogalech, 2000a). However, in spite of their substantial contributions to the development of the economy in general and agricultural sector in particular, they are constrained by a number of factors. Therefore, it is important to pay special attention to the work and lives of the poor rural women.

In Ethiopia, like in many other parts of sub-Saharan Africa, where subsistence agriculture predominates, placing strong emphasis on increasing the productivity of labour, land, capital and other resources is paramount importance. Therefore, this study is initiated in view of understanding the agricultural productivity difference between men and women farmers in Yubdo District of West Wollega Zone of Oromia National Regional State.

1.2. Statement of the Problem

Most of the smallholder farmers in Sub-Saharan African countries' agricultural productivity are generally low (Olakojo, 2017). The low level of agricultural productivity is mostly for female farmers compared to their male counterparts'. Studies have persistently identified a gender gap in agricultural productivity of 20 to 30 percentage points in disadvantage of women as an important obstacle for the development of the agricultural sector. Numbers of these studies indicate that once differences in access to productive resources and individual characteristics are taken into account, estimates of the gender productivity gap become insignificant. Henceforth, the evidence speaks of a difference in productivity that arises mainly from differential access to resources and differential farmers' characteristics by gender (Kilic *et al*., 2015; Aguilar *et al.,* 2015).

Rural men and women have different access to productive resources, services, information, and employment opportunities, which may hinder women's productivity and reduce their contributions to agriculture, food security, nutrition, and broader economic and social development goals (Duffy *et al.*, 2017).

Women take part actively in farming activities and in processing farm products, in addition to their domestic and reproductive responsibilities. The role women play in agriculture and the rural society is fundamental to agricultural and rural development in sub-Saharan Africa. Different studies reveal that rural women farmers play a vital role in food production and food security. Particularly in low income countries in which agriculture accounts for an average 32% of the growth in GDP, and in which an average 70% of the countries' poor live and work in rural areas, women make up a substantial majority of the agricultural workforce and produce most of the food that is consumed locally. Agricultural production in these countries which include almost all of the countries in Sub-Saharan Africa is an engine of economic growth, and provides the basis for most rural livelihoods (WDR, 2017).

In general rural women in the developing world and throughout Ethiopia in particular make critical contributions to household agricultural production and productivity consequently to household and national food security. However, it is often mentioned that most of the household decisions related to production, processing and marketing are dominated by male

members of the households. Women not only need access to productive resources but also need to use those resources efficiently by making necessary decisions in farming activities. Because of socially constructed roles, various factors may affect women's level of involvement in such decision making (Sinidu, 2017).

Ethiopia is one of most populated country with 107.53 million inhabitants distributed along a one million square kilometer land-locked area (Worldometers, 2018). Its economy is highly dependent on agriculture. Last decade's increasing trends in crop production and yields provide a hopeful message to the more than 30% of rural population living below the national poverty line. Stimulating greater gains in agricultural productivity and promoting gender equality on this front may be the next steps toward further alleviation of poverty and food insecurity, as well as improved development outcomes for future generations and rural households (Doepke and Tertilt, 2014; FDRE NPC, 2017).

The situation in the study area, Yubdo district, is not different from Ethiopian case. The district is one of the highly populated areas in West Wollega Zone where population density is about 217 persons per Km^2 (CSA, 2018). As the result, farm size is so small to produce sufficient food to the population and the number of female headed households is also increasing from time to time since death of husband, divorced problem and males are migrating to other areas in search of better employment leaving behind their wives and children. Thus, females would take over the position of their husband in addition to their routine household management. Therefore, it is essential to study the productivity of female headed households in agricultural sector as compared with their male counterparts in the area where gender dis-aggregated information in this aspect is missing. So far no attempt has been made before to measure the agricultural productivity difference between male and female headed household in the study area. So, this study intends to fill this knowledge/information gap.

1.3. Objectives of the Study

1.3.1. General objectives

The overall objective of the study is to analyze difference in agricultural productivity between male and female headed households in Yubdo district of West Wollega Zone of Oromia National Regional State.

1.3.2. The specific objectives

The specific objectives of this study were:

1. To assess gender division of labour in agricultural activity in the study area.
2. To examine access to and control over productive resources between male and female headed households in the study area.
3. To estimate male and female productivity in agriculture in the study area.

1.4. Research questions

The study tried to answer the following questions:

1. What is gender division of labour in agricultural production in the study area?
2. What does access to and control over productive resources looks like between male and female headed households in the study area?
3. What is the difference in agricultural productivity between male and female headed households in the study area?

1.5. Scope and limitations of the study

This study was carried out to analyze difference in agricultural productivity between male and female headed households with the sample of 75 male and 75 female headed who are randomly selected from six *Kebeles* in Yubdo district of West Wollega Zone, Oromia National Regional State, Ethiopia. The type of data used in this study was cross sectional data and data were collected with the aid of structured questionnaire from sampled households. One of the limitations of this study was the use of cross sectional data. Because, productivity can differ from time to time depending on the existing natural and human factors. The study could have benefited more if panel data had been used as productivity can be time variant depending on the existing natural and human calamities.

Despite appropriateness of using survey method of data collection, the other limitation of this study was that the respondents were asked to quantify the value of continuous variables, such as the yield of major crops, the size of land he/she owned, etc. from their memory. The actual values for the continuous variables would have been more appropriate to take measurement of the variables. In addition, it is important to note that, Ethiopia is diversified in agro ecological, socioeconomic, cultural, and institutional environment, and the study being location specific in nature, its results could not be generalized to the zonal or regional level.

1.6. Significance of the Study

Understanding the gender difference in agricultural productivity of households especially between male and female headed households helps to design means of developing the agricultural sector and thus essential for the long-term success of the economy. On the other hand, the causes of gender related differences in productivity is crucial, because, if gender affects the productivity directly, meaning if men's and women's productivities are different when they have exactly the same constraints and resources, then it may be necessary to modify research strategies to ensure increasing their productivity. If, on the other hand, differences in productivity arise because men and women face different constraints, especially access to complementary inputs, then it may be more important to design projects that improve women's access to these complementary inputs.

Therefore, the result of this study enables us to know the sources of agricultural productivity differences between men and women headed household farmers working in a similar environment. The study, furthermore, provides some basic information need for policy makers and institutional interest in designing programs and projects that are appropriate to the needs of both men and women. Development actors operating in the area would be benefit from the result of the research so that they work to fill the gap existing between men and women towards bringing sustainable development in the area.

1.7. Organization of the Thesis

The thesis is organized under five chapters. Chapter one addressed background, statement of the problem, objectives, research questions, scope and limitations and significance of the

study. The second part presents review of literature including definition and constituent of gender, gender division of labour, gender difference in access to and control over resources, gender difference in agricultural productivity and review of empirical findings on gender disparity. The third chapter deals with the research methodology. The fourth part presents the results and discussion. The last chapter summarizes the major findings of the study and draws appropriate policy implications.

2. REVIEW OF LITERATURE

In this section, theoretical, conceptual and some previous empirical findings of gender and agricultural productivity are reviewed and offered as follow.

2.1. Theoretical Literature

Below this section an endeavor is made to discuss some of the concepts used in this study such as gender, gender role, gender division of labour, gender differences in access to and control over resources and measurement of productivity in agriculture.

2.1.1. Concept of gender and its roles

The socially constructed roles and responsibilities of women and men that are learned (and therefore unlearned) roles and responsibilities, and expectations, of women and men often described in terms of masculinity and femininity. However, most of the literature on gender focuses on women and girls and the factors that affect their socioeconomic outcomes (Farre, 2012). Gender refers to relations between men and women, not an exclusive focus on women. In much of agricultural development, the focus has been on men, so achieving gender equality requires rebalancing by paying greater attention to women. However, the importance of relations between women and men, as well as the differential roles, resources, and responsibilities of women and men of different ages, ethnicity, and social class need to be kept in mind in both analysis and programming (FAO and IFPRI, 2014). Gender relates to socially assigned roles and behaviors attributable to men and women. It also refers to the social meaning of biological sex differences (Ogato *et al.,* 2009). It is the basis for a very basic division of labour between males and females within most societies: the division between productive, reproductive and communal activities (Paris, 2013).

As pointed by IFAD (2014b), gender is one of the ways in which societies and smaller social groups are stratified. It is a term used to describe social differentiation .In other word, gender is an established social and cultural role of men and women or it is a system of roles and relationships between men and women that are determined by the social, political and

economic concepts. It is the analytical term, which refers to socially determined difference between women and men as opposed to sex, which is biologically determined.

Gender roles are socially rather than biologically determined; they are fluid and subject to change based on changing norms, resources, policies, and contexts. Every society is marked by gender differences, but these vary widely by culture and can change dramatically within or between cultures over time (FAO and IFPRI, 2014). In almost all societies, women and men differ in their activities and undertakings, regarding access to and control over resources and participating in decision-making (Mohammed & Abdulquadri, 2012).

According to Brieger *et al.* (2017), gender role expectations are mutual and, hence, so deeply encoded in national cultures that both sexes hold largely similar values when they are part of the same culture. Accordingly, Wetzel (2013, p. 97) writes that ‘‘societies in which men place the strongest emphasis on emancipative values are also those in which women do so. In fact, the between societal variation in emancipative values is 98% identical between women and men.’’Men shift their attitudes toward gender equality along with women (Ingle hart and Norris, 2003). They argue therefore that widespread emancipative values have not only an influence on women’s own motivation to take leadership positions in business, but also on men’s acceptance of women’s ambition to become business leaders.

According to Sinidu (2017), gender roles include: productive roles that generate an income women engage in paid work and income generating activities, but gender disparities persist in terms of wage differentials, contractual modalities, and informal work; reproductive roles related to social reproduction, such as growing and preparing food for family consumption and caring for children; community managing roles that include unpaid and voluntary activities, mainly carried out by women, to complement their reproductive role for the benefit of the community, such as fetching water for the school; and community or politics roles related to decision-making processes, such as membership in assemblies and councils. Women’s role can be identified as reproductive, productive, and community managing, while men’s roles are categorized mainly as either productive, community, or politics. Women’s multiple and competing roles lead to their time poverty, which can imply asset and income

poverty. The unequal value placed on roles of women compared with men is mainly responsible for their inferior status and the persistent gender discrimination they experience.

2.1.2. Gender division of labour

All over Africa men and women have separate responsibilities and play different but complementary roles. Though the gender division of labour differs considerably across border depending on culture and economic status, women universally carry the major burden of producing food and providing food daily for consumption to the family (Mukasa and Salami, 2016).

The gender partition of labour is vital concern in farming areas which define what activities are deemed appropriate for males and females in developing countries. In these areas, certain tasks are well thought out to be carried out exclusively by either males or females, and there can also be gender division on who can make decisions about those tasks. Gender division of labour vary by country, agro-ecosystem, socio-economic status, cultural norms, degree of mechanization, market orientation (subsistence and commercialized), and availability of male labour (Paris, 2013). The gender division of labour varies significantly across societies. In some cultures women actively take part in employment outside of the home, while in others there is a clear specialization of tasks along gender lines. Women are often principally responsible for managing small livestock and providing animal health care (WDR, 2017).

Women work longer hours than men in most developing countries when both paid and unpaid works are taken into consideration. However, much of their work remains undervalued because it is unpaid and limited to the domestic sphere. Women often spend less time on average in paid market work than men, where as they are largely responsible for water and fuel wood collection, food preparation, household tasks, child care and care of the sick and elderly (FAO; IFAD; ILO, 2010).

Women who live in rural areas do play multiple roles in the world's agricultural systems. They may be mothers, housekeepers, wage laborers, agricultural processors, market women, and entrepreneurs as well as agricultural producers. Most rural women make constant tradeoffs in allocating labour time and productive resources among their roles and obligations.

Most farming systems display mixed patterns of women's agricultural responsibilities, combining production cycles where one sex is primarily responsible with crops where responsibility is shared. Women are often responsible for the livestock, vegetables and tree crops cared for near their dwellings. Application of manure for vegetables, fruits, cash crops and trees is mainly handled by women (Tesfaye and Desta, 2017).

In addition the authors indicated that the class also influences women's participation in agricultural production in Bangladesh, Indonesia, and Peru all found that women in more affluent farm families devoted less time to field work and more time to cooking for hired laborers. Although in low technology systems poor women are likely to do more field work than more wealthy women, in highly mechanized systems, many women in wealthy farm households do substantial amounts of field work. One of the most influential explanations was offered by Boserup in 1970. She noted that in sparsely populated areas such as Africa where shifting hoe cultivation is the rule, men take part in cultivation, primarily in land clearing, but women do most of it. Such areas were contrasted with more densely populated areas of Asia where the agricultural system is that of extensive plow cultivation. Here, men perform the farm tasks associated with the plow, and the hand operations, or some of them, are left for women to perform. In regions of intensive cultivation of irrigated lands, both men and women must work in the fields to support a family on small holdings. In linking population density and the consequent differences in modes of production to women's roles within the production system. Boserup makes an implicitly evolutionary argument which identifies population pressure as the engine that propels agricultural intensification and technical change. The unfolding of this scenario removes women from control of land and other productive resources, thus marginalizing them, and constraining their productivity (Boserup, 1970).

2.1.3. Gender differences in access to and control over resources

Before going to discuss the issue of access and control of resources, the common understanding of the terminologies access to and control over resources need to be identified. The term “access” refers the ability to get and take advantage of the resources. The term “control” refers to the power and usufruct right, thus it is clearly attached to decision making in the resources being utilized (Hawa, 2018).

Because of gender relations women regularly do not tolerate to be effective decision-makers, women farmers often not as well-organized as they should be. In many African countries, women and men farmers operate separate farm businesses, but men may decide how to spend some or all of the profits from the women's businesses. This reduces the ability of women to generate working and investment capital, so their businesses often stay small, making women unattractive value chain partners (Farnworth *et al*., 2013). Men frequently control key productive assets such as ploughs, which can mean that their fields are worked first. Women may also be required to work on men's fields and in men's businesses before tending to their own. Sometimes women find it hard to implement the training they have received because they need to obtain the agreement of their partners to make changes which may not be helpful.

Every this means that women's fields may be ploughed end, be planted too late to take full advantage of the growing season, and be harvested afterward than the most advantageous time. This affects food security because in many sub-Saharan African countries, women are the main growers of staple crops even those considered "male crops" (Farnworth *et al*., 2013). Men and women often "control" different crops meaning that they are ones responsible for selling or otherwise using those crops, including for household consumption. For instance, maize is considered a "male crop" when it is sold at market, because men are responsible for selling it, even though women may have contributed the bulk of the labour required for its production. Groundnuts have traditionally been considered a "female crop" in many parts of Africa because of their centrality to the family diet. However, when "female crops" become attractive in the market, ownership often switches to men (Farnworth *et al*., 2013).

Men farmers had more access to and control over farm assets, household assets and vehicle assets than women farmers (Paul, 2014). They are less likely than men to own land or livestock, adopt new technologies, use credit or other financial services or receive extension advice. For land, the most important asset for agricultural households, the available evidence shows that women represent fewer than 5 % of all agricultural land holders in the countries of North Africa and West Asia for which data are available. In Southern and Southeastern Asia, sub Saharan Africa and Latin America the average is 12, 15 and 19 % respectively. Women are not only less likely to hold land; they also typically control smaller land holdings than men. Female-headed households have been found to own much less machinery than male

headed households (FAO, 2011a). Livestock holdings of female farmers are also much smaller than those of men, and women are much less likely to own large animals, such as cattle and oxen, that are useful as draught animals. To this must be added significant differences in the education levels of female and male farmers, although access to education is one area where the gender gap has clearly narrowed in recent decades.

The size of the gender asset gap differs by resource and location, but its underlying causes are repeated across regions. Social norms systematically limit the options available to women (FAO, 2011b). There are several reasons why women are more likely to get less information or extension services or less likely to use or process the information received. Women often lack of mobility, access to transport, and funds for participation in meetings, training or demonstration plots. The relatively more limited access to education opportunities and lower access to mass media and other forms of ICT among women as compared to men are also factors contributing to gender gaps in adoption of new technologies. Women farmers generally have lower education levels which affect their understanding and adoption especially if the technology requires use of more technical and intensive knowledge. In many cases, social and cultural barriers and greater time burdens are major constraints by women in acquiring information, education and training (Regasa, 2012). Gender discrimination can be a barrier to improving agricultural productivity. Unequal distributions of resources, including credit, extension services, labour and fertilizer create inefficiencies which lower yields and profits; and markedly reduce incomes in some countries. This is especially true for low-income countries, notably sub-Saharan Africa, where agriculture makes up a large proportion of the total economy and where a large number of women participate in the sector (Ward *et al*., 2010).

Generally, gender gap in agriculture refers to the fact that women typically have less access to and control over productive assets, inputs, productive resources, and services needed to make the most productive use of their time. Moreover, women often have less decision making authority in the household and community. These social and institutional barriers lead to a gender gap that hinders women's productivity and reduces their contributions to agriculture and achievement of broader economic and social development goals (Sinidu, 2017).

2.2. Measurement of Productivity in Agriculture

2.2.1. Productivity

According to Debertin (2012) in his book, in economic theory, productivity is defined in terms of the rate of output produced per unit of input utilized, if the production process involves a single input and output. Beyond the single output and single input case, however, the definition and measurement of productivity become less straightforward. In this case, the average productivity concepts of comparing an aggregate output index to an aggregate input index is used to obtain a ratio measure of productivity.

As pointed by OECD (2001b), productivity is commonly defined as a ratio of a volume measure of output to a volume measure of input use. At its most fundamental level, productivity measures the amount produced by a target group (country, industry, sector, farm or almost any target group) given a set of resources and inputs. Productivity can be measured for a single entity (farm, commodity) or a group of farms, at any geographical scale. The measure should reflect the ultimate purpose for the inquiry. If for example, the purpose is to compare productivity between farms, then measures that are micro-based are required. If the need is to evaluate national agricultural policy at the country level, then macro measures are required. This same analogy can extend beyond the sector to the national economy. While the desired purpose can vary, the measurement issues associated with deriving the different indicators are the same. However, data requirements may differ depending on the type of indicator; farm-level productivity measurement for one commodity and one input (for example, labour productivity of maize farms) may only require basic information on output quantities and input use, while producing aggregated measures generally requires pricing outputs and inputs.

Similar to most indicators, a single statistic rarely, if ever, tells a complete story to provide policy-makers and analysts with sufficient information to unambiguously prescribe the best policy. For example, a productivity measure for agriculture that is often cited is crop output per land area (commonly referred to as crop yield), with a higher yield corresponding to higher productivity. It quickly becomes apparent that the challenge with this and similar measures rests with how they are interpreted. Continuing with this example, a higher yield

may be indicative of improved fertilization practices (use of a better fertilizer and/or more efficient application), land of higher quality allocated to the crop, the use of a better-educated workforce or more efficient use of capital. However, it may also just be explained by basic factors beyond the farmer's control, such as the soil conditions and even the weather (Aicha *et al*, 2017).

In general, productivity can be measured in two ways: Productivity in relation to a particular input or partial productivity and productivity in relation to all inputs together or total factor productivity (TFP). Labour and capital productivity, which may be measured by the value added per unit of labour and per unit of capital, respectively, are partial productivities. The partial productivity method enables us to measure the contribution of each input, which could be hidden in the total productivity measure.

There are two distinct approaches to measurement of productivity: the growth accounting and econometric methods. The growth accounting approach involves compiling detailed accounts of inputs and outputs, aggregating them into input and output indexes and using these indexes to calculate a TFP index. One of the major problems of computing a TFP index is aggregating the different inputs and outputs. In most cases, outputs can be aggregated in terms of their monetary values; however, the problem lies in the aggregation of inputs. This approach also does not allow for identification of the contribution of individual factor of production. In addition, success of the use of TFP method depends very much on the availability of data of all components of the index (Coelli *et al.*, 2005).

Alternatively, econometric methods can be used to estimate the components of TFP using production, cost and profit functions. There are various production functions that enable measurement of productivity. Both the growth accounting and the econometric approaches of measuring productivity have strengths and limitations. Each approach also requires certain assumptions, which must be considered in interpreting the findings of productivity studies. In econometric approach, the assumptions depend on the type of production function used. Furthermore, in order to estimate cost or profit functions, the additional assumptions of competitive pricing and efficient utilization must be made. The growth accounting approach in addition requires price information on both inputs and outputs. However, both approaches

can be useful and should be considered appropriate. Therefore, the choice between the two approaches should be based on research objectives, the data requirement, and the availability of data and the appropriateness of assumptions (Capalbo and Antle, 2016).

2.2.2. Production functions

The relationship between inputs and outputs in a production process of a firm or any production unit can be investigated through the application of a production function. According to Debertin (2012), a production function is a technical relationship between output and factors of production of any production unit. In other words, a production function shows the maximum output that can be produced from given quantities of input with a given state of technology. The production function, therefore, represents the technology used by the farmers based on the technical methods of production.

$Y= f(X_1, X_2, X_3 \ldots\ldots X_n, U)$ ……………………………………..……… (1)

Where, Y denotes the output, X_i is the amount of the i^{th} input factors, f is the functional form relating to the output and the 'n' variable inputs and U is disturbance term.

Using production function it is possible to measure technical efficiency (TE) and allocative efficiency. Given the technology and set of input levels, TE reflects the ability of a farmer to produce output. Thus, it is associated with the farmers' ability to equate the level of its actual production from a given input to the maximum possible level of production that could be produced using the same level of inputs. Allocative efficiency, on the other hand, refers to the adjustment of inputs and outputs to reflect relative prices. It measures the ability of farmer to equate the marginal value product (MVP) per unit of input across different outputs. If the marginal cost (MC) of an input is equal to its marginal revenue, the firm is said to be allocative efficient and if its marginal cost is greater than its marginal revenue, the firm is said to be allocative inefficient. A farm with allocative efficiency minimizes the total cost of producing a given quantity by selecting a combination of factor inputs where the slope of the production function is equal to the slope of such inputs and output relationship in a production function. Studies based on production function can guide resource allocation. For instance, within production function, production elasticities of inputs can be evaluated in the elasticities

of substitution between inputs, and returns to scale can be examined (Gujarati, 2004). These characteristics can be tools for economic analysis and policy formulation.

There are diversified forms of production functions applied in economic literature, all of which have their own quality and drawbacks. The most common ones are linear, the Cobb-Douglas (CD), the quadratic, the translog and the constant elasticity of substitution (CES) production functions. The choice of a function, however, involves a certain amount of subjective judgment; guided by considerations of a prior economic and physical logic; goodness of fit; ease of analysis and judgment about economic implications (Heady and Dillon, 1961; Debertin 2012). No one function is superior in every aspect and it is difficult to show conclusively that one particular function is the correct one. Considering relevance of the study, comparability with previous studies, flexibility and computational ease as criteria for choosing the model, CD production function was selected among the other functions.

2.2.3. Gender difference in agricultural productivity

Gender differences in agricultural productivity in developing countries are observed mainly in the access to and use of agricultural inputs, tenure security, and related investments in land and improved technologies, market and credit access, human and physical capital, and informal and institutional constraints. These factors explain the difference in agricultural productivity between male-managed plots and female-managed plots (Palacios-López and Lopez, 2014; Olakojo, 2017).

Most estimates of male-female differences in technical efficiency from production function studies show that male and female farmers are equally efficient farm managers, controlling for levels of inputs and human capital (Quisumbing,1996; Addison,2016). It is often argued that women's lower levels of human and physical capital result in lower productivity or inability to respond to economic incentives. Much of the evidence cited to support this argument comes from agriculture. Yet, the measurement of differences in agricultural productivity between men and women is fraught with conceptual and methodological difficulties. These arise from the difficulty of defining appropriate measures of productivity in different farming systems, omission of individual characteristics in attempts to measure

productivity differences by sex, and the lack of clarity regarding the measurement of sex and gender differences.

An evaluation of male-female productivity differences should ideally be based on estimates of total factor productivity, in which an index of output is divided by an index of inputs, aggregated over all types of outputs and inputs, respectively. Lack of gender-differentiated data on inputs and outputs, however, has prevented the use of this approach. Existing studies therefore use partial productivity measures, such as yield and labor productivity. These partial measures of productivity are complicated by differences in farming systems and social and cultural institutions. It is feasible to estimate technical efficiency differences between male and female farmers in farming systems where men and women manage separate plots, as in many African societies (Mukasa and Salami, 2016; Olakojo, 2017).

It is more difficult to isolate managerial efficiency differences in agricultural settings where plots are cultivated jointly by male and female family members and hired laborers. In the latter, found in the "male" farming systems of Asia and Latin America, the farm manager is usually assumed to be the male head of the household, regardless of the actual contribution of women to decision-making and farm labor. Despite the volume of attempts to document male-female productivity differences, relatively few control for individual characteristics such as education and physical assets. If women systematically had lower levels of education and physical assets than men, which is typical in most agricultural settings, an approach that did not control for individual stocks of physical and human capital would tend to overestimate productivity differences due to sex .That is, women farmers would be expected to have lower productivity simply because they are female, not because they have fewer resources. Such an error would be unfortunate because the accurate diagnosis of sources of productivity differences, if they exist, is important in order to identify appropriate policy interventions for increasing women's productivity and welfare. The inadequate specification of individual farmer characteristics contributes further to the confusion between "sex" and "gender" as a source of productivity differences. Sex differences are due to innate biological differences between men and women. Gender differences, on the other hand, arise from the socially constructed relationship between men and women. These differences affect the distribution of

resources and responsibilities between men and women, and are shaped by ideological, religious, ethnic, economic, and cultural determinants (Oakley, 2016).

2.3. Review of Empirical Findings

Tadele and Mahendran (2015) examined on gender difference and its impact on agricultural productivity in case of Sheko District in Bench Maji Zone of SNNP, Ethiopia. The model of data analysis is Cobb- Douglas production function model and decomposion model .Their result shows that in estimation of the production function the seven explanatory variables were included among which four variables namely, livestock holding, herbicide use, land size and male labour were statistically significant for MHH while livestock holding, herbicide use, land size and female labour were statistically significant for FHH,the comparison of the marginal value product (MVP) with the factor cost showed that MHH could increase productivity using more herbicides and male labour while FHH could do so by using more herbicides, male and female labour. The agricultural productivity difference between MHH and FHH was about 66.76% in the study area. However, if FHH had equal access to the inputs as MHH, gross value of the output would be higher by 21.39% for FHH.

The study conducted by Shambel (2013) on gender differential in agricultural production and its impact on household farm income in case of Fedis district of East Hararghe Zone of Oromia National Region State. The study used 74 male headed and 49 female headed households for interview as a primary source of information from four *Kebeles*. The study employed descriptive analysis to assess the socioeconomic characteristics of the two groups. Besides, two econometric models, namely Cobb-Douglas production function and decomposition models were used to quantify the value of crop yield. In the model nine explanatory variables were included such as mineral fertilizer used, number of extension contact made, household head education level, amount of credit accessed, hectare of land holding, agricultural labor used, amount of improved seed used, amount of herbicide applied and livestock holding. The descriptive result of all explanatory variable showed that male headed households had significantly better access to productive resources than female headed households. The result of econometric model showed that the explanatory variables such as,

herbicide use, improved seed use and fertilizer use significantly affected the productivity of agriculture for farmers in the study area.

Debalke (2016) examined on gender differences in terms of household income and level of asset accumulation in Arbaminch Surrounding District, Gamo Gofa Zone, SNNPR, and Ethiopia. The result of the OLS regression model revealed that out of 13 variables included in the model, 10 explanatory variables are found to be significant up to less than 10% probability level. Those are age, education level of household head, cultivated land size, livestock holding, labor availability, membership to organization, frequency of extension contact, credit, distance to nearest market and irrigated land size were found to have significant association with household income and asset accumulation. Statistically significant dissimilarity persists between MHH and FHHs in household income and asset accumulation. The result of Blinder-Oaxaca model confirmed that the differences in level of income and asset accumulation marked highly by the differential endowments between men and women. In line with this, the decomposition output reports the mean predictions by groups and their difference. It shows the mean of log income is 5.275 for men and 4.0625 for women, yielding income gap of -1.225 which is statistically significant at 1% probability level.

Hawa (2018) examined on determinants of gender differences in soybean production: the case of Bambasi district, Benishangulgumuz regional state, Ethiopia. The result of the study revealed that FHH had less endowment of productive resources and they were poorly accessed institutional and social services. Women and men play a key role in all types of soybean production and related activities. Women in MHH and FHH were over burden in reproductive activities. FHH had better access to and control over resources and benefits. In MHH the access and control over resources and benefits was vested in the hands of husband. OLS estimation reveled that education of household head, household labour force, cultivated land size, tropical livestock unit, access to credit, frequency of extension contact, fertilizer application, hired labour, membership in social organization were significantly affect the production of soybean in both MH and FH households while pesticide application was significantly affect MHH. Factors such as lack of reasonable grain price, lack of land and soil fertility problem, lack of seed provider organization, high cost of fertilizer price, lack of credit, lack of soybean variety, problem of pest were the major constraints for MHH. Lack of

land and soil fertility problem, lack of oxen, lack of credit, high cost of fertilizer price ,lack of labour, inadequate extension service, lack of reasonable grain price, high cost of seed price, lack of seed provider organization were the major constraints for FHH.

As Wakweya (2004) examined the impact of gender differences on agricultural productivity in Wenchi district of south west Shoa zone. The data used in the study were collected from 75 MHH and 65 FHH randomly selected from 6 PAs of the district. The result of the study further suggests that men's gross value of output per ha was 68.83% higher than that of women's. However, the descriptive statistics of this study show that there is a difference in household endowments, which have very large overall on the productivity difference between male and female headed households by about 92.41%. If women had the same human capital and used the same amounts of inputs as men, the value of their output would increase by some 23.58% over the MHH.

Mekonnen *et al.* (2018) examined gender based productivity differences in Ethiopia using kern-el density of productivity, by gender of household head and by gender of plot decision maker. They employed across-sectional instrumental-variable regression method using a regionally representative dataset of more than 7,500 households and 32,000 plots in four major regions (Tigray, Amhara, Oromia, and SNNP) in Ethiopia that was collected during the 2010 main season. They found that on average, the value of production per hectare of farming households was 10,942 birr. Female headed households have significantly less value of production by mean of 9,898 birr/ha than male headed households by mean of 11,273 birr/ha. The most commonly grown crops in the survey areas are maize, teff, wheat, barley, sorghum, and enset. There are significant gender differences in crop choice. Female heads are significantly more likely to grow maize, enset, potatoes and fruits; while male heads are more likely to grow teff and other pulses. There is no statistical difference between plots managed by females and those managed by males or those jointly managed by household members.

Bethelhem (2017) examined on factors affecting differences in livestock asset ownership between male and female-headed households in northern Ethiopia by using panel data from Northern Ethiopia. They applied the Blinder-Oaxaca decomposition technique and

investigated the potential causes of the difference between female-headed households and male-headed households. The results show that descriptive analyses of FHHs are less well-off than MHHs in terms of labor, land and non-land asset endowments. Empirical analysis exposed that FHHs own significantly lower livestock assets than MHHs. The differences in the observed characteristics as well as in the returns to characteristics contributed to the gender disparity in livestock ownership. They find that lower endowment of male labor, children (age 6-14) and land area are the factors affecting a lower level of livestock accumulation in FHHs. Decomposition analysis also showed that FHHs would still own fewer animals even if they had the same characteristics as MHHs. This difference, which is attributed to unexplained factors, is mainly affected by the period encompassing the outcome of the Ethio-Eritrean War (2001). Indeed, there may have been a need to sell livestock to feed the army during that period, which was more likely to affect FHHs because of their relative vulnerability. Findings also show that the gender difference is more pronounced in the ownership of large animals than in that of small animals.

2.4. Conceptual Framework

Depending on the statement of problems and review of literature the following conceptual framework are discussed here below. Gendered differences in agricultural productivity may emerge for several reasons. Men and women within the same household often have competing economic interests and the expropriation of property following the death of a spouse. Lineage systems can have implications on entitlements including land ownership rights and rules of inheritance. In the broader community, female farmers regardless of membership in any one form of household structure may face similar constraints. Women's relative disadvantage in terms of human capital, land tenure, and access to credit, extension services, improved seed markets, and remunerated employment can contribute to lower levels of farm investments and agricultural productivity of female farmers.

The differences in agricultural productivity of male and female are also explained by the following agricultural inputs such as in organic fertilizer, herbicides and improved seed. These factors would have positive effect on agricultural productivity. Socioeconomic characteristics like education level of household, size of livestock holding, non/off farm income, land size and number of oxen would also have significant effect on the agricultural

productivity of male and female headed household. Thus, factors related to their characteristics was included in the analysis believing that they would have positive on agricultural productivity of male and female headed household.

Demographic factors such as farming experiences and labour utilization would have been significant effect on the agricultural productivity of male and female headed households. Institutional factors such as extension services and amount of credit access would have been significant effect on the agricultural productivity of male and female headed households. Therefore, policies, programs and institutional arrangements which target access to credit and access to education among others are important factors that can substantially affect gender difference of agricultural productivity.

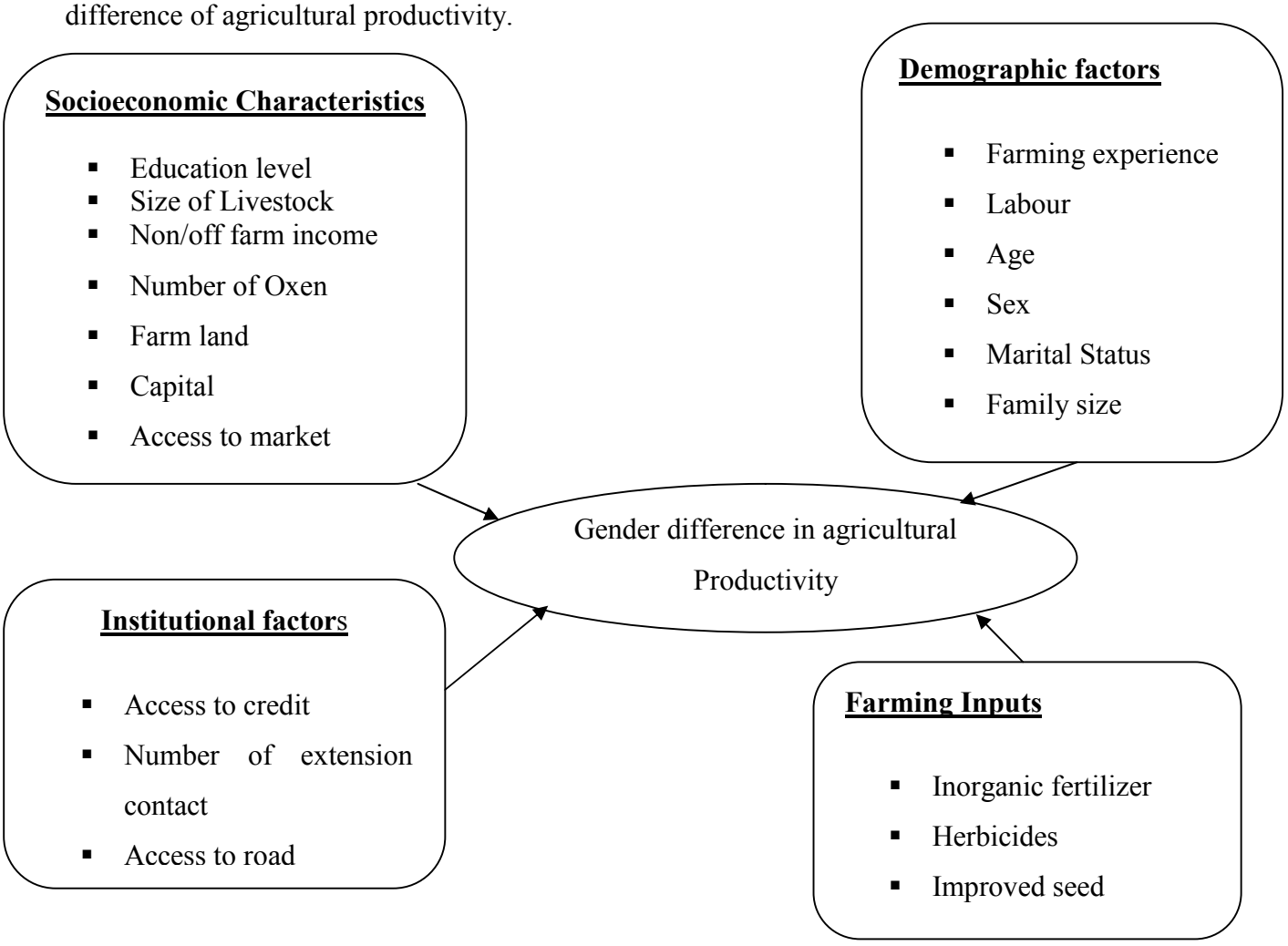

Figure 1: Conceptual framework

Source**:** Own sketch through review of literature

3. RESEARCH METHODOLOGY

In this chapter, description of the study area, types and sources of data, methods of data collection, sampling technique and sample size determination, and methods of data analysis are presented.

3.1. Description of the Study Area

3.1.1. Location

Yubdo district is one of the twenty three districts found in West Wollega Zone of Oromia National Regional State (Figure 2). It is located at a distance of 548Km from Finfinne, the capital city of the country to the west. The capital town of the zone is Gimbi which is 110Km from the district. The district is bounded by Aira Guliso in the North, Lalo kile in the West, Nole Kaba in the South and Ganji in the East.

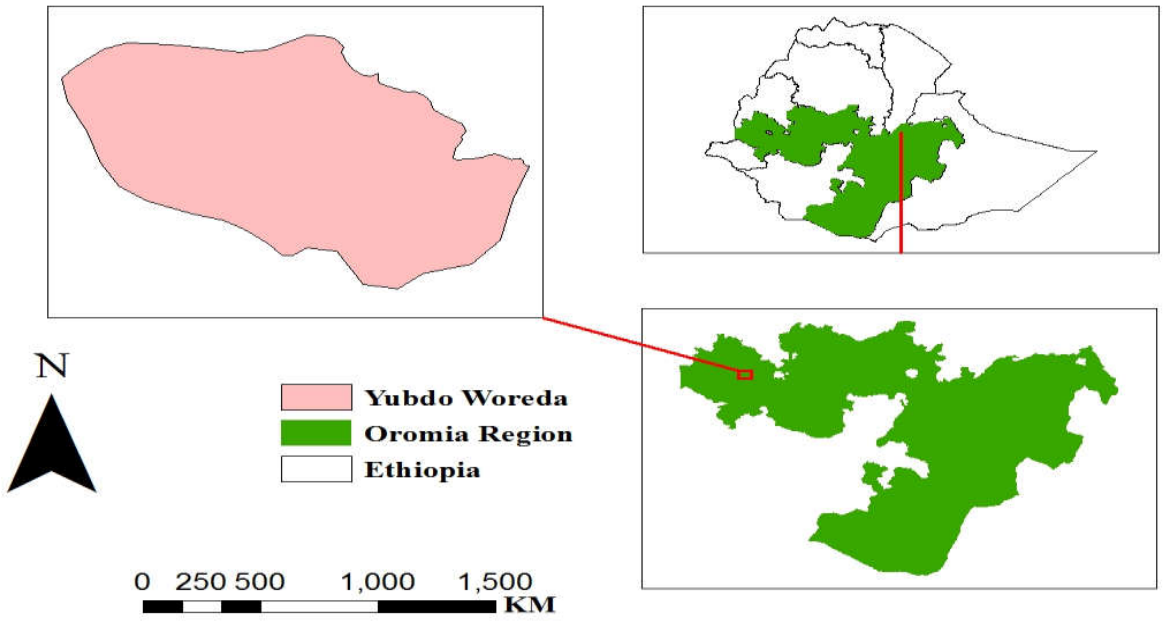

Figure 2. Map of study area

Source: Ethio- GIS (2018)

3.1.2. Physical features and area coverage

Yubdo district is characterized by rising and falling hill with plain mountain topography ranging between 1200-1800 meter above sea level (m.a.s.l). It mainly consists of Woinedega (93% of the *Kebeles* of the district), Kolla (7%) agro-climatic zone and the average rainfall varies between 1200-1820 mm per year. Average temperature varies between 10^0C and 15^0C. The district covers an area of 233.84km^2 (CSA, 2018) and divided into 20 *kebele* (18 Rural *Kebele* and 2 *kebele* of the town). According to information obtained from the agriculture office of the district, about 78.5% of the land is cultivated, 10.7% grazing land, 5.7% natural forest, 1% water body and 4.3% belongs to other categories (CSA, 2018).

The water resource found in the district comprises of rivers such as *Karsa*, a tributary of the *Kobara* and coffee is an important cash crop of this woreda. Over 50 Km^2 are planted with this crop. Platinum occurs in this woreda, developed on serpentinized dunite, locally named *Birbirite*, after the *Birbir River*; the platinum probably being remobilized and concentrated by hydrothermal alteration in conjunction with shearing. The total reserves are about 12 tons, with an average grade of 0.34 gram/ton (CSA, 2018).

3.1.3. Population

Currently the total population of the district is 50,811 out of which females account for 46.84%. The community in the district comprises of a total of 7719 households (11.92% female headed households).The average family size is estimated to be 6 persons per household and the average population density is 217 per km^2.The population of Yubdo district is almost exclusively Oromo constituting 99% of the population. The rest 1% of the ethnic groups are Guraghe and Amhara. The religions of the district are Protestant, Orthodox, Muslim and Traditional beliefs (CSA, 2018).

3.1.4. Economic activities

As agriculture is the dominant economic activity engaging 90% of the labour forces. Crop production is dependent on rainfall and the major crops produced in the area according to their importance are coffee, maize, niger, teff, millet and sorghum. Coffee is one of most cash

crops grown in the woreda and the most source of income for the population of the woreda. Productivity of these crops is below the national average due to poor fertility of soil, poor agronomic practices and use of low level of agricultural inputs (CSA, 2018).

Livestock are also reared by most families. Oxen provide traction power for the cultivation of the agricultural lands. On the other hand, livestock are kept as a source of income through milk and by products of milk. Livestock productivity is also low due to absence of adequate feed and disease infestation. With regard to the off-farm activities practiced in the area, small percent of the total population is engaged in this sector of the economy. Around 21% of the population is engaged in off-farm activities. Tannery, blacksmith, weaving, tailoring, carpentry and petty trading are some of the off- farm activities widely practiced in the area. All craftsmen practice traditional technology inherited from their parents that require a greater energy and more time resource. The level of income generated by the participants of this sector is considerably low (CSA, 2018).

3.2. Type and Source of Data

In order to achieve the stated objectives, both qualitative and quantitative data were collected from primary and secondary sources. The main source of data for the study was primarily field survey which focused on data related to socioeconomic and demographic characteristics of the respondents, and other related information that were essential for the research purpose. The secondary data sources were collected from published and unpublished materials, which include books, journals, scientific research works and office records.

3.3. Methods of Data Collection

The qualitative data were collected through focus group discussion and participatory observation. The quantitative data were gathered by using of structured questionnaire. The questionnaire covered information on household demographic and farm characteristics, crop and livestock production, household income and ownership of farm inputs. Both male headed and female headed households in the sample *Kebeles* were interviewed. The interview was conducted by six enumerators who were trained on the subject matter of the questionnaire. Enumerators are recruited based on pre-established criteria such as; proficiency in speaking

Afaan Oromoo, education level, experience in similar work, and knowledge of the study area. Training was provided to enumerators on how to approach the respondents and how to administer the interview schedule and how to record the responses from households. Before carrying out the actual data collection, pre-testing of questionnaire were done at field level for consistence, clarity and suitability. A proper follow-up and observations were made during data collection to end with reliable data from each *kebeles.* Data collection was carried out from February to the 2nd week of March, 2018.

3.4. Sampling Method and Sample Size Determination

This study employed probability sampling procedure to draw a representative sample**.** Two stage sampling procedure were used to select sample households. In the first stage, about 6 *kebeles* were selected randomly from 20 *Kebeles* found in the district. In the second stage from these 6 *Kebeles* 75 male and 75 female headed households are randomly selected. The total sample from each *kebeles*, male and female headed households is determined by fifty (50) to fifty (50) ratios respectively due to the lower number of female headed households in the data to define the proportion. Probability proportional to sample size was employed to select the total of sampled households' farmers. Hence, a total of 150 households were selected (table 1). The sample size was determined by using the formula given by Yamane (1967: 886) as follow:

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

Where:

n −Represents sample size

N −Represents total number Male headed and Female Headed

e −Represents the desired level of precision (taking 8%)

Table 1. Distribution of sample households by *Kebeles* and sex of household head

Kebele	Total number of MHH and FHH in the selected *kebeles*			Sample		
	Male Headed	Female Headed	Total	Male Headed	Female Headed	Total
Bikiltu Aira	417	74	491	11	9	20
Muco Aira	452	125	577	10	14	24
Worra Gutu	515	93	608	13	12	25
Boti Aira	634	123	757	17	14	31
Jemalogi Aira	485	82	567	10	13	23
Jarso Boloso	524	123	647	14	13	27
Total	3027	620	3647	75	75	150

Source: Administration Office Baseline Survey and Survey Sampling (2018)

3.5. Methods of Data Analysis

Based on the objectives of the study descriptive and inferential statistics as well as econometric model were used to analyze the data using SPSS version 20.

3.5.1. Descriptive and inferential statistics

To assess gender division of labour in agricultural activity and to examine access to and control over productive resources between male and female headed households in the study area, and to compare general and farm characteristics of both male and female headed households, the study used descriptive statistics such as frequency, percentage, means, SD, minimum and maximum; and inferential statistics such as t-test and chi-square.

3.5.2. Econometric analysis

In this section, Cobb-Douglas production functions, definition of the dependent variable and explanatory variables are briefly discussed. Then, the hypothesized explanatory variables were analyzed with the help of Cobb-Douglas production function and the result was interpreted. In addition, marginal value product of the significant variables is compared with factor cost to indicate allocative efficiency. Finally, the sources of agricultural productivity

difference between male and female headed were obtained using Oaxaca-Bliender decomposition model (OB-decomposition model).

3.5.2.1. Cobb-Douglas production function

Cobb-Douglas production function is one of the most widely used functions in the economic analysis of problems related to empirical productivity estimation in agriculture and industry. Many empirical studies**,** Aguilar *et al. (*2015), Tadele and Mahendran (2015), Debalke (2016), have employed the CD form of production function to measure agricultural productivity.

The CD production function may be good approximation for production process for which factors are imperfect substitutes over the entire range of inputs value (Heady and Dillon, 1961; Debertin, 2012). It has also a number of desirable properties like the coefficients are positive and each less than one. The sum of elasticities of output with respect to the relative inputs also provides the returns to scale of the parameters. Although this function has other advantages in that it shows diminishing marginal return, it involves some limitations. One of the limitations of the CD production function is that the elasticity of substitution between factor inputs is restricted to unity. The implications of zero output at zero inputs may also be unacceptable in some instances. However, since the advantages are more important than the limitations, it is one of the commonly used production functions.

The CD production function has the following features where some of them make it so interesting and popular. First, the function is homogenous. The sum of the parameters has interesting economic interpretation since it gives information about the returns to scale or the scale of operation of the production process. The returns to scale are increasing, constant or decreasing depending on whether the sum is greater than one, equal to one or less than one, respectively. Secondly, the function is strictly quasi concave for positive values of inputs; and its iso quants are negatively slopped throughout and strictly concave for positive value of inputs. Thirdly, the function yields diminishing return to each input, i.e. the value of the production elasticities are less than one. Finally, the coefficients are the output elasticity coefficient for inputs and show the relative distributive shares of inputs in the total output. So, because of these and others, CD production function is selected for this study.

Cobb-Douglas production function was used to examine the agricultural productivity differences between the male and female headed households. According to Gujarati (2004), the generalized form of the Cobb-Douglas production function can be specified as:

$$Y = AX_1^{B1}X_2^{B2}X_3^{B3} \dots\dots\dots\dots\dots\dots\dots\dots\dots X_n^{Bn}e^{Ui} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where, Y is gross value of farm outputs in birr per ha, Xi's are explanatory variables such as land size (ha), fertilizers (kg), plant protection chemicals (lit), livestock holding (TLU), labour (man-days), household head education level(years), number of extension contact(number of contact), amount of credit used(in birr), improved seed (kg), farm experience (in year) ,number of oxen (in number) and non-farm/off-farm income (in birr); A is efficiency parameter and represents the level/state of technology and U_i is disturbance term.

3.5.2.2. Definition of variables and hypothesis setting

Dependent variable: The amount of gross value of farm output expressed in birr per hectare is used as a dependent variable. Outputs of major crops namely coffee, maize, niger, millet, teff and sorghum are included in the definition of the dependent variable. Moreover, income from livestock sold and livestock by-products, if any, in the production period of year 2017/2018 was included.

Explanatory variables: In line with the theoretical background and on the basis of the previous studies on similar subjects of productivity analysis, the following explanatory variables were hypothesized to affect the dependent variable.

Size of livestock holding (SILIHO): It is continuous variable. Farmers in the study area consume some percentage of their livestock and livestock byproducts and sell the remaining for cash income generating. Besides source of cash, livestock increases the availability of manure, which would increase the productivity of crops. Therefore, it is expected that a household with a bigger size of livestock, as measured by TLU, had opportunity to acquire production inputs and thus improve his/her productivity. Hence, apositive relationship was expected (Debalke, 2016).

Land size (LSIZE): It is continues variable which refers to cultivated land expressed in hectare. The size of land reflects ownership of an important farm asset. Larger farm size implies more resources and greater capacity to invest in farm and increased production (Tadele and Mahendran, 2015). Thus, farmers with larger land size could be expected to have higher gross value of farm productivity.

Education of household head (EDU): For most of the farming households, the decision on what/how/how much to produce is made by the household head. It is taken as continues variable. Education levels have a bearing on farmer's access to improved farm techniques and effective use of information available on technologies. This implies that the education level of the household head, as expressed in number of years of schooling, would have positive impact on productivity of farmers (Debalke, 2016).

Inorganic fertilizer (INFERT): The variable stands for all kinds of chemical fertilizer (UREA and NPS) measured in terms of kg per ha which is taken as a continues variable. Chemical fertilizer is used to increase soil fertility and hence increment in the productivity is expected (Shambel, 2013).

Herbicides (HERB**):** It is a countiues variable which refers to chemicals used in litre per ha to control weeds. It is expected to have positive impact on productivity (Wakweya, 2004).

Labour (LBOUR): Labour is one of the major inputs for agricultural production. It is expressed in man-days per hectare and taken as continues variable. The variable includes all labour spent in the major type of activities on farm. An increase in man-days increases the production and productivity. Hence, it would be expected to have positive relationship (Tadele and Mahendran, 2015).

Amount of credit accessed (ACCREDIT): It is continues variable which refers to cash money (in birr) loaned to farmers for purchase of agricultural inputs. The availability of farm credit helps the farmers to purchase modern input and increase productivity. Those farmers who have access to credit are believed to adopt and use modern technology than the non-credit users (Leulsegged *et al.*, 2015).

Improved seed (IMPSEED): An improved seed variety plays a vital role in improving productivity per unit of land and taken as continues variable because most of the farmers were user of it. Farmers who use improved seed (measured in kilogram) expected to get higher amount of product per plot of land (Shambel, 2013).

Number of extension contact (NEXCONT): New techniques and up-to date information reaches to producer farmers through extension service which is taken as continues variable. Frequent extension contacts can deliver services like advice, training and information on agricultural and other related issues. Thus, the number of extension contacts is expected to have a positive effect on the total value of farm output (Debalke, 2016).

Farming experience (FAEXP): It is continuous variable. Farmers with longer farming experience are supposed to have better competence in assessing the characteristics and potential benefits of new technology than farmers with shorter farming experience. Moreover, farmers with longer farming experience are expected to be more knowledgeable and skillful. It is assumed that farmers who have more farming experience can get better produce than farmer with shorter farming experience. Therefore, this variable is hypothesized to positively influence household farm income (Hawa, 2018).

Number of oxen (OXEN): It is continuous variable in which the number of draught oxen owned by a household during the survey periods. Oxen are one of the basic farm assets and are one of the sources of traction power in the area. For that reason, farmers who own more oxen would be in aposition to undertake farm activities on time and when required. Owners of more oxen power likely to get better farm productivity and production (Leulsegged *et al*., 2015).

Non-farm/off-farm income (NFINCME): This represents the total amount of off-farm/non-farm income (in birr) the farmer or any of the household members earned with in the year. It is taken as continues variable. Agricultural production may not be the rural household's only source, or even their most important source of income. To be food secure, rural people must have multiple livelihood strategies. Hence, it is expected that the availability of off-farm/non-farm income is positively associated with household farm income (Debalke, 2016).

Table 2**:** Summary of definitions of variables and working hypothesis

Variables	Description of the variables	Type	Unit of measurement	Sign
SILIHO	Size of livestock holding	Continues	TLU	Positive
LSIZE	Land size	Continues	Ha	"
EDU	Education of household head	Continues	Years of schooling	"
INFERT	Inorganic fertilizer	Continues	Kilogram per hectare	"
HERB	Herbicides	Continues	Litre per hectare	"
LBOUR	Labour	Continues	Man-days	"
ACCREDIT	Access to credit	Continues	Birr	"
IMPSEED	Improved seed	Continues	Kilogram per hectare	"
NEXCONT	Number of extension contact	Continues	Number of contact	"
FAEXP	Farming experience	Continues	Year	"
OXEN	Number of oxen	Continues	Number	"
NFINCME	Non-farm/off-farm income	Continues	Birr	"

3.5.2.3. Estimation techniques

The estimation technique employed in this study was Ordinarily Least Square (OLS). The OLS has very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis including linearity, unbiasedness and minimum variance (Gujarati, 2004). All the production functions are estimated separately using OLS techniques with the help of Statistical Package for Social Science (SPSS) computer software. Since the CD production function is a power function, it is impossible to directly use the Ordinary Least Square (OLS) method. Therefore, logarithmic transformation is making to obtain its linear form and to estimate the parameters. In this study, the natural logarithm was employed.

To examine whether the production functions of male headed households (MHH) and female headed households (FHH) are different from each other, equation 3 was estimated separately for MHH and FHH. Moreover, pooled data set without and with a dummy gender variable was estimated. The respective transformed models are shown as follows:

Productions function for MHH:

$$\ln Y_M = \ln A_M + B_{1M} \ln X_{1M} + B_{2M} \ln X_{2M} + B_{3M} \ln X_{3M} + .. + B_{12M} \ln X_{12M} + U_M \ldots (4)$$

Productions function for FHH:

$$\ln Y_f = \ln A_f + B_{1f} \ln X_{1f} + B_{2f} \ln X_{2f} + B_{3f} \ln X_{3f} + \cdots .. + B_{12f} \ln X_{12f} + U_f \ldots . \ldots \ldots .. (5)$$

Production function using pooled data:

$$\ln Y_p = \ln A_p + B_{1p} \ln X_{1p} + B_{2f} \ln X_{2p} + B_{3p} \ln X_{3p} + \ldots \ldots .. + B_{12p} \ln X_{12p} + U_p .... (6)$$

Production function using pooled data with dummy gender variable:

$$\ln Y_p = \ln A_p + B_{1p} \ln X_{1p} + B_{2f} \ln X_{2p} + B_{3p} \ln X_{3p} + \cdots + B_{12p} \ln X_{12p} + DG + U_p .. (7)$$

Where, m =MHH, f =FHH, p =Pooled data set, G =Gender dummy variable (G=1 for MHH; G=0 otherwise) and D is the regression coefficient for the dummy variable and it indicates gender differences in technical efficiency. B_{im}, B_{if} and B_{ip} (i=1, 2... 7) are output elasticities of i^{th} input under MHH, FHH and pooled data sets, respectively.

Furthermore, Marginal value product (MVP) of inputs is computed from the coefficients of the regression. MVP of a factor is the additional return from adding one more unit of that factor, holding all other inputs constant. Comparing the MVP of a factor with the prevailing factor cost (opportunity cost) shades some light on the efficiency of resources use. MVP is computed at the mean value of inputs and may be used to indicate whether disequilibrium in resource use is big or small (Ellis, 1993).

The MVP of the factor can be computed as follows:

$$MVP = b_i * \frac{Y}{X} \ldots \ldots (8)$$

Where b_i is the regression coefficient (output elasticity), Y is the gross value of farm output (geometric mean) and X_i is the geometric mean value for factor i.

Finally, Oaxaca-Blinder decomposition model of the productivity differential between male and female farmers was used to decompose the productivity difference (Oaxaca, 1973). Although this approach is to decompose the wage gap, it can also be applied to decompose

productivity difference between, say, men and women farmers (Shambel, 2013; Tadele and Mahendran, 2015). The decomposition model adopted was presented as follows:

$$\ln\left(\frac{Y_m}{Y_f}\right) = \left[(B_{im} - B_{if})\ln X_{if}\right] + \left[B_{1f}\ln\left(\frac{X_{im}}{X_{if}}\right)\right] \quad \text{(9)}$$

Where:-

Y_m and Y_f represent mean output (Geometric mean) of males and females respectively

X_{im} and X_{if} are geometric mean levels of inputs of male and female

B_{im} and B_{if} are estimate of output elasticities of male and female headed households as defined earlier.

The model decomposes the overall average male-female output gap into the portion due to differences in the technical efficiency and the portion attributable to differences in input endowments. In other words, the first bracketed expression on the right hand side is a measure of change in output due to shift in output elasticities of the production functions. The second bracketed term is a measure of difference in output due to difference in volume of input use per hectare.

3.5.2.4. Testing procedures

Before estimation of the models, the severity of multicollinearity (the linear relationship) among continuous explanatory variables was checked by computing the Variance Inflation Factors (VIF). Variance Inflation Factors shows how the variance of an estimator is inflated by the presence of multicollinearity. Following Gujarati (2004), the VIF_i is given as:

$$VIF_i = \left(\frac{1}{1 - R_i^2}\right) \quad \text{(10)}$$

Where R_i^2 is the coefficient of determination that is obtained when the continuous explanatory variable is regressed against all the other explanatory variables. As R_i^2 approaches 1, the VIF approaches infinity. That is, as the existence of collinearity increases, the variance of the estimator increases and in the limit it can be infinity. If there is no collinearity between regressors, the value of VIF will be 1. As rule of thumb, if VIF of a variable exceeds 10, that variable is said to be highly collinear (Gujarati, 2004).

In order to test the homogeneity between the parameters of the production functions, the Chow's test was performed. This examines whether the male and female headed household production functions differed significantly due to shift in the intercept and due to change in the slope of the functions.

The major steps adopted in computing Chow's F-test is as follows: Firstly, estimation of production functions for male and female headed households is made to obtain their residual sum of squares, say, $\sum e_1^2$ and $\sum e_2^2$ with $n_1 - k$ and $n_2 - k$ degrees of freedom, respectively. Where, n_1 and n_2 are the number of observations in male and female headed households and k is the number of parameters including the constant. Secondly, the pooled function (equation 6) is run to obtain residual sum of square, $\sum e_p^2$ with n_1+n_2-k degree of freedom. Thirdly, compute F as

$$F = \frac{(\sum e_p^2 - (\sum e_1^2 + \sum e_2^2)/K}{(\sum e_p^2 + \sum e_2^2)/(n_1 + n_2 - 2k)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (11)$$

In the last step, the computed 'F' ratio is to compare with the theoretical value of 'F' with k and (n_1+n_2-2k) degrees of freedom and reject the hypothesis that the separate regression are the same if the calculated F value is greater than the tabulated one (Gujarati ,2004).

The significance of the calculated Chow's F-statistic implies that there is a shift in the production function between male and female headed. If there is a change in the parameters of the two functions, it can be said that the function has undergone a structural change (Koutsoyiannis, 1997). Structural change may mean that the two intercepts are different or the two slopes are different, or both the intercept and the slopes are different. However, the above test does not tell whether the shift is in scale parameters (intercept term) or slope parameter (elasticity coefficient).

The significance of the coefficient for the gender dummy (D) in equation (7) implies that there is a shift in the intercept term. If, on the other hand, the coefficient is insignificant, then both production functions have the same intercept term. Again, in order to check whether there is a shift in the slope parameters, the Chow's F-value is computed using residual sum of squares for the pooled production function with a dummy gender (equation 7) instead of that

of equation (6). The Chow test does not explicitly show which slope coefficient is different from each other in the two production functions, i.e. MHH and FHH. Therefore, in order to check the equality between the coefficients of both the production functions, the log-linear transform of equation (3) is estimated with both intercept and slope dummies as follows:

$$\ln Y_p = \ln C + C_1 \ln X_{1p} + C_2 \ln X_{1p} + \ldots + C_{12} \ln X_{12p} + C_{13} G_{i_p} + C_{14}(D_1 \ln X_{1p} \ldots\ldots$$

$$+ C_{24}(D_1 \ln X_{12p}) + U_p \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where G_i is a dummy with a value of one for MHH and zero otherwise; other variables being as defined earlier. If all or some of the coefficients of the slope dummies ($C_{13}$to C_{24}) are positive and significant, then the output elasticities of MHH with respect to that particular input is greater than that of FHH, otherwise they are the same.

4. RESULTS AND DISCUSSION

This section presents the results and discussion obtained from the descriptive, inferential and econometric analysis.

4.1. Characteristics of Sampled Households

4.1.1. Ethnicity and religion of the household headed

The survey results showed that the sample households were exclusive in ethnic and were 100% Oromo. Total number of family members of the sample households was about 3647out of which 3027 were male and the rest 620 were female. The figure found consist with secondary data obtained from district of agricultural office which indicates that male constitute about 53.16% of the total population of the district.

In terms of religion, the result of this survey shows that, about 50.7%, 38.7%, 9.3% and 1.3% of MHH were Protestant, Orthodox, Muslims and Others, respectively. The corresponding figures for FHH were 49.3%, 34.7%, 6.7% and 9.3%, respectively.

Table 3. Religion of the households headed frequency and percent (%)

Religion	Male headed of Respondents	Female headed of Respondents	Total
Orthodox	29(38.7%)	26(34.7%)	55(36.7%)
Muslim	7(9.3%)	5(6.7%)	12(8%)
Protestant	38(50.7%)	37(49.3%)	75(50%)
Others	1(1.3%)	7(9.3%)	8(5.3%)
Total	75(100%)	75(100%)	150(100%)

Source: Own survey result (2018)

4.1.2. Family size and level of education of the household head

The average household size was 3.79 and 2.93 for male and female headed households respectively. As the t-test shows the mean difference was statistically significant at 1%

probability level (t=3.83) (table 4). This implies that male headed households have larger family size than female headed households. Asres *et al.* (2015) also indicated that FHH had relatively lower family size as compared to MHH in their study conducted in North West Ethiopia. The result is also consistent with that of Hawa (2018) in the Case of Bambasi District, Benishangul Gumuz Regional State, Ethiopia.

The level of education is central to alleviate most of the challenges in life. The knowledge attained through level of education is important to determine the decision of household head and to capacitate the social and economic well-being of the individual in the house hold. Understanding the literacy and skill level of producers is important in packaging the information and technology dissemination and education to them (Regasa, 2012).

The survey result shows that the mean level of education of households was 4.56 and 3.15 for male and female headed households, respectively. As the t-test shows the mean difference was statistically significant at 1% probability level (t=2.87). The minimum and maximum level of education of households was 0 and 12 for male headed household while it was 0 and 8 for the corresponding female headed households. In general, FHH had less access to formal education as compared to MHH in the study area.

Table 4.Average family size by age in man-equivalent and educational level of the households

	Family size		Educational level	
	Male Headed	Female Headed	Male Headed	Female Headed
Mean	3.79	2.93	4.56	3.15
SD	1.33	1.41	3.27	3.27
Minimum	1.04	0.50	0	0
Maximum	7.20	6.70	12	8
t-value	3.83***		2.87***	

NB: *** significant at 1% probability level
Source: own survey (2018)

4.1.3. Marital status of sampled households

Regarding marital status of the sample respondents, about 75 of MHH were married and 61 of FHH were widowed, 4 of the FHH separated and 10 of FHH were divorced

(table 5). The difference is quite significant as shown by the chi-square value of 150 at 1% probability level.

Table 5. Marital status of sampled household head

Marital status	MHH(N=75)	FHH(N=75)	All cases (N=150)
Married	75	0	75
Widowed	0	61	61
Separated	0	4	4
Divorced	0	10	10
Total	75	75	150
	x^2= 150.000	P = 0.000	

Source: own survey (2018)

As shown in table 6, the major reasons behind the cause for females to be head of the household were death of husbands (81.33%), Conflict with spouse (14.67%) and husband migration (4%). Of the respondents (61 FHH) who reported death of husbands as causing female headship, 11 of them recognized conflict with spouse for the case of economic problems through their livelihood while the other 3 attributed to husband migration for job opportunities. The economic problem implies that in most cases when a husband lacks resources to sustain a household, the husband or the wife options for separation.

Table 6. Reason for being female headed household by frequency and percent (%).

Reasons	Frequency	%
Death of husband	61	81.33
Conflict with spouse	11	14.67
Husband migration	3	4.00
Total	75	100.00

Source: Own survey (2018)

4.2. Farm Characteristics of household head

4.2.1. Land use pattern and use of fertilizer, improved seed and herbicides

This study found that there was land holding difference in the study area between the two groups. The result showed that the total land holding of the sample households was 334.82 ha where the average per household was 2.23 ha. The minimum and maximum land holding for male headed household was 1 ha and 6 ha respectively, while it was 0.5 and 5 ha respectively for the corresponding female headed households. The average cultivable landholding was slight difference from the total showing all the land owned were not used for production of agricultural produces. Male headed households had about 2.80 ha of cultivable land and it was 2.05 ha for that of female headed households, the difference being significant at 10% probability level (t=1.71).

In addition to cultivated land, the average grazing, forest & wood land, and wasted land holding was slight difference from the total showing all of the land owned by the household head. Male headed households had about 0.25, 0.01 and 0.16 ha of grazing, forest &wood land, and wasted land respectively while female headed households had 0.21, 0.03 and 0.01 ha of grazing, forest & wood land and wasted land respectively. Their difference of grazing and wasted land was significant at 5% probability level. The finding is consistent with that of Asres *et al*. (2015) on their case study in northwest Ethiopia found that, female headed households were also inferior as compared to their male counterparts in terms of land and asset ownership. Tadele and Mahendran (2015) found that in their study of gender differences and its impact on agricultural productivity in the case of Sheko district in Benchi Maji Zone of SNNP, Ethiopia, land holding of FHH was smaller than that of MHH. This indicates that landholdings of the households headed by women were smaller than that of the male headed household.

Both male and female headed households were used the arable land for different perennial and annual crops in the year under consideration. The rest of lands owned by the households were forest and wood land, grazing land, wasted land and other lands. As per the information from the community members of the surveyed *Kebeles* during the discussion made with FGDs, farmers were normally used all cultivable land they have for cropping as the land they

have is less. Farmers in the area were also known by fallowing lands that were affected by erosion and highly degraded and stony. Habitual farmers were used such kind of land for livestock grazing. Some part of their land also used for construction of house.

Society in the study area applies different soil and water conservation activities aimed at maintain soil moisture and reduce rain off. This condition by much helped them to maintain soil moisture for agricultural produce. In addition as per the information from the surveyed households and discussion made with FGD the soil structure they have been constructing to protect soil erosion and run off was soil bund, stone face, hillside terracing and cut off drain. Additionally, tree plantation also widely practiced as part of reducing run off and erosion.

Table 7**.** Land use pattern and use of fertilizer, improved seed and herbicides of MHH and FHH

Land category	Male headed household		Female headed household		
	Mean	SD	Mean	SD	t-value
Total farm size (ha)	3.48	3.03	2.98	2.66	1.07
Total cultivated land (ha)	2.80	0.84	2.05	0.71	1.71*
Forest & wood land (ha)	0.01	0.11	0.03	0.12	-0.57
Grazing land (ha)	0.25	0.18	0. 21	0.09	1.3**
Wasted land (ha)	0.16	0.06	0.01	0.00	0.86**
Fallowed(ha)	0.14	0.07	0.20	0.10	-2.60
Other land (ha)	0.02	0. .21	0.50	0.58	-1.03
Amount of input applied					
Fertilizer(NPS) in Kg	85.70	46.5	62.72	33.45	3.47*
Fertilizer(UREA) in Kg	24.94	19.18	17.83	10.75	2.79*
Improved seed(in kg)	14.43	8.16	11.37	6.84	2.48***
Herbicides(in litre)	3.09	1.83	3.05	2.32	0.11

NB: ***, ** and * significant at 1%, 5% and 10% probability level

Source: Own survey (2018)

Advancements in technological resources have positively impacted farmers in developing countries by providing a means to improve soil fertility and increase land productivity and overall crop yields. Marketable inputs like fertilizer, pesticides and improved seeds are one of the most important ingredients to increase agricultural production and productivity. They are

widely used by farmers in the study area. This is believed to increase agricultural output through enhancing crop productivity which, in turn, is thought to improve food security, reduce rural poverty, and transform agriculture into a more productive and profitable sector (Benson *et al*.,2014).

Comparing the two groups of the households, male headed households were better in using agricultural input than the female headed households. The average fertilizer (NPS and UREA), improved seed and herbicides used by male headed households were 85.7, 24.94, 14.43 and 3.09 respectively where as the result found for the female headed households were 62.72, 17.83, 11.37 and 3.05 respectively. The deferential results between the two groups in using fertilizer (NPS and UREA) and improved seed were significant at 10% and 1% probability level as described in the (table 7).

4.2.2. Cropping pattern

The general types of agricultural produces in the study area were coffee, maize, niger, teff, millet and sorghum, chat, mango and others. But the dominant once were coffee, maize, niger, teff, millet and sorghum. Niger is one of major crops followed by maize, millet and coffee. As seen from table 8, there was no significant difference between male headed and female headed households in terms of types of crops they cultivated like niger, teff and sorghum. But crops like coffee, maize and millet are statistically significant between the male headed and female headed households. This implies that there was gender sensitivity in the types of crops farmers cultivated in the study area. Also the data showed that there were differences between the two groups in the area of land allocated for these major crops. The average land covered by the five major crops was 2.79 ha in male headed household and 2.01 ha by female headed households. Coffee is the only perennial crop in the area and produced both for cash generating and consumption purposes.

Table 8. Cropping pattern of surveyed households head

Types of crops	Male headed household		Female headed household		t-value
	Mean area (ha)	SD	Mean area (ha)	SD	
Coffee	0.74	0.79	0.51	0.28	2.46***
Maize	0.57	0.68	0.5	0.18	2.68**
Niger	0.23	0.19	0.21	0.12	0.68
Teff	0.4	0.42	0.39	0.45	0.73
Millet	0.62	0.85	0.33	0.56	2.49***
Sorghum	0.23	0.11	0.22	0.11	0.53
Sum of the Area	2.79		2.01		

NB: *** and ** significant at 1% and 5% probability level

Source: Own survey (2018)

4.2.3. Crop yield

The average yield of maize for MHH and FHH was about 12.36 and 10.49 quintals per ha, respectively, which was statistically significant at 10% (t=1.71). The average yields of coffee, niger, teff, millet, and sorghum were about 9.19, 2.23, 0.82, 4.27 and 3.99 quintal per ha for MHH, respectively and for FHH the respective yield of these crops was 7.43, 2.06, 0.69, 3.79 and 3.71 quintal per ha. This indicates that MHH had higher yielded per ha of land compared to FHH (table 9).

Table 9. Yield of major crops qt/ha (quintal per hectare)

Types of crops	Male headed household		Female headed household		
	Mean	Standard deviation	Mean	Standard Deviation	t-value
Coffee	9.19	6.75	7.43	4.71	1.85***
Maize	12.36	7.12	10.49	5.70	1.71*
Niger	2.23	1.29	2.06	0.96	1.31***
Teff	0.82	0.59	0.69	0.44	0.65
Millet	4.27	2.20	3.79	2.06	1.38
Sorghum	3.99	2.36	3.71	2.07	0.67

NB: ***,* Significant at 1% and 10% probability level

Source: Own survey result (2018)

4.2.4. Livestock Holding

In the study district livestock is one of the important means of livelihood for the households, the area is even known by its fattening practices and marketing of livestock by-products. Most of the households are participating in livestock rearing along with crop production. All the interviewed households have an animal at least chicken. The major livestock that are reared by the respondents are cattle, sheep and goat, donkey, and chicken. In order to compare the livestock holding of the households where by able to contrast the difference in livestock holding between male headed and female headed households, it needs to convert the different types of livestock into standard unit called Tropical Livestock Unit (TLU) (appendix table 2).

The mean livestock holdings for the sample households were 3.84 TLU, of which the average for the male headed households was 3.87 TLU and 3.80 TLU for female headed households. The difference between the two households were tasted and found to be significant at 5% probability level. This implies, the male headed households were relatively wealthier than the female headed households as livestock is a measure of wealth and source of income in the study area. The result was similar with Bethelhem (2017) which examined on factors affecting differences in livestock asset ownership between male and female-headed households in northern Ethiopia.

Table 10. Livestock holding in tropical livestock unit by gender household head

	Male headed household		Female headed household		
Category	Mean	Standard deviation	Mean	Standard deviation	t-value
Oxen	2.29	1.00	1.94	0.81	2.32*
Cows	2.16	1.62	1.64	1.95	0.82**
Yungbulls	1.90	1.11	1.68	0.82	0.68
Calves	0.50	0.45	0.43	0.23	0.76
Heifers	-	-	0.75	-	-
Sheep	0.51	0.39	0.46	0.40	1.62
Goat	-		0.19	0.09	-
Chicken	0.19	0.15	0.17	0.11	0.87*
Mule	1.1	-	-	-	-
Donkey	0.66	0.44	0.60	0.22	0.39***
TLU	3.87	1.67	3.80	2.07	0.22**

NB: ***, ** and *Significant at 1%, 5% and 10% probability level
Source: Own survey (2018)

4.2.5. Labour utilization

Labour is an important input to increase agricultural production and productivity. Since MHH and FHH operated different agricultural practices, they have different kinds of labour source in the study area. The most labour source was family labour. Although, exchange labour, labour pooling mechanism and hired labour were practiced during the peak season. According to the survey result (table 11) 57.3 % of MHH and 77.3% of FHHs reported that there were labour shortages during the main cropping season. The chi-square test indicates that, it was significantly different at 1% probability level. Problem of labour was more signified in FHH than in MHH. The result was consistent with Tadele and Mahendran (2015) the study conducted in SNNP of Ethiopia. The MHH in the study area had more adult family member whereas FHH have less number of adult family member.

Table 11. Labour shortage among sample households headed by percent (%)

Labour shortage	MHH	FHH
Yes	57.3	77.3
No	42.7	22.7
Total	100	100
	x^2=6.819 P = 0.009	

Source: Own survey (2018) NB: Significant at 1% probability level

Community in the study area got labour from assistance from relatives and traditional laboure pooling system (*debo*) in order to overcome the problem posed by labour shortage. Assistance from relatives was the most used practices which the household is served from relative labour force to one another. The other labour arrangement was *debo*, which the household is request their fellow citizen or relative without an arrangement to perform their activities in return. Hired labour was used when the household is in need of more labour in addition to exchange labour and labour pooling mechanism. MHH hire more labour than FHH and the chi-square test indicate that it was significantly different at 5% probability level (p=0.035). The result was in contrast to the finding of Tadele and Mahendran (2015) on the study conducted in SNNP of Ethiopia indicate that there is no significance difference among MHH and FHH. On the other hand the result was consistent with that of Hawa (2018) in the Case of Bambasi District, Benishangul Gumuz Regional State, Ethiopia.

Table 12**.** Labour utilization by sample households headed by percent (%)

Labour source	MHH	FHH
Hiring labour	61.3	52
Assistance from relatives	22.7	38.6
Traditional labour pooling system	16	6.7
Unable to overcome	0	2.7
x^2=8.58	P=0.035	

Source: Own survey results (2018)

4.2.6. Farming experience and number of oxen

The mean years of farming experience of the sample households of MHH and FHH in the study area was 22.24 and 18.49, respectively (table 13). The t-test result indicates that there was significant difference among the two groups at 10% probability level (t=1.66). This shows that the MHH were more experienced than FHH in the study area.

Table 13. Mean of farming experience and number of oxen of respondents

Variables	MHH		FHH		t-value
	Mean	SD	Mean	SD	
Farming experience	22.24	14.25	18.49	13.27	1.66*
Number of oxen	2.08	0.93	1.79	0.76	2.05**

NB: ** and * significant at 5% and 10% Source: Own survey result (2018)

Draught animals are used as a source of power for farming in the study area. As shown in the above table on the average, MHH had about 2.08 oxen while FHH had 1.79 oxen, which was significant at 5% probability level (t=2.05). This shows that FHH has less access to draught oxen as compared to MHH in the area. The most widely used method of overcoming shortage of oxen was exchange of labour for oxen, pairing oxen with others, borrowing oxen from relatives and hiring oxen. In some cases women who have no oxen have their land ploughed by giving services such as weeding, clearing the land for a week for the owner of the oxen. Similarly, if FHH has a male labourer, he can work for those who own oxen in exchange for the use of the oxen to cultivate the land. An individual should plough two days for the oxen owner in order to use a pair of oxen on his land for one day which is known as "*Qafi*" by the local language. On the other hand, those who have no adult male labour are forced to give out

land to share croppers. Share cropping (*Qixxee*) is practiced if she/he has land and not able to cultivate because of shortage of labour or other inputs, he/she provides the land to somebody and shares the output equally. As regarding to gender based ownership of oxen, due to cultural reasons in all the study area, draught animals are considered as the property of men. Even in FHH, oxen are considered as the property of the male members.

4.2.7. Sources of farm income

Rural people derive income from multiple sources both from within and outside agriculture. They have commonly more than one source of income as they usually participate in both on farm and off farm activities. Sales of crops, livestock and their by products, and off-farm activities are the major cash income sources for the households in the study area. The mean cash income from different crops which constitutes the highest proportion was about 27,702.28 birr for MHH and 21,261.4 birr for FHH, the difference is significant at 1% probability level (t=2.83). The result was consistent with Mekonnen *et al.,* (2018) examined on gender based productivity differences in Ethiopia, which shows female headed households have significantly less value of income from the value of crops than male headed households.

As pointed out earlier, agriculture in Yubdo does not satisfy the basic needs of the people. Therefore, people have to acquire alternative sources of income. The mean cash income from off-farm activities of MHH was about 1,341.66 birr while it was 1203.78 birr for FHH and the main off-farm activity of the study area were petty trade, working as daily labourer.

Table 14. Sources of income for household headed in birr (mean)

Source of income	Male headed Household		Female headed Household		
	Mean(in birr)	SD	Mean(in birr)	SD	t-value
Sale of crops®	27,702.28	14723.24	21,261.40	13041.38	2.83***
Sale of livestock and their by products	4,081	3512.62	3,784.86	3001.68	0.55**
Off/non-farm income	1,341.66	661.21	1203.78	1258.71	0.34
Total	33,124.94		26,250.04		

® - *Refers coffee is the major source of income out of all crops for the households.*

NB: *** and ** significant at 1% and 5% probability level

Source: own computation (2018)

4.3. Gender Based Division of Labour

Women and men inYubdo district have clearly separate labour roles to participate and ensure the accessibility of goods and services for family consumption and well-being. In the progression of producing cops for food and cash purposes in agricultural production, the distinguishing role of both women and men is needed. In addition to agricultural production women and men have separate division of labour for the domestic work in their livelihood. The main criteria for the division of labour in the area are age and sex for the sampled family members. Heads of the households were asked about the major activities performed by all the family members to see whether the agricultural production system had gender division or not. The major activities (productive, reproductive and community works) undertaken by the respondents were ranked according to the number of men and women family members participated in the activities.

As the result of this study, about 12.39 of men and 11.41 of women family members in MHH and about 9.94 of men and 11.83 of women family members in FHH participated in land preparation which is statistically different at 5% probability level for MHH. Ploughing is entirely men's activity. However, women may help in clearing the land and in softening of the soil. Women would never try ploughing using oxen. Sowing and coffee planting are also activities carried out more by men.

In another way both men and women have shared agricultural activities with each other. Weeding and digging is a responsibility of both men and women and is done either alone or together. But not all crops need both weeding and digging. Digging is mainly for maize and followed by weeding. In most cases weeding is one time activity. Weeding is unavoidable for maize and is a usual task for teff. According to the result of this study, about 12.54 of men and 16.23 of women family members in MHH and 13.16 about of men and 17.27 of women family members in FHH participated in weeding which is statistically significant at 1% probability level.

Table 15. The average number of men and women family member participated in different activities

Activities	Male headed households			Female headed households		
	Men	Women	t-value	Men	Women	t-value
	Average	Average		Average	Average	
Land preparation	12.39	11.41	2.02**	9.94	11.83	0.45
Ploughing	15.28	0.00	-	13.27	0.00	-
Sowing	11.17	0.00	-	9.35	0.00	-
Weeding	12.54	16.23	2.3***	13.16	17.27	2.29***
Harvesting	13.87	13.29	0.52	12.98	12.70	0.34
Treshing	13.16	12.19	0.83	12.91	11.47	1.69**
Transporting	11.22	10.65	1.03*	10.69	10.13	0.91
Marketing	9.94	9.83	0.25**	10.83	10.25	0.73
Vegetable Gardening	10.38	9.98	0.51	9.85	10.29	-0.64
Coffee planting	10.13	9.60	-0.63	10.21	10.87	-0.84
Coffee processing	8.07	11.27	0.74	12.18	13.15	-0.85
Livestock Herding	14.05	11.71	1.5**	15.58	12.31	1.85***
Cleaning of House	12.78	12.30	0.35	20.13	17.06	0.93**
Milking	0.00	24.76	-	0.00	26.51	-
Fetching Water	16.64	17.67	-	21.12	23.90	-
Grain mill	11.31	11.49	-1.19	15.04	16.18	0.64
Food preparation	10.78	11.45	-2.09	30.24	32.40	-0.63
Child care	0.00	10.25	-	0.00	15.08	-
Fire wood collection	12.08	20.00	-0.012	17.09	40.00	-0.25
Washing of cloth	14.01	12.18	1.61	17.06	18.81	0.04

NB: ***, ** and * significant at 1%, 5% and 10% probability level
Source: Own computation (2018)

After weeding and digging, harvesting, collecting and threshing in order are relatively common tasks of women in the area. Harvesting involves different tasks for different crops: reaping for teff, millet, niger; and stripping off the cob for maize. Preparing the threshing ground is a woman's task while threshing is done by men (majority) and women (few

especially in FHH where there is no male). Collecting and transporting is frequently done by women but using pack animals men do transport grain from field to home. With regard to livestock production, men are responsible for herding, usually assisted by boys. They also feed cattle, track animals for drinking water sources and vaccination centers. It is only in the absence of male that women take the responsibility of looking after the livestock. Women do milking cows, clean cattle barns, buying salts for cattle and taking care of sick animals. In general, as women usually look after milking cows, men give care to oxen.

Food preparation including grinding of grains, preparing coffee, etc is mainly done by women. They are also responsible for cleaning the house, fuel collection (either cow dung or fire wood) and water fetching. Treatment of children is mainly the duty of women, excessively. Husband and wife go to the market alone or together but in most cases they go together with people from their neighborhood. The average distance they travel from the nearest market is about 5 km whereas the furthest market is about 16 km. Men market the high value assets such as livestock and larger quantities of grain while women sell or buy smaller quantities.

On the whole, the result of this study shows that women work on the average for 12 hours a day and the working hours increase during the farming season. On the other hand, men on average work for 10 hours. Paired samples t-test indicates that there was a significant difference between working hours of the two groups at 5% probability level. From these discussions, it can be concluded that some of the agricultural activities undertaken in the study area are gender based division of labour; especially, land ploughing using oxen and sowing are only undertaken by men while milking cows and other domestic works are done by women in the study area.

4.4. Access and Control of Resources

Cultivable land is the source of revenue up on which the households enhance its livelihood. Also it is the source of reputation and power in the community. As indicated from the result (table 16), about 75 number of the MHH respondents reported that, cultivable land for crop

production was jointly accessed, but the control of cultivated land was in the hands of male. Regarding to farm tools, 75 and 55 number of male and female was accessed, respectively. The benefits derived farm tools was exclusively controlled by men. In FHH land was mostly accessed and controlled by women. This indicates that women in MHH were dispossessed of control over resources.

Regarding livestock possessions, there were differences in access to and control over in both MHH and FHH. The majority of the respondents reported, they jointly accessed to livestock's and their products such as oxen, cow, goat/ sheep, donkey/horse and poultry. However, the benefit derived from it in the form of selling live animal, the control of the money was vested in the head of the household headed. Among the type of livestock listed, about 73 and 75 of women were controlled over poultry and livestock products in the MHH. In FHH women had full access and control over livestock and their products. Because in FHH women was the most decision maker of the household so that they bypass predict on how to use the income derived from the resources. Farm implements are important for the undertaking of agricultural activities.

In the study area there are different types of farm implements. Even though women actively participate in agricultural activities the control of farm implements in MHH was under the head of the household. In FHH, woman were accessed and controlled over farm implements. To boost agricultural production and productivity the essential role of agricultural inputs both men and women in MHH were equally accessed to agricultural inputs. But men were fully control the agricultural inputs utilized. Women in FHH were fully access and control over agricultural inputs. In access to grain both men and women in MHH had full access. Regarding to control over, women enjoyed more than men. In FHH Women were fully accessed and enjoy the benefit of stored grain. The result shows that women in MHH and in FHH are different in control over resources. Since women are involved in all agricultural activities, the controls over resources are vested in the hands of men in MHH.

Concerning to the financial services such as savings, credit and insurance provide opportunities for improving agricultural output, food security and economic vitality at the household, community and national levels. Improving women's direct access to financial

resources leads to higher investments in human capital in the form of children's health, nutrition and education. Producers who are unable to cover their short-term expenses or who want to purchase more productive but more expensive technologies must rely on either credit markets or other credit sources. In the study area men and women reported as they had equal accessed of credit in the male headed. But their difference was controlling of the credit services. From the survey data result about 75 men and 55 women had the power to control over the credit services in the MHH. In FHH both male and women had the access of credit and the control of credit was mostly by women.

Table 16. Access to and control over resources in the household head

Resources/Services	Male headed households								Female headed households							
	Male				Female				Male				Female			
	Access		Control		Access		Control		Access		Control		Access		Control	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Land	75	0	75	0	75	0	0	75	75	0	6	69	75	0	75	0
Farm tools	75	0	75	0	55	20	0	75	75	0	3	72	75	0	75	0
Farm inputs	60	15	60	15	60	15	0	75	59	16	1	74	75	0	73	2
Oxen	65	10	65	10	73	2	0	75	63	12	7	68	75	0	75	0
Horse/donkey	58	17	58	17	39	36	6	79	60	15	1	74	38	37	34	41
Cow	75	0	75	0	75	0	48	27	75	0	10	65	75	0	59	16
Sheep/Goat	75	0	75	0	75	0	61	14	75	0	1	74	75	0	57	18
Chicken	73	2	54	21	75	0	73	2	75	0	7	68	75	0	75	0
House	75	0	75	0	75	0	1	74	75	0	1	74	75	0	75	0
Grain	75	0	62	13	75	0	74	1	75	0	18	57	75	0	74	1
Credit	75	0	75	0	75	0	55	20	75	0	1	74	75	0	59	16
Livestock products	73	2	23	52	75	0	75	0	70	5	0	75	75	0	75	0

Source: Own Survey result (2018)

The results was unfailing with the findings of other researchers which state that crop marketing and the control over revenues from sales are often gender differentiated, and in some cases vary by crop type (Tewodaj *et al*., 2009; Hawa, 2018). The marketing and income

from cash crops grown by the household in larger scale are controlled by the household head (who is nearly always male in households where the head has a spouse in the household), though there are many cases where small quantities of these important crops may be sold by the heads spouse. As is the case with many spheres in agriculture, control over the sale of and proceeds from livestock and livestock products is generally gender differentiated, with women nursing to market small livestock and poultry, as well as dairy products and eggs. The sale of cattle and other large livestock is for the most part in the male domain. Marenya *et al*. (2015) articulated that if the social, legal, and economic environment provides the household members (especially women) with commendable fall-back positions, such as divorce and legal recourse or social approve, then it may be possible to achieve an equitable sharing of joint production. Without such bargaining power, unequal (inequitable) intra-household allocation is likely to be the outcome.

4.5. Results of Econometric Models

4.5.1. Estimation of the production function

In this section the identified explanatory variables were analyzed with the help of Cobb-Douglas production function and the results were interpreted. As discussed in section 3.5.2.1, CD production function was employed to estimate the parameters of the production function for MHH, FHH and pooled data set. Before fitting the data to CD production function, multicollinearity test for explanatory variables was done using variance inflation factors (VIF). The results of VIF analysis indicate that the VIF values for all continuous explanatory variables were by far less than 10. Therefore, all the explanatory variables were included in the model for further analysis (appendex table 3**)**.

The existence of heteroscedasticity problem that violates the assumption of constant variance was checked. The graph of standardized residuals against the frequency of their occurrence showed normal distribution of the residuals, which indicate the absence of a heteroscedasticity problem. Additionally, the insignificant F-value of 0.579 under the Ramsey' RESET test indicated that there is no problem of omitted variables. The fitness model was checked by using Linktest. All the P-value was insignificant which mean the model was correctly specified (appendex table 4).

4.5.2. Comparison of productivity of the two groups

Identifying the source of the output difference between MHH and FHH is a necessary step in the determination of an appropriate policy intervention. Difference in gender affects the sources of output difference by shifting the value of the scale and slope parameters of the production functions. In order to test the overall significance of the difference in production function parameters between male and female headed households and hence the shift in production functions due to gender difference, the Chow's F-test was computed using equation (11) of section 3.5.2.4.

Table 17. Comparison of the overall production parameters of both groups

Item	Number of observations	Degree of freedom	Residual sum of squares	Chow's F-value
MHH	75	62	2.870	12.10 ***
FHH	75	62	6.072	4.20 ***
Pooled	150	137	12.510	21.47 ***

NB: *** Significant at 1% probability level
Source: Own computation (2018)

F-value for the overall difference in parameters is significant at 1% level of probability, implying that there is a shift in production function between the two groups. However, in order to test whether the shift is scale parameter or slope parameters, pooled production with an intercept dummy for gender of the household (equation 7) was estimated (table 18).

As defined in section three under methodology part separation of difference in production by male headed and female headed households into parts due to efficiency difference and parts due to difference in the input endowment is a key to clearly indicate the variation of the two groups. For this purpose pooled production function with dummy gender intercept were computed and the result confirmed that there is significant difference between the two groups in efficiency implying the variation is due to dissimilarity in amount and types of input accessed and used. The table 18, illustrated that the coefficient of gender dummy is significant having a probability value ($p = 0.000$) indicating there is evidence of difference in productivity and hence gross farm income between male and female headed households in efficiency in the study area.

Table 18. Estimates of production function for pooled sample with dummy gender

Explanatory Variables	Regression coefficients	P>t
Intercept	9.656	0.000
Size of livestock holding	0.033	0.486
Land size	0.313	0.000
Education of household head	-0.002	0.796
Inorganic fertilizer	0.267	0.000
Herbicides	0.083	0.018
Labour	0.009	0.055
Access to Credit	-0.004	0.258
Improved seed	-0.062	0.058
Number of extension contact	-0.014	0.122
Farming experience	-0.088	0.336
Number of oxen	0.166	0.024
Non-farm/off-farm income	0.004	0.246
Gender	0.339	0.000
R^2	71.25%	
Adjusted R^2	68.50%	
F-value	25.93	0.000
Number of observation	150	

Source: Own Survery result (2018)

As shown in Table 18 the coefficient of gender in the pooled production function is significant in the analysis (p=0.000) which means their difference was due to intercept term. This implies that gender yield differential is due to technical efficiency with which these inputs are used. In other words, FHH in the study area were not equally technically efficient as that of MHH, the result of Shambel (2013) and Tadele and Mahendran (2015) was inconsistent with the present finding. Their results of finding show that the coefficient of gender dummy was insignificant.

Both male headed and female headed households' production functions were found significant at 1% using F-value test. This showed the null hypothesis stating that all the coefficients of explanatory variables are zero was rejected. Twelve explanatory variables were used for this study out of which five variables such as land size, inorganic fertilizer, labour, number of oxen and number extension contact were significant for male headed households. The number of variables that affected the female headed households of agricultural productivity significantly was five including land size, inorganic fertilizer, labour, herbicide

and improved seed. The coefficients of multiple determinations indicated that the variation in gross value of farm output per hectare associated with the factors of production included in the model was 70.09 % and 44.86 % in the male and female headed households respectively.

Table 19. Coefficient of cob-Douglas production function

		MHH (75)		FHH(75)		Pooled (150)	
Variables	Unit	Coefficient	P>t	Coefficient	P>t	Coefficient	P>t
Constant		10.075	0.000	9.524	0.000	9.75	0.000
SILIHO	TLU	0.056	0.407	-0.006	0.928	0.088*	0.076
LSIZE	Ha	0.418***	0.000	0.275***	0.008	0.376***	0.000
EDU	Years	0.003	0.783	-0.001	0.922	0.014*	0.065
INFERT	Kg/ha	0.167**	0.024	0.332**	0.012	0.316***	0.000
HERB	Litre/ha	0.017	0.645	0.199***	0.008	0.096**	0.045
LBOUR	Man-days	0.009**	0.043	0.022*	0.072	0.012**	0.022
ACCREDIT	Birr	-0.006	0.071	0.001	0.969	-0.004	0.267
IMPSEED	Kg/ha	0.057	0.361	-0.166***	0.008	-0.064*	0.074
NEXCONT	No of contact	-0.028**	0.021	-0.015	0.259	-0.012	0.196
FAEXP	Years	-0.064	0.564	-0.042	0.803	-0.174*	0.079
OXEN	Number	0.200**	0.034	0.002	0.991	0.213***	0.008
NFINCME	Birr	0.005	0.195	0.001	0.852	0.005	0.245
R^2		70.09%		44.86%		65.29%	
Adjusted R^2		64.30%		34.19%		62.24%	
F-Value		12.10	0.000	4.20	0.0001	21.47	0.000

NB: ***, **and * significant at 1%, 5% and 10% probability level

Source: Own survery (2018)

Dependent variable is gross value of farm output per ha and all the variables in the model are transformed into their logarithmic form. The practical difficulty arises in the conversion of raw data of value zero to logarithmic form being the logarithm of zero is undefined. To overcome this problem, the zero observations may be replaced by some figure of arbitrary small size or a constant value can be added to all observations (Heady and Dillon, 1961). Accordingly, zero observation was replaced by a small number near to zero (0.001) depending

on the previous literature (Wakweya, 2004; Shambel, 2013; Tadele and Mahendran, 2015; Debalke, 2016).

It was stated previously in section 3.5.2.3. that the coefficients of the production function estimated are called the elasticity coefficient, indicating the percentage share of each explanatory variable in the variation of the dependent variable or the average percentage change in the dependent variable as the result of 1% change in one explanatory variable, keeping other factors constant. Brief discussions of the significant variables in both MHH and FHH production functions are presented below.

The farmland of a farmer is one of the most important variables affecting the level of farmers' gross value of output per ha. It has a significant and positive impact on productivity of agriculture in both MHH and FHH. Other factors being constant, a 1% increase in the area under the major crops increases gross value of farm output by 0.418 % and 0.275% for male and female headed households, respectively. In other words, these figures indicate that farmland contributed about 41.8% and 27.5% to the output of the total inputs for MHH and FHH, respectively. This result was consistent with the result of Debalke (2016) on the study of gender difference on household income and asset building the case of Arbaminch surrounding district, Gamo Gofa Zone, SNNPR, Ethiopia.

The elasticity coefficient of inorganic fertilizer for male and female headed households was important variables that affect the productivity of agriculture at 5% probability level for male headed and female headed households. Increasing inorganic fertilizer by 1% in male headed and female headed household increase productivity by 0.167% and 0.332% respectively. In other words these figures indicate that inorganic fertilizer contributed about 16.7% and 33.2% to the output of the total inputs for MHH and FHH, respectively.

Labour contributed positively and significantly to the agricultural production and gross value of farm output at 5% and 10% level of probability for male headed and female headed household respectively. The result of the survey showed that increasing labour by 1% increases the gross value of farm output by 0.009% and 0.022% for male headed households and female headed households correspondingly. The labour elasticity was relatively higher for

female headed households implying labour was more efficiently utilized in farm production in this household.

Number of oxen for male headed and herbicide for female headed were contributed positively and significantly to the agricultural production and gross value of farm output at 5% and 1% level of probability respectively. The result of the survey showed that increasing oxen and herbicide by 1% increases the gross value of farm output by 0.20% for male headed and 0.199% for female headed households. In other words this information indicate that number of oxen contributed about 20% and amount of herbicide contributed about 19.9% to the output of the total inputs for MHH and FHH, respectively.

Improved seed for female headed and extension for male headed contributed negatively and significantly to the agricultural production and gross value of farm output at 1% and 5% level of probability for both. The result of the survey showed that increasing improved seed by 1% decreases the gross value of farm output by 0.166% for female headed households and 0.028% for male headed. This is due to the increasing price of improved seed over time for female headed and less contact of DA in the study area for male headed households.

4.5.3. Marginal value product (MVP) of inputs

Allocative efficiency can be determined by comparing the MVP of a factor with its opportunity cost (factor price). The MVP of a factor is the additional return from adding one more unit of that factor holding all other inputs constant. MVP, which exceeds its opportunity cost, suggests that there is scope for productivity raising output by increasing the use of that factor. Conversely, increasing the use of a factor, which has MVP less than the associated opportunity cost, decreases the productivity (Ellis, 1993). The MVP of the inputs used in the production functions was calculated from the elasticity coefficients (table 19) and from the geometric mean of input level in the production processes using equation (8) in section 3.5.2.3. For comparison purposes the prices of inputs were required. Accordingly, the factor price for inorganic fertilizer (NPS and UREA) was 2388 birr per 100kg (NPS=1346, UREA=1042) in the production year of 2017/2018. Human labour was valued at their opportunity cost, i.e., the local wage rate of 30 birr per day. Local average renting price of a

farmland was estimated to be 2400 birr per ha and this value was used for valuing farmland. The MVP of the significant variables in the CD function is given in table (19).

Table 20. Marginal value of product and factor cost of significant explanatory variables

		MHH(75)		FHH (N=75)		Factor
Inputs	Unit	MVP	Ratio	MVP	Ratio	cost
Land size	Ha	40234.4	16.76	15124.62	63.01	2400
Inorganic fertilizer	Kg/ha	722.39	0.3	251.71	0.11	2388
Labour	Man-days	591.56	19.71	126.61	4.22	30

Source: Own computation (2018)

As it can be seen from table 20, the MVP of land size, inorganic fertilizer and labour in MHH were greater than that of the inputs for FHH. So; the productivity MHH is much higher than the productivity of FHH.

Concerning land size, the MVP in MHH was more than twice that of FHH. In MHH, the MVP was higher than the opportunity cost, utilization of one additional unit of land size in hectare resulted in 40,234.4 birr in gross value of output for MHH. In FHH the MVP was higher than the opportunity cost but twice less than the MVP for MHH.Utilization of one additional unit of land size in hectare resulted in 15,124.4 birr in gross value of output for FHH; the above table shows that the productivity of FHH is much lower than that of MHH by 25,110 birr for total gross value of farm output.

The MVP of inorganic fertilizer (NPS and UREA) in MHH and FHH were lower than opportunity cost in both sample groups. This shows that inorganic fertilizer (NPS and UREA) is Over-utilized in both groups. Additional use of one unit of inorganic fertilizer (NPS and UREA) results in 1665.61 and 2136.29 birr decrease in gross value of output for MHH and FHH, respectively. Therefore, decreasing the use of in organic fertilizer obviously can improve the efficiency of farm productivity.

Finally, the MVP of labour was higher in MHH and FHH than opportunity cost in both sample groups. This shows that labour is under utilized in both groups. Additional use of one unit of man-day results in 561.56 and 96.61birr increase in gross value of output for MHH

and FHH, respectively, keeping other inputs constant. Thus, farmers in the study area could increase their productivity by using additional labour. It should be kept in mind that labour has been defined as man-days for production, not as the total labour force of the households. Therefore, making better use of the total labour force clearly can improve the efficiency farm productivity.

4.5.4. Source of productivity difference

This section presents estimates of the agricultural productivity differences between male and female headed households using decomposition model. As discussed in section 3.5.2.3, this model is helpful to measure the percentage contribution of the different to agricultural productivity difference between male and female headed households. This method allows distinguishing the productivity difference that can be explained by differences in household endowments and differences in the efficiency of these endowments. In addition to the estimates of production functions, the decomposition analysis requires the geometric mean values of different inputs and output. Table 21 presents geometric mean values of various inputs and output in both MHH and FHH. The geometric mean of output and input endowments were computed from the explanatory variable before converting to natural logaresim since geometric mean does not compute negative values in the data. It is observed that the inputs used by MHH were higher as compared to FHH for all the explanatory variables used in the model.

Table 21. Geometric mean of dependent and explanatory variables in the model

Variables	Male headed	Female headed
Livestock holding in TLU	3.98	3.94
Land used(ha)	1.379	0.8912
Educational level (in years of schooling)	0.001	0.001
Inorganic fertilizer used (Kg)	75.12	64.65
Herbicides used (Lit)	0.0001	0.01
Labour used (Man-days)	85.397	78.04
Amount of credit used (birr)	3071.42	3070.33
Improved seed used on average (kg)	0.0001	0.1
Number of extension contact	32.77	33.27
Farm experience(years)	25.94	25.8
Number of oxen(number)	0.01	5.5
Non-farm/off farm income(birr)	1212.3	1211.2
Gross value of farm output (birr/year)	53,471.52	49,014.78

Source: Own survey result (2018)

By following the methodology described in the section 3.5.2.3 (equation 9), the total sources of productivity difference were decomposed into output elasticities and input endowments (table 22).

Table 22. Decomposition of productivity difference between MHH and FHH

Sources of productivity difference	percentage Contribution	
	Due to output elasticities	Due to input endowments
Total estimated difference (70.84 %)	-17.6	88.44
Livestock holding	8.5	1
Land used	-1.6	67.5
Educational level	-2.7	0
Fertilizer used	-68.7	17.4
Herbicides used	83.8	-4.6
Labour used	-5.6	9.8
Amount of credit used	-4.8	0.04
Improved seed used on average	-51.3	-0.69
Number of extension contact	-4.5	-1.5
Farm experience	-7.2	0.5
Number of oxen	33.7	-1.1
Non-farm/off farm income	2.8	0.09

Source: Own survey (2018)

As shown in the above table it can be seen that the total productivity difference in agriculture between the two groups was about 70.84%. However, they have different human capital, endowment and different access to factors and inputs as discussed in the descriptive part. Inputs use differentials accounted for 88.44%. This implies that the productivity could be increased by 88.44%, if the FHH could adjust their inputs to the same level of MHH. On the other hand, the difference in output elasticities was -17.6%. This indicates that productivity difference as the result of difference in output elasticities is greater for MHH as compared to that of FHH. The result was relatively confirmed with Tadele and Mahendran (2015) in their study of gender differences and its impact on agricultural productivity in the case of Sheko district in Benchi Maji Zone of SNNP, Ethiopia.

A comprehensive assessment of the contributions made by different inputs in the total productivity gap between male and female headed households reveals that difference in access to land use caused the biggest bound. This further indicates that if FHH could adjust

their farm land to the level of MHH, they can increase their productivity by about 70.84%. Hence, increasing the access of FHH to farm land could highly increase their productivity in agriculture in the study area. Descriptive results of this study also show that on average FHH had only 2.05 mean of land size while MHH had about 2.80 mean of land size on average, which was significant at 1% probability level (t=1.71). And also inorganic fertilizer, labour, livestock holding, farming experiences, Non- farm income and amount of credit use contributes difference between MHH and FHH made about 17.4%, 9.8%, 1%, 0.5%,0.09% and 0.04% productivity difference in agriculture, respectively (table 22).

Most researchers often argued that women's lack of access to resources results in lower productivity or inability to respond to economic incentives (Shambel, 2013; Tadele and Mahendran, 2015). Looking at the contribution made by the output elasticities or change in factor specific productivity, herbicides used is one of the variables which contribute largely to output elasticities or change in factor specific productivity difference. Which constitutes 83% to the total output difference followed by fertilizer used and improved seed in which they reduce the diffence in output gap by 68.7% and 51.3% respectively. Number of oxen and non-farm/off-farm income contributes output gap between MHH and FHH by 33.7% and 2.8% correspondingly.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary and Conclusion

The study examined on Gender difference and its Effect on Agricultural Productivity: The Case of Yubdo District in West Wollega Zone Oromia National Regional State Ethiopia. The data used in this study were collected from 75 MHH and 75 FHH randomly selected from 6 *Kebeles* of the district. Independent t-test was used to test the differences between MHH and FHH in terms of continuous variables and x^2-test for categorical variables. Moreover, Cobb-Douglas production function was estimated to measure productivity difference between MHH and FHH.

By means of socio-economic characteristics of the sample households, FHH are found to have relatively lower family size, labour force, educational level and livestock holding than MHH. Additionally, land holdings of FHH are slightly smaller than that of MHH. The result also shows that MHH used more agricultural inputs compared to the FHH. Totally, women farmers are poor in access to and control over resources compared to men farmers. Differences in access and control over resources between men and women give the feeling to be a direct reflection of culturally arranged gender division of labour. There are a lot factors which obstacle to the women farmers to have access to productive resources like traditional legal, social and institutional factors.

In the study area, women work for greatly longer hours than men. Obviously, there is no limit to the time and energy that woman farmers can apply. Women's burden hinders their participation in education, training and/or extension activities. With regard to gender role, women play a significant role in agricultural production. They participate in all activities except ploughing using oxen and sowing seed. This shows that agricultural activities in the study area have gender division of labour in a certain approach.

Twelve variables were hypothesized to affect the gross value of farm output per ha. The results of the production function analysis revealed that four variables were positively and statistically significant for MHH such as farmland, inorganic fertilizer, labour and number of Oxen while farmland, inorganic fertilizer, labour and herbicide use were positively and

statistically significant for FHH. Improved seed for female headed and number of extension contact for male headed contributed negatively and significantly to the agricultural production and gross value of farm output.

A test of structural change between production functions for MHH and FHH exposed that shift in production function of MHH was due to difference in intercept of the production function. The coefficient of the dummy gender had positive and statistically significant effect showing that there was difference in the intercept term or difference in technical efficiency between MHH and FHH.

The marginal value product of farmland, inorganic fertilizer and labour were higher for MHH as compared to FHH. Comparison of marginal value product with the factor cost both MHH and FHH could increase productivity by using more farmland and labour. The result of the study further suggests that men's gross value of output per ha was 70.84% higher than that of women's. Though, the descriptive statistics of this study show that there is a difference in household endowments, which have very large overall on the productivity difference between male and female headed households by about 88.44%. The value of FHH output would increase by some 17.6% over the MHH if women had the same human capital and used the same amounts of inputs as men.

Therefore, it can be accomplished that MHH had higher productivity with the obtainable input level. On the other hand, if the FHH have equal access to inputs as that of MHH, FHH would be more productive than MHH. From the coefficient of gender dummy, it can be concluded that women are equally technically efficient farm managers as men farmers. However, their productivity is well below potential. Handling this potential productivity gain by improving the situation of women farmers would substantially increase food production by this means reducing the level of food insecurity in the study area.

5.2. Recommendations

The agricultural productivity of male headed and female headed households was affected by different factors in the study area. Based on the result of the study and serious issues identified in the study, the following points need to be considered as possible policy implications in order to increase the productivity of farmers in general and that of women farmers in particular.

- From the comparison of marginal value product with the factor cost of the land was not utilized by both male headed and female headed in the study area. Increasing output by increasing the area under farming is an alternative in the study area because arable land was not efficiently utilized. Therefore, raising the productivity of land is central importance for increasing agricultural productivity through efficient utilization land and use of yield increasing inputs.
- Since labour utilizations was one of the significant factors influencing agricultural productivity, labour utilization of male headed households and female headed households should be increased through their source of labour .
- As the estimate of CD production function indicates, number of oxen for MHH and herbicide use for FHH significantly affects the productivity of agriculture for those households in the study area. Therefore, measures should be taken to ensure timely availability of oxen and use of herbicides in the area.
- By comparing the two groups of households, farm inputs utilization for production was significantly lower for female headed households. Hence, development workers should give much attention to female headed households through increasing their access to these productive inputs.
- The surveyed result showed that in the study area men worked less time than women in terms of hours per day but the time women participated in agricultural activity was very low due to the fact that women allocate much of their time and energy for home based activities like fetching of water, collecting of fire wood, washing of cloth, grain mill activity, child care and the like. Therefore, technologies that decrease women work get down need to be introduced from the concerned body.

6. REFERENCES

Addison, M., Ohene-Yankyera, K. and Fredua-Antoh, E., 2016. Gender role, input use and technical efficiency among rice farmers at Ahafo Ano North district in Ashanti region of Ghana. *Journal of Food Security*, *4*(**2**): 27-35.

Aguilar, A., Carranza, E., Goldstein, M., Kilic, T. and Oseni, G., 2015.Decomposition of gender differentials in agricultural productivity in Ethiopia. *Agricultural Economics*, *46*(**3**): 311-334.

Aicha Mechri, Peter Lys and Franck Cachia, 2017. International Consultants for the Global Strategy to Improve Agricultural and Rural Statistics at the Statistical Division of the Food and Agriculture Organization of the United Nations (FAO).

Asfaw Solomon, Shiferaw Bekele, Simtowe Franklin and Leslie Lipper, 2012. Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food policy*, *37*(**3**): 283-295

Asres Elias, Makoto Nohmi, Kumi Yasunobu & Akira Ishida., 2015. Does Gender Division of Labour Matters for the Differences in Access to Agricultural Extension Services? A cases study in North West Ethiopia*, Journal of Agricultural Sciences* 7(**1**): 1-10. DOI:10.5539/jas.v7n1p138.

Benson Todd, David Spielman, and Leulsegged Kasa, 2014. *Direct seed marketing program in Ethiopia in 2013: An operational evaluation to guide seed-sector reform* (Vol. 1350). Intl Food Policy Res Inst.

Bethelhem Legesse, 2017. Factors affecting differences in livestock asset ownership between male-and female-headed households in Northern Ethiopia. *The European Journal of Development Research*, *29*(**2**): 328-347.

Bogalech Alemu, 2000a. Mainstreaming Gender in National Development Programmes. Economic Focus, 3(**3),** Ethiopia.

Boserup, E., 1970. Women's Role in Economic Development. Routledge, London.

Brieger, S.A., Francoeur, C., Welzel, C. and Ben-Amar, W., 2017. Empowering women: The role of emancipative forces in board gender diversity. *Journal of Business Ethics*, pp.117.

Capalbo, S.m. and Antle, J.M., 2016. *Agricultural productivity: measurement and explanation*. First published in 1988 by Resources for the Future, Inc. This edition first published in 2016 by Routledge.

Coelli, T.J., Rao, D.S.P., O'Donnell, C.J. and Battese, G.E., 2005.*An introduction to efficiency and productivity analysis*. Springer Science & Business Media.

CSA (Central Statistical Agency), 2018. Agricultural sample survey: Area and production of crops, main season, Annual Report of Yubdo.

Davis Kristin, Burton Swanson, David Amudavi, Daniel Ayalew, Aaron Flohrs, Jens Riese, Chloe Lamb and Elias Zerfu, 2010. In-depth assessment of the public agricultural extension system of Ethiopia and recommendations for improvement. Discussion paper 01041.Washington, DC: IFPRI.

Debalke Debela, 2016. Gender difference on household income and asset building: The case of Arbaminch Surrounding District, Gamo Gofa Zone, SNNPR, Ethiopia

Debertin, D.L., 2012. Agricultural production economics.

Doepke, M. and Tertilt, M., 2014. *Does female empowerment promote economic development?* The World Bank.

Duffy, C., Murray, U., Nowak, A., Girvetz, E., Corner-Dolloff, C., Twyman, J., Huyer, S., Jarvis, A. and Spillane, C., 2017. National level indicators for gender, poverty, food security, nutrition and health in Climate-Smart Agriculture (CSA) activities.

Ellis, F., 1993. *Peasant economics: Farm households in agrarian development* (Vol. 23). Cambridge University Press.

FAO and IFPRI (International Food Policy Research Institute), 2014. Gender in agriculture*: Closing the Knowledge Gap. (Ed.), Quisumbing*, A.R., Raney, R.D., Behrman, A.J.and Petrman.A. FAO*,* Springer.

FAO .2011. The State of Food and Agriculture. Rome: FAO.

FAO, 2011a. "The State of Food and Agriculture 2010–2011. Women in Agriculture: Closing the gender gap for development." Rome (available at http://www.fao.org/docrep/013/i2050e/i2050e00.htm).

FAO , 2011b. *The State of Food and Agriculture 2010-2011: Women in agriculture- Closing the gender gap for development.* FAO, Rome.

FAO , I. and Isric, I., 2012. JRC: Harmonized World Soil Database (version 1.2). *FAO, Rome, Italy and IIASA, Laxenburg, Austria*.

FAO, IFAD (International Fund for Agricultural Development) and ILO (International Labour Organization), 2010. *Gender dimension of agricultural and rural employment: differentiated path ways out of poverty, status, trends and gaps,* Rome, Geneva.

Farnworth, C., Sundell, M.F., Nzioki, A., shivutes, V. and Davis, M., 2013.*Transforming gender relation in agriculture in Sub-Saharan Africa*. SIANI, Sweden.

Farre, L., 2012. The role of men in economic and social development of women- implication for gender equality.Institutd‟AnàlisiEconòmica and Barcelona GSE

FDRE NPC (Federal Democratic Republic of Ethiopia National Plan Commission) .2017.Voluntary national reviews on SDGs of Ethiopia: Government commitments, national ownership and performance trends.

Finley, A. P., 2007.The" graying" of Mexico and its impact on female-headed households: Theoretical and methodological considerations, Latin American research review, 42(**3**): 183-204.

Ghimire R., Wen-chi H., Shrestha R.B., 2015.Factors affecting adoption of improved rice varieties among rural farm households in Central Nepal. Rice Science, 22(**1**): 35-43

Gujarati, D., 2004. *Basic econometrics*. The Mc-Graw Hill.

Hawa Mehari., 2018. Determinants of Gender Differences in Soybean Production: The Case of Bambasi District, Benishangul Gumuz Regional State, Ethiopia.

Heady, E. and Dillon J., 1961. Agricultural Production Functions. Iowa State University Press, USA.

IFAD (International Fund for Agricultural Development). 2014b. “Reducing rural women’s domestic workload through labor-saving technologies and practices toolkit.”Rome (available at https://www.ifad.org/topic/gender/overview/tags/knowledge_notes).

Inglehart, R., &Norris, 2003. Rising tide: Gender equality and cultural change around the world. Cambridge: Cambridge University Press.

Kilic,T., Palacios-Lopez, A. and Goldstein, M., 2015. Caught in a productivity trap: a distributional perspective on gender differences in Malawian agriculture. *World Development*, *70*: 416-463.

Kilic,T., Winters,P.and Carletto,C.,2015. Gender and agriculture in sub-Saharan Africa: introduction to the special issue. *Agricultural Economics*, *46*(**3**): 281-284.

Koutsoyiannis, A. 1997. Theory of Econometrics: An Introductory Exposition of Econometric Methods, 2nd ed. Macmillan Publishers Ltd, USA.

Marenya, p., Menalekassie, and Tostao, E., 2015. Fertilizer use on individually and jointly managed crop plots in Mozambique. *Journal of Gender, Agriculture and food security, 1(**2**): 62-83.*

Mekonnen Daniel, Gerber Nicolas. and Matz, Julia, 2018. Gendered social networks, agricultural innovations, and farm productivity in Ethiopia. *World Development*.

Mohammed, B.T and Abdulquadri, A. F., 2012. Comparative analysis of gender involvement in agricultural production in Nigeria. *Journal of Development and Agricultural Economics, 4*(**8**): 240-244. DOI: 10.5897/JDAE11.034.

Mukasa, A.N. and Salami, A.O., 2016. Gender productivity differentials among smallholder farmers in Africa: A cross-country comparison. *African Development Bank Group Working Paper*, *231*

Nahusenay Abate, 2017. An investigation of gender division of labour: The case of Delanta district, South Wollo Zone, Ethiopia. *Journal of Agricultural Extension and Rural Development*, *9*(**9**): 207-214.

Niang, I., Ruppel, O.C., Abdrabo, M.A., Essel, A., Lennard, C., Padgham, J. and Urquhart, P., 2014. Africa, climate change, 2014: impacts, adaptation and vulnerability—Contributions of the Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 1199-1265.

Nyamekye, I. and Ntoni, J.O., 2016. Effect of human capital on maize productivity in Ghana: A Quantile Regression *Approach. International Journal of Food and Agricultural Economics*, 4(**2**): 125.

Oakley, A., 2016. *Sex, gender and society*. Routledge.

Oaxaca, R., 1973. Male-Female differentials in urban labour markets. International Economic Review, 14(**1**): 693-09.

OECD (Organization for Economic Co-operation and Development), 2001b. Measuring Productivity OECD Manual: Measurement of Aggregate and Industry-level Productivity Growth. OECD, Paris.

Ogato, G.S., Boon, E.K., and Subramani, J., 2009. Gender roles in crop production and management practices: A Case Study of Three rural communities in Ambo District, Ethiopia, *Journal of Human Ecology*, 27(**1**): 1-20.

Olakojo, S.A., 2017. Gender gap in agricultural productivity in Nigeria: A commodity level analysis. *Economics of Agriculture*, *64*(**2**): 415-435.

Palacios-López, A., Lopez, R., 2014. Gender differences in agricultural productivity: The role of market imperfections (No. 164061). Department of Agricultural and Resource Economics, the University of Maryland.

Paris, T., 2013.Women farmers in research and Technology development. http://irri.org/index.php?option=com_k2&view=item&id=12636:women-farmers-in research-and-technology-development.

Paul M., 2014. Gender wise analysis of access to and control over assets and resources in rural households of Andhra Pradesh (Drought Prone Areas).

Quisumbing, A.R., 1996. Male–female differences in agricultural productivity: Methodological issues and empirical evidence, *World Development*, 24(**10**): 1579-1595.

Regasa Catherine., 2012. Gender and institutional dimension of agricultural technology adoption: A Review of and synthesis of 35 case studies". Selected poster prepared for presentation at the International Association of Agricultural Economics (IAAE) Triennial conference August 18-24, Foz do Iguacu, Brazil.

Shambel Worku, 2013 .Gender Differential in Agricultural Production and Its Impact on Household Farm Income: The Case of Fed is District in East Hararghe, Ethiopia.

Sinidu Gashaw, 2017. Determinants of Rural Women Empowerment in East Hararghe Zone, Ethiopia.

Storck, H., Berihanu Adenew, Bezabih Emana, Borowiecki and Shimelis W/Hawariat, 1991. Farming system and farm management practices of smallholders in Hararghe highlands. Farming Systems and Resource Economics in the Tropics, Vol.11, Wirtschafts-verlagVauk, and Kiel, Germany.

Tadele Melaku and Dr. A. Mahendran, 2015. Gender difference and its impact on agricultural productivity: The case of Sheko district in bench Maji zone of SNNP, Ethiopia", *International Journal of Current Research*, 7(**11**): 22938-22942.

Tesfaye Abebe and Desta Mulu, 2017. The role of women in the management and utilization of home garden: The Case of Dale District, in Southern Ethiopia. *Asian Journal of Plant Science and Research*, *7*(**4**):41-54.

Tewodaj Mogues, Cohen Marc. J., Birner, R., Lemma Mamusha, Randriamamonjy, J., Tadesse Debay & Paulos Zelekawork, 2009. *Agricultural extension in Ethiopia through a gender and governance lens*. IFPRI: Washington D.C.

UNDP (United Nations Development Programme), 2016. Ethiopian Economy. Available on www.africaneconomicoutlook.org

UNDP (United Nations Development Programme), 2018. Ethiopia's progress towards eradicating poverty. Paper to be presented to the inter-agency group meeting on the implementation of the third United Nations decade for the eradication of poverty (2018 – 2027) Addis Ababa, Ethiopia.

Wakweya Tamiru, 2004. Gender difference and its impact on agricultural productivity: The Case of Wenchi District in South West Shoa Zone, Ethiopia. Alemaya University.

Ward, J., Lee, B., Baptist, S., and Jackson, H. 2010.Evidence for action: Gender equality and Economic Growth, the Royal Institute of International Affairs, Chatham House, London.

WB (World Bank), IFPRI (International Food Policy Research Institute), 2010. Gender and Governance in Rural Services: Insights from India, Ghana, and Ethiopia. The World Bank, Washington, DC.

WDR (World Development Report), 2017: Gender in agriculture. Investing in women as drivers of agricultural growth.

Welzel, C., 2013. Freedom rising: Human empowerment and the contemporary quest for emancipation/Christian Welzel.

Worldometers, 2018. World Population Prospects: Department of economic and social affairs, Population division. The 2017 Revision. Available at www.worldometrers.info info/ world-population/Ethiopia-population/).

Yamane Taro, 1967.Statistics: An introductory analysis, 2nd Ed., New York: Harper and Row

YDAO (Yubdo District of Agricultural Office), 2018. Annual Report.

YDEO (Yubdo District of Education Bureau Office), 2018. Annual Report.

7. APPENDIX

Appendix table 1: Conversion factor for household labour into ME

Age group (years)	Male	Female
<10	0.0	0.0
10 – 13	0.2	0.2
14-16	0.5	0.4
17-50	1	0.8
>50	0.7	0.5

Source: Source: Storck *et al*., 1991

Appendix table 2: Conversion factor of livestock number into TLU

Animal	TLU	Animal	TLU
Chicken	0.013	Young bulls	1.0
Sheep/goat(adult)	0.13	Cows and ox	1.0
Sheep/goat(young)	0.06	Donkey(young)	0.35
Calf	0.25	Donkey(adult)	0.70
Heifers	0.75	Horse	1.1

Source: Source: Storck *et al*., 1991

Appendix table 3 : Multicollinearity test among explanatory variables

Variable	VIF	Tolerance
INFERT	3.20	0.312292
IMPSEED	3.04	0.329484
HERB	2.01	0.496964
FAEXP	1.77	0.566035
LSIZE	1.65	0.607350
LBOUR	1.56	0.642842
SILIHO	1.40	0.712607
NEXCONT	1.39	0.718147
EDU	1.24	0.804513
ACCREDIT	1.14	0.880799
OXEN	1.09	0.921352
NFINCME	1.05	0.953976
Mean VIF	1.71	

Source: Own survey result (2018)

Appendix table 4: Linktest for model fitness

```
. linktest
```

Source	SS	df	MS	Number of obs =	150
				F(2, 147) =	138.32
Model	23.5326965	2	11.7663482	Prob > F =	0.0000
Residual	12.5050417	147	.085068311	R-squared =	0.6530
				Adj R-squared =	0.6483
Total	36.0377382	149	.241864015	Root MSE =	.29166

Tgrossvalue	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.3714858	2.504781	0.15	0.882	-4.578546	5.321518
_hatsq	.0289197	.115219	0.25	0.802	-.1987798	.2566193
_cons	3.410331	13.60273	0.25	0.802	-23.47184	30.29251

Source: Own survey result (2018)

Survey Questionnaires

This questionnaire is prepared for the study entitled **"Gender Difference and Its Effect on Agricultural Productivity"**: The purpose of this questionnaire was to collect data for the above title.

General Instruction for Enumerators (Data collectors):

- Please first introduce yourself before starting the interview.
- Inform the rationale of the study, which is to collect first hand data that used only for the M.Sc. thesis writing on the topic indicated above.
- For all closed questions used circle and use the space for open questions.
- This questionnaire should be completed for 2017/18 cropping season.
- Carefully read and complete the questionnaire accordingly.

Name of Enumerator _____ sign._____ Interview date_____

I. Background Information

1.1 .Village/Goti_____

1.2. Kebele _____

1.3. Agro ecology _____A= Woina Dega B=Kolla

II. Household Characteristics

2.1. Name of the respondent (household headed) _____

2.2. Marital Status 1= Married 2= Single 3=Divorced 4=Widow 5=Separated

2.3**.** If the household head is women, what was the reason? 1=Death of husband 2=Unmarried because of economic problem 3=Husband migration 4=Polygamy 5=Barren 6= Conflict with spouse 7=others (specify)

2.4. List of family members and their characteristics including the respondent

No	Name of family members	Sex 1=Male 2=Female	Age (Year)	Relationship with household headed(a)	Formal Education (Years)	Main occupation (b)	Farming Experiences(Years)	Ethnic Group (c)
1								
2								
3								
4								
5								
6								
7								
8								

a) 1=Husband 2=Wife 3=Daughter 4=Son 5=Others (Specify)

b) 1=Farming 2=Trade 3=Others

c) 1=Oromo 2=Amhara 3=Gurage 4=Others

2.5. Religion 1=Orthodox 2=Muslim 3=Protestant 4=Catholic 5=Others (Specify).

2.6. If no formal education, did you attended basic education and/or religion-based education? 1=Yes 2=No

2.7. If yes, for how many years? _____ (Write '0' for illiterate)

III. Land

3.1. Do you own land? 1=Yes 2=No

3.2**.** If yes, total land size in Senga _____

3.3. If no, why? _____

3.4. Indicate your land use pattern (1ha=8Senga in the study area)

S/N	Type	Senga owned by man	Senga owned by woman	Senga owned by both	Source (A)

1	Cultivated				
2	Forest and wood land				
3	Grazing				
4	Waste land				
5	Fallowed				
6	Others (specify)				

A) 1=given by family 2=Allocated by government 3=Rented 4=others (Specify)

3.5**.** What type of land access do you have? (1ha=8Senga)

S/N	Type	Senga	Remark
1	Own		
2	Rented in		
3	Rented out		
4	Borrowed		
5	Shared in		
6	Shared out		
7	Inherited		
8	Communal		
9	Others		

3.6. If you rented in land, how much do you pay in this year? _____ (birr) and for how long? ___ (Years)

3.7. How do you plough your land? _____ 1=Hand tools 2=Using own oxen 3=Rented Oxen 4=Borrowed Oxen 5="Qafi" 6=others (Specify)

3.8. When did you obtain land (E.C)? _____

3.9. Do you practice soil and water conservation activities (SWC)? 1=Yes 2=No

3.10. If yes, which techniques and area covered?

S/N	SWC techniques	Area covered(Senga)
1		
2		
3		
4		

3.11. If no, what is/are the major reasons? (According to their importance)_____

3.12. Do women have the right to obtain land? 1=Yes 2=No

3.13. If no, why? _____

3.14. Do women have the capacity to direct on the use of land? 1=Yes 2=No

3.15. If no, why? (Explain) _____

3.16. Do women inherit land? 1=Yes 2=No

3.17. If no, why? _____

IV. Crop Production Systems

4.1. How many days do you participate in farming in a month on average?

Male=_____Female=_____

4.2. Please estimate your production level for the last years.

S/N	Crops Cultivated	Area (Senga) 2017/18 (Note 1ha=8Senga)	Production (Qt) in 2017/18
1	Coffee		
2	Maize		
3	Niger		
4	Teff		
5	Millet		
6	Sorghum		

4.3. Did you apply agricultural inputs during last production period (2017/18)? 1=Yes 2=No

If yes, fill the following table

Crop cultivated	Seed(Kg)		Chemical Used			Fertilizer (Kg)			Labour (Man-days)			
	Improved	Local	Insecticide (Liter)	Herbicide (Litre)	Pesticide (Gram)	NPS	Urea	Manure	Hired		Family	
									Male	Female	M	F
Coffee												
Maize												
Niger												
Teff												
Millet												
Sorghum												

Note: coffee was collected by number of seedling in place of seed in kg.

4.4 .Which perennial crops do you practice?

Coffee=_____ Mango=_____Gesho=_____Chat=____Others_____

V. Labour Use

5.1. How long you and your family do spends on average on each of the following activities during 2017/18?

S/N	Activities	Number of Family Participated	
		Men	Women
I	**Agriculture**		
1	Land preparation		
2	Ploughing		
3	Sowing		
4	Weeding		
5	Harvesting		
6	Treshing		
7	Transporting		
8	Marketing		
9	Vegetable Gardening		
10	Coffee planting		
11	Coffee processing		
12	Livestock Herding		
II	**Domestic Work**		
1	Cleaning of House		
2	Milking		
3	Fetching Water		
4	Grain mill		
5	Food preparation		
6	Child care		
7	Wage work		
8	Fire wood collection		
9	Washing of cloth		

5.2. Have you encountered labour shortage during last production years? 1=Yes 2=No if yes answer question # 5.3 and 5.4 otherwise pass

5.3. If yes, for what specific activities have you encountered labour shortage? _____

1=Cultivation of land 2=Weeding 3=Crop harvest 4=Threshing 5=others (Specify)

5.4. If yes, how did you overcome problems posed by labour shortage? 1=Hiring labour 2=Assistance from relatives 3=Traditional labour pooling system 4= was not able to overcome the problem 5=others (specify) _____

5.5. If you hired labour, how many man-days during the last year? _____

5.6. How many type of labour you hired? Male _____ Women_____

5.7. How much do you pay annually if you rent in labour for crop production? _____birr

5.8. What is an average price of daily labour? _____birr

5.9. According to your perception who works longer hours both in agriculture and other tasks? 1=Male ___hours 2= Women____hours

VI. Use of oxen

6.1. How many oxen of your own do you use for ploughing? _____

6.2. For which activities did you use oxen? 1=Ploughing 2=Threshing 3=others

6.3. Do you face oxen shortage during your farming practices in last production period? 1=Yes 2=No

6.4 .If yes, how did you cope up with such shortage? 1=Pairing with others 2=Exchanging labour for oxen 3=Using oxen of relatives 4=Hiring oxen 5=Others (specify)

6.5. For how many days did you hired oxen? _____days

6.6. If you hired oxen, how much did you pay per day? _____Birr, _____ in kind (specify)

VII. Livestock production

7.1. Do you have livestock? 1=Yes 2=No

7.2. If yes, how many livestock have you owned?

Type	Number at present	Income obtained, if sold any in last year (birr)	Who owned? 1=Men 2=Women 3=Family
Oxen			
Cow			
Young bulls			
Calves			

Heifers			
Sheep			
Goats			
Chicken			
Horse			
Mule			
Donkey			

7.3. Number of milking cows in 2017/18? _____, Milk produced per day_____ Liter, lactation period in month_____, percentage of milk sold during 2017/18 _____%,

7.4. What income have you earned from sale of livestock production in 2017/18?

Type	Unit	Amount Produced	Amount sold	Unit price (birr)	Remark
Milk	Litre				
Butter	Kg				
Egg	Kg				
Hide and skin	Number				
Others (Specify					

7.5. What type of animals is sold by men in your locality? _____

7.6. On which livestock do women have the right to sale in your area? (List according to their importance) _____

7.7. Do women have the right to own livestock? 1=Yes 2=No

7.8. If no, why? (Explain the reason) _____

VIII. Agricultural Extension Services

8.1. Did you participate in extension program in 2017/18? 1=Yes 2=No

8.2**.** Did you have an extension contact? 1=Yes 2=No

8.3. If yes, frequency of contact? (Total number of visit per year)_____

8.4. If no, why? 1=No DA nearby 2=Unknowingly 3=No need for service 4=others

8.5. If yes, what was/were the types of extension message given by the agents?

1=Use of fertilizer 2=Natural resource advice 3=Animal production advice

4=Use of credit 5=Home economics 6=Use of insecticides/herbicides 7=others (specify)

8.6. Are there women development agents? 1=Yes 2=No

8.7. Who do you prefer? 1= Male agent 2=Women agent and why for? _____

8.8. For how many years have you participated in extension program? _____Years

8.9. How far from your house the DA center? _____Km _____hours

8.10. Have you attended farmer's training within last years? 1=Yes 2=No

8.11. Have you ever attended demonstration or any other trials? 1=Yes 2=No

8.12. Have you ever hosted field day or demonstration trial? 1=Yes 2=No

8.13. What are your sources of finance for purchase of agricultural inputs? 1=Crop sales 2=livestock sales 3=Off-farm activities 4=Credit 5=others

8.14. Do women have access and control over agricultural inputs in the area? 1=Yes 2=No

8.15. If no, why? (Explain) _____

IX. Financial Services

9.1. Is there any credit giving institution in the area? 1 = Yes 2 = No

9.2. If yes, what are they? _____

9.3. Did you receive credit services within last one year? 1 = Yes 2 = No

9.4 .If yes, from where do you get the services? 1= OCSSCO/IMF 2 = NGO 3 = Local Money lender 4 = VSLA 5 = Services cooperative 6 = Friends and relatives 7 = others

9.5. If no, why? 1 = High interest rate 2 = Lack of collateral 3 = No credit services 4 = No need of credit 5= others (specify)

9.6. What was the amount you got from credit services during the last one year? _____Birr

9.7. For what purposes you have taken the credit 1 = Purchase of seed 2 = Purchase of plough oxen 3 = Purchase of agricultural inputs 4 = Purchase of household food 5 = Purchase of family requirements 6 = others (specify)

9.8. Do you repay the loan on time? 1 = Yes 2 = No

9.9. If no, why? _____

9.10. Do women have control over the credit they borrowed 1 = Yes 2 = No

9.11. If yes, why?_____

9.12. What are the major problems relating to credit services?_____

9.13. Comparing (1) male and (2) women, who is getting credit services better in your area? Why? _____

X. Sources of Income

10.1**.** What is your source of income? 1=Sale of crops 2=Sale of livestock 3=Off-farm income 4=Remittance 5=others

10.2. What was the average price for major crops during the last years?

No	Type of crops	Average price (birr) per Qt	Remark
1	Coffee		
2	Maize		
3	Niger		
4	Teff		
7	Millet		
8	Sorghum		

10.3. What is your total food need in a year? _____Qt

10.4. Do you consult your family when you want to spend money? 1=Yes 2=No

XI. Access and Control over Resource

11.1. Access and control over resources in the family member?

Resources/Services	Access		Control	
	Men (use code A)	Women (use code A)	Men (use code A)	Women(use code A)
Land				
Farm tools				
Farm inputs(seed,fertilizer,pesticides,etc)				
Oxen				
Horse/donkey				
Cow				
Sheep/Goat				
Chicken				
House				
Grain				
Credit				
Livestock products				

A *, 1=yes, 2=No

XII. Decision Making

12.1. Do women participate in household decisions 1 = yes 2 = No

12.2. Who decide on the following activities?

S/N	Activities	Men (use code Z)	Women (use code Z)	Others (Specify)
1	Crop calendar			
2	Sale of food crops			
3	Use of income			
4	Sale of cash crops			
5	Use of agricultural inputs			
6	Use of improved seeds			
7	Sale of livestock			
8	Sale of fixed assets			

Z* A=Not decide B= Less decide C=More decide D= Most decide

12.3**.** Do you participate in any leadership position in your kebele? 1 = Yes 2 = No

12.4**.** If yes, explain your responsibility_____

12.5. If no, why? _____

12.6. Are you a member of any formal organization? 1 = Yes 2 = No, What? _____

12.7. Have you taken any gender related training/education? 1 = Yes 2 = No

12.8. Who inherit assets of household if husband died 1 = Wife 2 = Son 3 = Daughter 4 = other (specify)

XIII. Market Accessibility

13.1. Where do you sell your agricultural products? 1= on farm 2=Local markets 3=others

13.2 .To whom do you sale your agricultural products? 1=Wholesaler 2=Retailer 3=Consumers 4=others

13.3. Who usually go to the market from your family? 1=Male 2=Women and name of market_____

13.4 .How far is the nearest market? _____Km _____Hours

13.5. How far is the longest market? _____Km _____Hours

XIV. Others

14.1.What are the harmful traditional practices in your locality? _____

14.2. Is there a polygamy act in your area? 1 = Yes 2 = No

14.3. Number of days you were out of farm work for social engagements within last one year? _____days

14.4 .How do you evaluate the number of women headed number over time 1 Increasing 2 = Decreasing 3 = Constant

14.5 .If increase, why? _____, If decrease why _____

14.6. Is there grain mill in near-by? 1= Yes 2 = No, distance _____km, time take walking _____hours.

14.7. What type of house you have? 1 = Corrugated iron sheet 2 = grass house 3 = others

XV. Chick List for Focus Group Discussion

1. What is the meaning of gender?

   _____

2. What are the causes of female headed in the area?

   _____

3. How do you estimate the number of women headed number over time?

   _____

4. When and where you obtained your land?

   _____

5. Do you practice soil and water conservation activities?

   _____

6. Do women have the ability to direct on the utilize of land?

   _____

7. As to your insight who works longer hours both in agriculture and other tasks? (men or women)_____

8. What type of animals is sold by men in your locality?

   _____

9. Do women have the right to sell livestock in your area?

   _____

10. Who have the responsibility to manage the house?

    _____