Smallholder farmers' contract farming as a response to climate change and variabilities in Ethiopia: Empirical analysis from Kofele and Adama Districts of Oromia Regional State

A Dissertation Submitted to the Center for Environment and Development Studies, College of Development Studies

Presented in the Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Ph.D.) in Development Studies (Environment and Development)

Addis Ababa University

Addis Ababa, Ethiopia

August 2020

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Getachew Megersa Bekele

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Supervisor

Engdawork Assefa (Ph.D) Associate Professor, Addis Ababa University, Ethiopia

Addis Ababa University

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Declaration

I, Getachew Megersa Bekele, declare that this piece of PhD dissertation entitled **"Smallholder farmers' contract farming as a response to climate change and variabilities in Ethiopia: Empirical analysis from Kofele and Adama districts of Oromia Regional State**" is my original work and that it has not been submitted to ad presented and will not be presented to any other university for similar or any other degree award.

Researcher's Name	**Date**	**Signature**
Getachew Megersa Bekele	_____	_____

Place _____

Date of Submission_____

This dissertation has been submitted for the examination with my approval as University Supervisor.

Supervisor's Name_____

Signature_____

Date_____

DISSERTATION APPROVAL

ADDIS ABABA UNIVERSITY, SCHOOL OF GRADUATE STUDIES

This is to certify that Getachew Megersa Bekele prepared this thesis entitled: **"Smallholder farmers' contract farming as a response to climate change and variabilities in Ethiopia: Empirical analysis from Kofele and Adama districts of Oromia Regional State**", submitted in fulfillment for the requirements for the Degree of Doctor of Philosophy (Environment and Development Studies) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Chairperson. Examining Committee	Signature	Date
Fitsum Hagos	Mohammed M.	01.10.20
External Examiner	Signature	Date
Feyisa Lemessa		30.09.20
Internal Examiner	Signature	Date
Kassahun Asseffa		30.09.20
Advisor	Signature	Date

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Certification

This is, to certify that the thesis entitled **"Smallholder farmers' contract farming as a response to climate change and variabilities in Ethiopia: Empirical analysis from Kofele and Adama districts of Oromia Regional State**", submitted to Addis Ababa University, College of Development Studies, Center for Environment and Development Studies for the award of Degree of Philosophy in Development Studies (Environment and Development). This piece of research work is genuine, carried out by Getachew Megersa Bekele under my guidance, and accepted standards with respect to originality and quality.

Thus, I hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree or diploma with respect to this dissertation.

Advisor's Name	**Date**	**Signature**
Engdawork Assefa (PhD)	30.09.20	

Chair, Center for Environment and Development Studies

Acknowledgements

First, I sincerely provide my deepest gratitude and praise to my Lord, Jesus Christ for helping me in accomplishing this task.

Second, I love to extent my special thanks to my supervisor, Engdawork Assefa (PhD) for his unreserved guidance and support he gave me in the course of the paper work. I am also very grateful for Addis Ababa University and Jigjiga University for providing me financial support for the study. Moreover, my appreciation goes to former Chairpersons: Feyera Senbeta (Ph.D), Ermias Teferi (Ph.D), Tesfaye Zeleke (Ph.D), respectively and current chairperson: Tamirat Tefera (Ph.D) of the Center for Environment and Development Studies for their commitment in running the Ph.D program effectively.

Third, I am also grateful to all experts, officers, Kofele and Wonji-Shewa Sugar Factory officials, Cooperative Union managers in providing the data required for this study. In addition, I like to thank my brothers Beruk Gizaw, Debela Tesfaye and my friend Abiso Lanbebo who realized the publications of articles on journals by providing financial support. I also extend my appreciations to Addis Ababa University, College of Development Studies, Center for Environment and Development Studies Teaching and Administrative staffs in providing me all the necessary cooperations to finalize the study.

Fourth, my sincerely thanks also directed to my beloved families, especially my wife, Medhanit Bekele for taking care of our children and encouraging me to thoroughly edit and organize this manuscript. Moreover, I extend my heartfelt thanks to my beloved son and daughters: Yonatan Getachew, Yanet Getachew and Maranata Getachew for the love they share that strengthen me to pursue my work.

Last, but not least, I love to express my appreciation to Tesfaye Deme (Ph.D) and all my classmates who helped and contributed to the completion of this thesis work.

Dedication

This piece of Ph.D work is dedicated to smallholder farmers engaged in Malt Barley and Sugarcane contract farming arrangements in West Arsi Zone of Kofele District and East Shewa Zone of Adama District, respectively. In spite of their limited access to modern agricultural technologies, knowledge and skills, they tried their best to engage in such agribusiness arrangements and earn their livelihood.

Smallholder farmers' contract farming as a response to climate change and variabilities in Ethiopia: Empirical analysis from Kofele and Adama districts of Oromia Regional State

General abstract

This study aims to investigate CF as a response to climate change and climate viabilities in Kofele and Adama Districts of Oromia Regional State. It specifically conducted to assess the perception of SHFs' on CF as climate change adaptation strategies (CCASs) and to assess the impacts of CF on net-income. It also examined the factors affecting adoption of CCASs, employed and explored the challenges and opportunities of CF in the study areas. This study employed a concurrent or mixed research approach: quantitative and qualitative approach and collected data from 368 households who were selected purposively and proportionately through random sampling. The study relied on household survey, FGDs, KIIs, field observations, case histories and secondary documents to collect data. The Likert Scale Measurement (LSM) was used assess the perception of SHFs' on CF as CCASs and employed Propensity Score Matching (PSM) to assess the impacts of CF on net-income earned by SHFs'. Furthermore, the study relied on the Multinomial Logit Model (MNL) to examine the factors of adoption of CCASs. The Principal Component Analysis (PCA) was used to identify and examine the major challenges in CF. Further, analysis of opportunities, challenges of CF were qualitatively described, and case histories were used in the analysis. SPSS Version 20 Software, Stata Version 14 software, Venizim Software 6.3 were used to enter and organize data. Moreover, the study organized and analyzed metrological data through Microsoft Excel and used Arc GIS 10.1 for mapping the study locations. For the perception studies, 46.2% (63) of farmers involved in Malt Barley at Germama were belongs to average perception category followed by those 33.9% (46) and 19.9% (27) categorized under better and poor perception category, respectively. Regarding SHFs involved in Sugarcane outgrower, 81.5% (189) and 18.5% (43) were in poor to average perception category, respectively. The Propensity Score Matching (PSM) and the average treatment effect (ATT) techniques such as Nearest Neighbour Matching (NNM), Radius Matching (RM), Kernel Matching (KM) and Stratification Matching (STM) revealed that the sampled households' heads that participated in CF arrangements experienced a decrease in net-income by 24.3%, 29.6%, 30.2% and 28.3% as measured by NNM, RM, KM and STM, respectively. The overall impact of the treatment effect measurement on the net-income revealed that the net-income of the participant SHFs CF faced a reduction of net-income by 28.1% on average. The MNLM results revealed that age of household head, educational status of household head, family size, livestock holding, access to credits, access to agricultural technologies and metrological information significantly affects the adoption of various CCASs. Moreover, the PCA results revealed that among all the variables in the five dimensions, lack of storage facilities for agricultural produce, poor market linkages, and shortage of trainings and other technical assistance, delay in financial services, poor pricing strategies and delay in payments exhibited the factor loadings of 0.97, 0.92, 0.83, 0.82 and 0.72, respectively. It explained the variation by 61.4% of the total variance in the 14 observed constructs. Therefore, we suggested that the policy practitioners should design a policy and legal framework on CF arrangement and scrutinize the overall CF processes. Consequently, the findings also implied that addressing the major factors challenging CF and maximize those opportunities in CF is essential. To this end, the concerned parties should work on strengthening the knowledge base through education, field trainings, and proper implementation of agronomic practices and ensuring sustainable livelihood.

Keywords: *Challenges, Contract farming, Climate change adaptation, Net income, LSM, Opportunities, PCA, PSM, MNL, SPSS, Stata.*

List of published papers:

1. Megersa, G. & Assefa, E. (2019). Perception of farmers' on contract farming as a response to climate change adaptation in Ethiopia: empirical evidences from two Districts of Oromia Regional State. *Journal of Sustainable Development in Africa*: Volume 21, No.4, 2019, *Published by Clarion University of Pennsylvania, Clarion. Pennsylvania: http://www.jsd-africa.com/.*(Published)

2. Megersa, G. & Assefa, E. (2019). The pursuit for enhancing the net income and sustainable livelihood for smallholder farmers: the case of contract farming in Oromia Regional State, Ethiopia. *Journal of Sustainable Development in Africa*: Volume 21, No.4, 2019, *Published by Clarion University of Pennsylvania, Clarion. Pennsylvania: http://www.jsd-africa.com/.*(Published)

3. Megersa, G. & Assefa, E. (2020). Sustainable agricultural solutions for overcoming climate change: adoption of contract farming as climate change adaptation strategies in Oromia Regional State, Ethiopia. *Journal of Sustainable Development in Africa*: *http://www.jsd-africa.com/, (*Published).

4. Megersa, G. & Assefa, E. (2020). "Contract farming in enhancing livelihood of smallholder farmers' in Ethiopia: an empirical evidences on challenges and opportunities from Malt Barley and Sugarcane contract farming practices.", *Journal of Sustainable Development in Africa*: *http://www.jsd-africa.com/: Under review*

Table of Contents

List of Figures

List of Tables

List of Acronyms

AIEI	African Impact Evaluation Initiative
ATT	Average treatment Effects
BBM	Broad Bed furrow Maker
BTS	Bartlett Test of Sphericity
CCASs	Climate Change Adaptation Strategies
CF	Contract Farming
CIA	Conditional Independent Assumption
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Agency
DFID	Department for International Development
ECX	Ethiopian Commodity Exchange
EHPEA	Ethiopian Horticulture Production Enterprise Agency
ESE	Ethiopian Seed Enterprise
ETB	Ethiopian Birr
EU	European Union
FAO	Food and Agriculture Organization
FBSPMS	Farmer Based Seed Production and Marketing Scheme
FGDs	Focus Group Discussions
G.C	Gregorian calendar
GDP	Gross Domestic Product
GOs	Government Organizations
IAC	Inter Academy Council
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
IIA	Independence of Irrelevant Alternative

KIIs	Key Informant Interview
KM	Kernel Matching
KMO	Kaiser Mayer Olkin
MNL	Multinomial Logit Model
MoFED	Ministry of Finance and Economic Development
NGOs	Non-Governmental Organizations
NMA	National Metrological Agency
NNM	Nearest Neighbor Matching
OATA	Oromia Agricultural Transformation Agency
OECD	Overseas Economic Commission Development
P.L.C	Private Limited Company
PAs	Peasant Associations
PAs	Peasant Associations
PCA	Principal Component Analysis
PNP	Participant and Non-Participant
PSM	Propensity Score Matching
RM	Radius Matching
SHFs	Smallholder Farmers
SLF	Sustainable Livelihood Framework
SPSS	Statistical Packages for Social Science
STM	Stratification Matching
SWC	Soil and Water Conservation
TLU	Total Livestock Unit
USAID	Unites States Agency for International Development
VIF	Variance Inflation Factor

Chapter 1_____

1. General introduction

1.1 Background of the study

In early 21st Century, contract farming (CF) is becoming an agricultural commercialization tool in different parts of the world (FAO, 2013 and USAID, 2012). This type of agricultural system is mainly focuses on the production of high value commercial crops such as Chip Potatoes, Barley, Malt Barley, Chick Peas, Lentils, French Beans and other horticultural crops (Wainaina *et al.*, 2012; Minot, 2011 and Bijman, 2008). CF as a commercialization of agricultural production takes place through large scale or small-scale schemes. It plays a key role in improving export value, knowledge transfer and serve as a means for achieving food security goals (Teemu and Carmen, 2018; Gebreselassie, 2006).

These days, CF has been a form of agricultural practice in many sub-Saharan African countries including Ethiopia (Nijhoff and Trienekens, 2012; Prowse, 2012 and Minot, 2011). It is one way of increasing agricultural production (Wendimu *et al.*, 2017), where large number of smallholder farmers (SHFs) depends on it as a source of earning their livelihood in different corners Africa (Prowse, 2012). Besides, it also plays a pivotal role in improving farming system through access to factors of production (USAID, 2012) and serve as CCASs and as coping for climate variabilities. Moreover, it is also one form of attracting Foreign Direct Investment (FDI) especially in developing countries (USAID, 2012 and Baumann, 2000) in Africa in general and Ethiopia in particular to alleviate the poverty situation of SHFs (FAO, 2017; Nijhoff and Trienekens, 2012). Furthermore, it provides SHFs with new technologies, markets, secured inputs, fair pricing mechanisms and a mechanism to foster a country's economic growth through earning foreign currency (Da Silva, 2005; Kirsten and Sartorius, 2002).

Furthermore, CF ensures self-sustained development and creates market access for SHFs' agricultural products (Kirsten and Sartorius, 2002). SHFs participation in CF scheme increases income and reduces poverty, which ultimately improve the wellbeing (USAID, 2012). As discussed in Parwez (2014), CF has been economically viable with lower costs to SHFs who are engaged in a contract scheme. It has been serving as a tool for development, long before the

recent 'boom' in foreign investment to the African continent (Watts, 1994 & 1992). Most recently, the popularity of CF as a 'smallholder-inclusive business model' has become one of the methods of lifting up the livelihood of SHFs.

An empirical study done by FAO (2015) on CF and USAID (2015) in its policy brief on "Building an Enabling Environment for Contact Farming Success" evidenced that the engagement of SHFs in CF has increased their income up to 44 per cent. This transforms the agricultural systems from very traditional subsistence to modern market oriented cash crop production. It was emphasized in (FAO, 2015; USAID, 2015; Barret *et al.*, 2012 and Arthur, 2005) that CF is aimed to address socio-demographic conditions, financial mobility, consumer demands, markets competitions, liberalization of trade and other favorable conditions. It also allows SHFs to have access to improved agricultural technologies and infrastructure all over the globe (Teemu and Carmen, 2018 & Bijman, 2008).

Most recently, the Government of Ethiopia established Agricultural Transformation Agency (ATA) and considered CF as an important tool of involving SHFs in value chain and modern agricultural practice (Nijhoff and Trienekens, 2012; ATA Annual Report, 2012). Cognizant of these facts, smallholder commercialization is serving as an entry point for structural transformation through inclusive growth causing a build-up of purchasing power by millions of SHFs, which subsequently re-spend, re-cycle more money through the economy (Agricultural Commercialization Cluster Planning Workshop, 2015). These ultimately reduce the hazards and stresses induced because of CC. It also fuels the demand for employment growth in non-farm sectors, which in turn increases the demand for food and other farm products that eventually creates market linkages between the rural and urban locations and increases income of the households (FAO, 2012). Moreover, to realize the agricultural transformation, the Ethiopia Investment commission has designed an investment policy that aimed to attract FDI, which maximizes mutual benefits and sharing risks by both the agro-processing firm and the SHFs engaged in CF (Ethiopian Investment Commission, 2015).

Despite the favorable investment climate, SHFs livelihoods in Ethiopia are vulnerable for the climate change (CC) and climate variability induced hazards such as drought and flood (Amsalu and Alebachew, 2009; Getachew, 2010). To overcome these conditions, SHFs have been

engaged in modern agricultural practice to adapt to CC hazards through different CC adaption practices including CF practices.

The researcher conducted this study in two study areas. In West Arsi Zone of Kofale District, Malt Barley is the dominant crop and one of the CF scheme attracting Brewery industries such as Heineken, Meta Diego and Asella Malt Factory as well. Moreover, Wonji Shewa Sugarcane CF scheme is the only out grower scheme, which is also the focus of this study.

The study was undertaken on "Contract farming as response to climate change and variabilities in Ethiopia by taking empirical evidences from West Arsi Zone, Kofele District and East Shoa Zone, Adama districts in the context of SHFs' engaged in Malt Barley and Sugarcane CF arrangements", respectively. The study examined the differences among the participants and non-participants, the determinants factors that affected CF arrangement, the challenges and opportunities of CF and climate change adaptations. Consequently, it would provide policy recommendations that serve as an input for decision makers, policy experts and indicates future research areas based on the findings of the study.

1.2 Statement of the problem and rationale of the study

Agriculture is the main source of livelihood for 85% SHFs' and contributing around 41.6% of the GDP in Ethiopia (Mulugeta, 2013; CSA, 2011b). SHFs agriculture is predominantly rainfed, and sensitive to CC induced effects (Deressa *et al.,* 2008). Moreover, land fragmentation, land shortages, large family size and increasing vulnerability to hazards characterizes SHFs' agriculture were the major bottlenecks of agriculture in Ethiopia (Mulugeta, 2013). Surprisingly as indicated that SHFs occupy 54.2 % of cultivated land (CSA, 2011a), whereas commercial and large-scale farming accounts for 4.6 % of total cultivated area and 17.9 % of annual production, respectively. However, CC has already exerted a profound effect on Ethiopian SHFs' livelihood, who are the most vulnerable to climate change hazards and food insecure because of their low adaptive capacity (IPCC, 2014; Conway *et al*., 2007; Thornton *et al.*, 2006). They are the most marginalized, vulnerable segments of population (Temesgen *et al.,* 2008) engaged in subsistence farming in general, and CF schemes in particular in Ethiopia (FAO, 2013; Kirsten and Sartorius, 2010). Accordingly, various issues underpin to undertake this study in the study areas by considering the following justifications.

First, as evidenced in Nijhoff and Trienekens (2012), there are very few researches conducted on CF practices as a systematic agricultural practice in Ethiopia; no researches done on CF business arrangements in enhancing adaptations to climate change and as a better way in diversification of livelihood choices and the studies overlooked by policymakers and development practitioners.

Second, even though there are many studies conducted in the field of CF practices in different corners of the world, there are little evidences documented in Ethiopia. For example, Nijhoff and Trienekens (2012) conducted their study on "critical factors for contract farming arrangements: the case of Ethiopia". However, it lacks comprehensiveness in considering and covering other aspects of CF (i.e. perception on CF arrangements, impacts of CF, major challenges and opportunities of CF and so on) and CC hazards. Ayelech (2012 and 2010) has also done exploratory studies on "contract farming in Ethiopia: an overview with focus on sesame value chain, and "contract farming: business models that maximizes the inclusion of and benefits for SHFs in the value chain", respectively. She confined her study to explore Sesame value chain, where the marketing is run under the guidance of Ethiopian Commodity Exchange (ECX). USAID (2012) also conducted an assessment on "contract farming and policy options in Ethiopia". This study focused on policy briefing aspect. It failed to examine CF arrangement and its relations to the climate change adaptations and climate variability coping (CVCSs) strategies. For these reasons, all these studies did not explicitly discussed about Malt Barley and Sugarcane CF practices and contributions of CF to CCASs and CVCSs. All of these studies were restricted to the analysis of value chains of limited crops such as Sesame, Oil and pulses and Wheat. It never touched the aspects of Malt Barley and Sugarcane CF in Ethiopia and these requires further investigations.

Third, there was no research done that tried to look into the importance of CF as an agricultural practice in curbing the changing climate and implications of these practices on livelihood of SHFs. For example, an empirical study by Minot (2011) only dealt with the overall aspects of challenges and opportunities of CF in Africa, but it did not relate the challenges and opportunities with CCASs and failed to consider it as a strategy to address climate change induced hazards. Barret *et al.* (2012) also conducted a study on "SHFs participation in CF Schemes". They analyzed the participation situation and benefits SHFs earned from CF. They did not mention how CF contributes in CCASs and improve the livelihood of SHFs.

Consequently, none of these studies studied impacts of CF on SHFs net income in Ethiopia and the linked of CF practices to CC adaptation practices in the context of Ethiopia in general and study areas in particular.

Fourth, there are common ground for CF practices and CCASs that SHFs employed to build their capacity to overcome climate change hazards. For instance, farmers can get access to farm inputs such as credit, fertilizers, agro-chemicals, technical expertise (Minot, 2011 and Bijman, 2008) and other services that broaden the base for better CC adaptation practices because of their participation in CF schemes. These boldly imply that SHFs can very easily use these resources to raise their productivity and increase their income (Prowse, 2012), which directly or indirectly contribute to curb CC induced hazards and improve livelihood of SHFs. On the other hand, CF creates an opportunity for agro-processing firm to acquire land and labor without displacing SHFs from their farmland (Bijman, 2007). Thus, there is a need to examine these relationships in the context of Malt Barley and Sugarcane CF arrangements in the study locations.

Fifth, in Ethiopia there are also few studies conducted on CF schemes itself as pinpointed in Nijhoff and Trienekens (2012). All the studies as discussed above lack comprehensive understanding of the problem under investigation. On the other hand, there are various studies conducted in the area of CCASs in different parts of Ethiopia. For example, an empirical study by Alemayehu (2015) entitled "Strategies to adapt to climate change in the Central Rift Valley of Ethiopia: landscape impact assessment for on-farm adaptation" explicitly analyzed farm level adaptation to CC by downscaling GCM models to locally relevant climate data required for impact models. However, it failed to establish linkages of modern agricultural commercialization (i.e. CF practices) with that of CC adaptations and failed to indicate the implications to overall farmers' livelihood.

Nevertheless, most of the researches tend to focus either on CF or climate change adaptation; they did not explicitly take into account the linkages between CF, CCASs and the implications on livelihood of SHFs. Consequently, this research work is expected to fill these knowledge gaps and helps the researchers, policymakers and development practionars to have deeper insights into the interface between CF practices and CF as CCASs and CVs in the study areas.

To fill these gaps, this research employed in-depth investigation of the problem in the light of sustainable livelihood framework in two study areas specific to CF business arrangements (i.e. Malt Barley and Sugarcane CF arrangements). Furthermore, it examines the perceptions of SHFs on various aspects of CF arrangement: as an agricultural commercialization, its impacts on net-incomes, the determinant of adoption of CCASs, the challenges and opportunities of CF in the study areas. Therefore, the main purpose of this study was to investigate the differentiated CF arrangements, CCASs in the study areas and add to the literature academic knowledge, and recommend some policy implications that would address problems related to CF arrangement and ways of enhancing CC adaptation options.

1.3 Literature review

1.3.1 Contract farming: concepts and perceptions

Different scholars defined CF differently based on the type, models, objectives and specifications followed by the contract scheme. For example, Eaton and Shepherd (2001) defined CF as an agreement between one or more farmer(s) and an agri-business firm for the production and supply of agricultural products under forward agreement, frequently at predetermined prices. Available literature shows that different scholars conceptualized CF differently based on different contexts. For example, Minot (2011 and 2007) defined CF as "an agricultural production carried out according to a prior agreement in which the farmer commits to producing a given product in a given manner and the buyer commits to purchasing it". On the other hand, Rehber (2007) and Singh (2002) argued that CF focuses on some specified conditions of production; supplying it through forward contracts and the agreement made between the farmer and the firm may be written or oral. But, Prowse (2012) stated CF in his review article entitled "Contract Farming in Developing Countries: A Review", more or less shared the definition forwarded by Rehber (2007) that CF takes into account two conventional type of CF.

First, it tried to incorporate market specification contract where market outlet for farmers, time of sale and price structure is set especially for those perishable items. Second, it takes into account the resource-providing contract, whereby certain inputs and technical support is provided to the producer by the firm (Prowse, 2012). However, these two cases failed to consider the communication skills of the farmers engaged in CF and the specific standards required to meet by SHFs. The two definitions, however, failed to explain the overall CF situations, the language of communication in writing the contract agreement and the level of farmers understanding of the nature of contract itself.

As illustrated by Eaton and Shepherd (2001), the contract arrangement depends on the depth and complexity of the arrangement with special focus on following three areas:

(i) **Market provision:**

The growers and buyers agree on terms and conditions for the future sale and purchase of a crop or livestock product;

(ii) **Resource provision:** In conjunction with the marketing arrangements the buyer agrees to supply selected inputs, including on occasion of land preparation and technical advice; and

(iii) **Management specifications:** The grower agrees to follow recommended production methods, inputs regimes, cultivation and harvesting specifications.

The growing demand for market liberalization, globalization as explained in Eaton and Shepherd (2001), the shift in consumer tastes, ever increasing climate change risks and the change in the role of government towards more market-based solutions are some of the major driving forces in changing patterns of agricultural production through adoption of various technologies (Mutandwa *et al.,* 2007). This in turn paves the way for introduction and use of such technologies and strengthens the importance of vertical coordination and institutional roles (USAID, 2015; Ayelech, 2010). The more quality and timing of important factors, the more specific institutional arrangements (DFID, 2014) like CF become necessary to respond to the demands of the growing population as efficiently as possible. In addition, more importantly, it plays a pivotal role to address the effects of climate change and to enhance CC adaptation processes in the face of climate change hazards. Moreover, as evidenced in Bijman (2008) CF serves as an instrument in linking SHFs to both domestic and foreign markets and thereby reduces poverty. Furthermore, FAO (2013) emphasized that CF is now regarded as one of the components of integrated rural development strategy and of dynamic partnerships whereby SHFs can obtain access to markets, as well as to technological and managerial assistance thereby helping SHFs to adapt to climate change.

In developing countries like Ethiopia, trade takes place through the exchange of items (agricultural products) in open markets, which demands high transaction costs and risks arising from uncertainty of quality, quantity and price of the agricultural products. In such markets, large number of buyers and sellers, which meet in time and space with imperfect information about product quality, quantity and price, gives rise to opportunistic behavior (Williamson *et al.*, 2004). In the case of CF, these market imperfections can significantly be reduced (Minot, 1986; Bijman, 2008) and help to diversify livelihood choices, which in turn reduce the vulnerability situations of SHFs in the advent of climate change, climate variabilities and other long-term weather hazards. CF as an agricultural practices and agricultural technology is a form of vertical coordination, which lies between spot market and full vertical integration. It can range from a

simple verbal agreement on amounts to be delivered up to detailed written agreements that include quality, quantity, timing, input specification, method of delivery, price formula, payment method and so on (USAID, 2015; FAO, 2013; Prowse, 2012; Bijman, 2008; Minot, 2007 and Rehber, 2007). However, experiences of several countries indicate that using a contract practices as an agricultural technology is not always be successful per se. There are many reasons for the failures of CF schemes. The very nature of the contract itself, being prone to manipulation, absence of mutual commitment between contract parties; absence of effective enforcement mechanisms, use of a 'one size fits all' approach, lack of government support, poor communication, and/or simply just by bad luck like a natural calamity (Ayelech, 2012 and Ayelech, 2010). Besides, as evidenced in Mutandwa *et al.* (2007) culture of the society plays a pivotal role for the success and failure of the contract arrangements.

The broad literature review on CF emphasized about five hypotheses helping scholars to understand CF practices: (1) SHFs tend to exclude the dualistic agrarian economies, but enjoy greater participation rates when inequality in landholding sizes is low. (2) Contract participants display significantly higher incomes than non-participant farmers do (as this was a key "success" criterion); although, there is a need to be cautious (Prowse, 2012). While recent econometric work has addressed selection bias at the household level, there has been no discussion in the literature about controlling for bias when selecting initiatives to evaluate. In other words, there is little surprise that many contact-farming initiatives show increased incomes for participants compared to non-participants (*Ceteris paribus*), for if they had *not* raised incomes they may well have collapsed.

(3) Crops that exhibit a high degree of variation in quality, perish easily, are hard to grow, or command a higher price per kg, may well be more likely grown based on contract terms. However, there is also some evidence to suggest that ordinary and standard commodities could be grown successfully via CF. (4) Large body of literature shows that large firms usually enter CF arrangements. (5) CF initiatives are most likely to supply markets in developed countries and supermarkets within urban centers in developing and emerging economies (Bijman, 2008). Interestingly, Prowse (2012) tried to compare the "successful" schemes with that of "failed" One. He concluded that CF can operate successfully in a very wide ranges of socio-economic conditions, including conflict-affected countries, fragile states and Least Developed Countries

(as CF is one response to overcoming the very high transaction costs in the thin and imperfect markets commonly found in such contexts) (USAID, 2015 and Minot, 2011).

1.3.2 Contract farming perceived as an institutional set ups

CF could be a reliable way to produce quality products and has been the potential to be adopted extensively throughout countries like Ethiopia to meet domestic product requirements and generate export market potential (Väth and Gobien, 2014). Nevertheless, CF is not the only mechanism to solve all production and marketing related problems, but also it could be a way to minimize problems of capital, quality inputs; modern technology adoption and output marketing for small farms (Prowse, 2012 and Bijman, 2008). At present, CF system has provided access to quality input and modern technologies by minimizing transaction costs within the value chains (FAO, 2013). Better institutional development may make SHFs are more desirable partners for firms. Because, many transaction costs that prevent them from contracting are a result of weak institutional arrangements. For example, if markets for information were better develop farmers could directly access important production information (Ilembo et al., 2012; Prowse, 2012; Eaton and Shepherd, 2001) rather than relying on the firm and its high fixed costs of extension services.

Some of the barriers to the participation of smaller farmers in CF systems could reduce the changes in the institutional structure of CF in particular and agricultural policy of a country in general. It is suggested that the increase in farm production in CF and develop the industry, the government and other private agribusiness firms should take initiatives to establish an effective and well-organized CF system. However, successful CF implementation depends on the coordination and collaboration of both integrator and contract farmer (Prowse, 2012). Favorable attitudes of the government towards the provision of incentives and policy supports are also essential factors for the success of CF adoption as best agricultural practices.

CF if managed very well, it could foster commercialization of farmers' produce in a way that investors also benefit from the local resource (Väth and Gobien, 2014). CF has many positive effects and negative effects on the livelihood of SHFs. The positive effects for instance as indicated in (Bellemare, 2012; Warning and Key, 2002; Bolwig *et al.*, 2009; Minten *et al.*, 2009 and; Porter and Phillips-Howard, 1997) increase in income and productivity gains. They continued their explanations that since CF can lead to risk sharing between the processor and the

producer. It also reduces price and income volatility (Minten *et al.*, 2009; Bolwig *et al.*, 2009), which shows positive spillover effects for non-contract crops and for adjacent non-contract farmers (Bellemare, 2012; Minten *et al.*, 2009; Govereh and Jayne, 2003; Warning and Key, 2002). Moreover, reduces market imperfections by providing credit, inputs, technology and information and hence lower transaction costs (Deininger, 2011; Grosh, 1994; Key and Runsten, 1999).

On the negative side, CF that is interpreted as just a tool for the investor to extract rents without positive effects for landowners (Porter and Phillips-Howard, 1997; Little and Watts, 1994). From this, it is clear that unequal power relations can make producers (SHFs) more vulnerable, since risks that transferred to them and they lose autonomy (Little and Watts, 1994; Porter and Phillips-Howard, 1997; Key and Runsten, 1999). Moreover, the prevalence of contract farming disrupts social structures; disturb the local political ecology; increase economic inequality; and increase workloads (Carney and Watts, 1990; Korovkin, 1992; Dolan, 2001; Yaro and Tsikata, 2013). Despite these negative findings, farmers generally seem very willing to enter into contracts. Väth and Kirk (2014) and Huddleston (2006) have shown that contract offers were not strictly followed and defaulting flourishes because of good price at open market. Similarly, Guo and Jolly (2009) found that a large and excess demand for contract farming in China demonstrated that farmers are interested to sign in contracts. Farmers' main motive for signing a contract seems to be to reduce their uncertainty about market and access to inputs. Masakure and Henson (2005), for example, using principal component analysis, shown that reduced market uncertainty (a guaranteed market for crops, a reliable supply of inputs, guaranteed minimum prices, and reliable transport provided to collect the produce) are what drives farmers to produce under contractual schemes.

In Ghana, it found that farmers are eager to secure access to inputs, credit and extension services via contract scheme (Väth and Kirk, 2014 and Huddleston, 2006). Guo and Jolly (2009) identify market access and price stability as their main motives for entering into contracts. These findings that are supported by Blandon *et al.* (2009), who identify prearranged quantities and prices as an incentive for farmers to sign contracts with supermarkets in Honduras. It, therefore, seems that the big advantage of contracts is to fulfill and satisfy security needs required by the contracting farmers.

CF as an institutional arrangement is becoming one of the mechanism to modernize Africa's agriculture (USAID, 2012). It is one of a tool in transforming or shifting from low yield production and low value crops to those cash oriented high value crops (Minot, 2011; Bijman, 2008 and 2007).

Of course, one of the major concern in fair-trade is the pricing issue, since premium price, pre-financing, and the contract it-self follow certification of the produce, whether between the firm and farmer or between the processor and the grower group (UNIDROIT, 2014). The contract agreements must clearly articulate the responsibilities of the two parties, put in place guiding principles about the volume, quality, price, payment terms, delivery conditions, conflict resolution mechanisms, input issues and some other related matters (UNIDROIT, 2014).

However, as to the understanding of the researcher one of the major challenges in fair-trade and CF is that either of the party may breach the contract. In such situation, the fair-trade mitigate it by suspending the certificate of the breaching party at the event of default (for example, repeated non-conformity and repeated breaching of the contract agreement) on contractual obligation.

In addition, it immensely plays a pivotal role in reducing poverty of SHFs in enhancing their income, which further improves the food security situations of farmers who are engaged in such business (Singh, 2011).

CF serves as a mechanism to avoid displacement of farmers from their land (i.e. a mechanism to avoid land grabbing) and allows sharecropping and land renting (Daniel, 2015). On the other hand, CF creates an enabling environment for SHFs to secure their water rights by accessing irrigation water available in their vicinity. On top of these, CF allows diversified cropping techniques and agronomic practices (a mix of practices) (Bijman, 2008 and 2007), which could greatly contribute towards building adaptation strategies related to CC. Furthermore, CF also lays the ground to improve the product quality where SHFs have a better chance of getting high price for their produce and it serves as a tool in land management practices where systematic land use practice are in place in order to enhance land capacity and to ensure productivity of land on sustainable basis(Singh, 2011).

1.3.3 Contract farming perceived as an agricultural development tool

CF plays a crucial role in agricultural development through the transformation of traditional subsistence agricultural production to modern ways of agricultural commercialization of SHFs in countries like Ethiopia. As evidenced in Annika (2014), CF creates access to market; increase productivity gain and increased income would enable subsistence farmers to move out of poverty, thus contributing to economic development. Contract would present a mutually advantageous relationship between agribusiness and smallholders (Von Braun and Meinzen-Dick, 2009 and Birthal *et al.,* 2005). An equitable sharing of production risk, for example, at the advent of CC induced adverse effects and crop insurance are considered as the characteristic of the imagined mutually beneficial agreement in CF arrangements. Moreover, SHFs get access to inputs, credit and market and consequently get their income improved and perhaps agri-business firms will get timely supply of crops, while benefiting from access to land and household labor (FAO, 2013; Prowse, 2012; Bijman, 2008; Eaton and Shepherd, 2001). Of course, the power balance or a "win-win" situation between the agri-business firms and contracting farmers, this is a mechanism to understand each other and a base to trust each other. Therefore, the perceived "win-win" partnership or opportunity that contracting provides is a justification for using CF as a solution to agricultural development endeavors in a transforming economy and a better CC adaptation strategy.

CF has also another dimension in the international policy discourses on agricultural development. As evidenced in Annika (2014), CF has a spillover effects, for example: in transferring technologies for non-participating farmers and enhance macroeconomic performance of a country. Annika further argued that CF in its agreement as a solution to fulfill the requirements and standards of the existing food regime (Annika, 2014). As a result, the buyer ensures a regular supply of a consistent quality from a large number of SHFs to whom the buyers provided inputs, technologies, and trainings to build the capacity of SHFs (Minot, 2013). In addition to these, it is imperative that CF practices play important role in livelihood diversification and facilitate CCASs. These in turn ensure sustainability of modern agricultural practice that maximize production and productivity, contribute to meet food security demand of the SHFs and reduce poverty situations of SFHs through creation of additional income generation schemes (FAO, 2013 and FAO, 2012).

1.3.4 Contract farming as an agricultural technology transfer

Drivers of the renewed interest in CF are both economic and political conditions, which are more of the state of the current world food regime and its opposing trends of globalization and localism (Annika, 2014). Firstly, the emergence of CF linked to the new lifestyles of consumers in wealthy countries that increasingly pay attention to diet and health (Kirsten and Sartorius, 2010). This compels agriculture to shift from a philosophy from 'here's what farmers produce to a situation where farmers take note of what the consumers want (Kirsten and Sartorius, 2010). The capacity to engineer food from farm to table (Kirsten and Sartorius, 2010) has led to a fundamental shift from agricultural commodities to products, and has given more weight to processing activities relative to the production phase of the value chain. The demand for a greater range of high-quality, differentiated products has further favored vertical coordination instead of trading in open markets. The participation in value chains requires investment in technologies, research and extension, to which SHFs often lack access to it (Annika, 2014).

There are also motivations related to the agri-business company's imperatives of increasing efficiency and minimizing transaction costs and risks in an increasingly volatile and competitive global market. It is evidenced in (FAO, 2013; USAID, 2012 and Da Silva, 2005) that transaction costs can be reduced by CF, since family labour internalizes the majority of labour costs such as wages, supervision, and social security costs, and risks related to production (Da Silva, 2005; Eaton and Shepherd, 2001). This is the rationale for the conventional economic concept of the 'inverse relationship' between farm size and productivity, or the 'diseconomies of scale' (Minot, 2007; Eaton and Shepherd, 2001).

Thus, the gains made by reducing labour costs, in turn, compensate for the slightly higher transaction costs associated with contracting to a large number of SHFs (Kirsten and Sartorius, 2010). Quite strikingly, conventional economics has adopted the Chayanovian notion of peasant self-exploitation and applied it to serve the interests of capitalized agriculture under the ideologically more neutral term of 'inverse relationship' in productivity and farm size (Oya, 2012), which is the notion of political economic approach. Prowse (2012) and Bijman (2008) also stated that the final driver of a renewed interest in CF relates to recent changes in the politics of development discourse. The researcher here underscored that CF has gained renewed momentum partly because of a desire to consolidate agribusiness interest with a pro-smallholder

development discourse and a need to shift from subsistence farming to market oriented cash crop production or more specifically *agricultural commercialization*. Similarly, Oya provocatively stated that the pro-smallholder bias may not constitute more than a public relations exercise for rent-seeking agribusiness as stressed in (Oya, 2012). Though CF has been advocated as a tool for development long before the recent 'boom' in foreign investment to the African continent (Watts, 1994 and 1992), it seems that the popularity of CF as a 'smallholder-inclusive business model' has exponentially increased in connection to the investor rush to land or as Daniel (2015) argued 'land grabbing' in Sub-Saharan Africa.

The rising interest of private investors, policy makers and development partners in CF arrangements in developing countries were driven by the following recent changes in the agri-food systems (FAO, 2013; Barret *et al.,* 2012; Prowse, 2012 and Arthur, 2005)

High agri-food prices and improved terms of trade opened up opportunities for the long-time neglected farm sector. It has also provided positive trickle down effects to farming and trading to incentivize investments into technologies for increasing yields. Improving quality and reducing post-harvest losses, population growth, shifting urban consumption patterns, increasing purchasing power of emergent middle-income segments in emerging economies are essential in such practices. It is also the related market growth and brings about structural transformation of agri-food markets (supermarkets, fast food etc). Moreover, it aimed to reduce the negative effects of market failure that could possibly be mitigate the problems of institutional arrangements (e.g. input supplies, non-financial services such as extension, training, information and access to markets and financial services such as bank transfer systems, savings, credits and insurance). Furthermore, the growing disputes over large-scale land acquisitions by investors and the search for politically and socially sound and economically viable alternatives such as formalized cooperation with SHFs (e.g. in the form of CF). Above all, increasing requirements for compliance with food safety/quality standards and traceability needs in international mainstream markets but increasingly also in local and regional markets (e.g. fresh produce supplies to supermarkets or staple food channeled through commodity exchanges). Increasing demand for sustainability certification of cash; peak oil prices and the effects on transport costs (local, export, import) for the procurement of inputs and distribution of produce and on production costs for inputs (fertilizers, packaging material, agrochemicals and so on).

There is an urgent need to adopt appropriate agricultural technologies to adapt to or mitigate climate change and CVs in order to prevent/minimize the damage CC can cause or to take advantage of opportunities that may arise. Emerging discussions on the role of private sector in improving food security through the upgrading of value chains is helpful in linking production surplus with consumption deficit areas. The diverse challenges such as the need to achieve food security without increasing the pressure on natural resources and the need to balance required foreign and domestic direct investments into agriculture more or less protects the rights of SHFs (i.e. competition for scarce land resources usually referred to as 'land grabbing'(Daniel, 2015; Dessalegn, 2011). Finally, the need to restore the reputation of agriculture to attract future generations to venturing into farming or accepting employment opportunities in rural areas given rural-urban migration of young people and the resulting aging farmer population in many developing countries (Will, 2013).

1.3.5 Opportunities and challenges in contract farming practices

CF as a tool for transformation in agriculture is an important mechanism to reduce SHFs vulnerability to CC induced adverse effects and reduce poverty. A study by Prowse (2012) underscored that CF plays a pivotal role in reducing poverty and raising the income of poor farmers utilizes family and locally hired labor, spending their income on other income generating activities (IGAs), local products and services. CF provides an opportunity for SHFs access to reliable market and guarantee minimum or fixed pricing structure. In addition, it provides access to credit; inputs, extension, transport service, and hence reduce transaction costs (Ayelech, 2012).

Empirical studies by different researchers and policy experts clearly underscored that there are ten very important factors for successful CF arrangements (Will, 2013; Nijhoff and Trienekens, 2012; Wainaina, 2012; Shepherd, 2011; Kirsten and Sartorius, 2010; Vermeulen and Cotula, 2010; Mair, 2008; Marti and Sandilands, 2008; Roy and Thorat, 2008; Ruben *et al.*, 2007; Bijman, 2007; Da Silva, 2005; Zegeye, 2003; Singh, 2002; Eaton and Shepherd, 2001 and Gow and Swinnen, 2001). They continued their explanations that the agri-business firms, SHFs engaged in CF practices and all the key stakeholders engaged in successful CF schemes should consider the quality standard of the agricultural produce under the CF schemes. Moreover,

presence of open communication and timely feed backs, well written contract terms, provision of extension support systems, timely collection of produce, side selling (defaulting), access to financial resources, access to inputs, pricing and methods of payment, and risk sharing factors are the corner-stone for the success of CF Schemes.

1.3.6 Historical development of contract farming in African and Ethiopia

A. African experiences on contract farming schemes

African countries experiences in CF schemes on different agricultural products such as Tea and Sugar Cane companies in Kenya, Cotton Company in Zimbabwe, and Palm Oil Company in Ghana provided insights on historical development of CF. The companies managed large CF schemes with many out growers in their respective countries. In contrast to Ethiopian experience in CF schemes on different agricultural products, the CF scheme experiences in other African countries dated back to 1964 the Kenyan Tea Development involving 600,000 SHFs cultivating an aggregate of 109,000 hectares till 2010 (USAID, 2012). Similarly, the Zimbabwe Cotton Company was a public enterprise established in 1969 and was the largest Company started its CF schemes in 1992. Ghana was another African country known for the largest palm oil producing company established in 1975 and known for its CF schemes in West Africa.

B. Ethiopian experience in contract farming arrangements

Contract farming in Ethiopia is an agricultural commercialization tools in transforming subsistence farming and export oriented high value agricultural production. Available empirical evidences such as USAID (2012) and Prowse (2012) clearly underscored that there are many CF arrangements in Ethiopia. The same study emphasized that the arrangements are identified CF in the selected value chain such as Coffee; Sesame and Haricot Bean. It was not allowed to enter through a contract arrangement, rather through the Ethiopian Commodity Exchange (ECX) established under the Proclamation No.550/2007 in 2007 and it became operational in April 2008 and authorized to handle all the matters pertinent to these selected value chains. It is only through this organ that these commodities transaction take place. ECX assures all commodities marketing actors the security they need through provision of a reliable, integrated system for handling, grading and strong commodities, matching offers and bids for the commodity transactions. A risk free payment and goods delivery system to settle transactions is in place,

while serving all fairly and efficiently (USAID, 2012). Thus, to the coffee marketing proclamation, the Sesame and White Pea Beans Transaction Regulation No. 178/2010 mandates that sesame trading in Ethiopia conducted only at primary transaction centers and the ECX. However, Ayelech (2010) in her action research indicated that CF arrangements for these items are non-existent.

However, the exploratory research by Nijhoff and Trenseken (2012) also had undertaken research on "Critical factors for contract farming arrangements: the case of Ethiopia. From this study, there are lessons learned and experienced gained, where CF is especially important for SHFs, particularly in Ethiopia. It served as a commercialization instrument to enhance export earnings, knowledge transfer and food security.

The empirical evidence indicated in Ayelech (2012 and 2010) and USAID (2012) the government of Ethiopia sees CF as an important commercialization tool to enhance export earnings, facilitated knowledge transfer and helps to ensure food security conditions. Even though there are little experiences in policy arena in Ethiopia regarding CF, the Ethiopian government expressed its deepest concern and taking CF as a key in improving export values in the country (PASDEP, 2005). SHFs Adoption of CF as a strategy is another greater opportunity for SHFs to access both domestic and international market through the network formation with private and NGOs (MoFED, 2007). Let us see the historical context of CF in Ethiopia.

Prior to 1991's: The history of CF in Ethiopia dated back to the establishment of the Ethiopian Seed Enterprise (ESE) primarily for production of Wheat and Teff. As indicated in USAID (2012) ESE has its own farm and entered in to large-scale commercial farming and SHFs more than three decades. According to Yonas *et al.* (2008), the use of contract seed production by ESE dated back to 1980s during the planned economic system by Derg Government. The contract was with seed-producing scheme with farmers' group approach, i.e. producers' cooperatives. The contract agreement was between cooperatives and the ESE where quality of the seed produced was the key aspect in the agreement. USAID (2012) documented that the cooperatives were fully responsible for honoring the contractual agreement for seed production by members. To realize this, farmers who are the members of the cooperative are obliged to merge their plots and form longer clusters, which are convenient for field management. The produced seed was stored in the

cooperative storehouse until tested. During this period, ESE was responsible transportation of the seed produce from cooperatives to the ESE centers. At the ESE centers, the standard monitoring procedure applied was seed cleaning, grading and packaging. There quota system and fixed pricing strategy was the rule of the system and the contract was based on the viability and sustainability issues (USAID, 2012).

From 1991 to the present: After 1997, CF arrangements with SHFs were mainly closely related with the implementation of five-year Seed Systems Development Project in Ethiopia (FYSSDP), focusing on Farmer Based Seed Production and Marketing Scheme (FBSPS) financially supported by IDA, IFAD and the Government of Ethiopia during 1997-2001 (USAID, 2012). The major aim of the project was to engage SHFs and support them in sustainable seed production and income generation by providing farmers with the necessary materials and inputs required including credits, training of farmers, and extension workers and small-scale seed cleaning facilities implemented as a pilot project by the previous Ethiopian Seed Industry Agency.

CF arrangement of the ESE was considered as a pioneer in starting up the CF schemes with cooperatives during Derg Regime, with SHFs become successful, and increased the awareness of the farmers. As emphasized in USAID (2012) and Yonas *et al.*, (2008), most of the contractual schemes was sustainable and ended up with certification of seed production. The arrangement it-self involves the formal agreement between the ESE and farmers groups (farmers' cooperatives) representing individual farmers stipulating the obligations of all parties. The contractual agreement stipulated was so strong and geared towards provision of technical support, basic seed or certified seed for multiplication and raw seed packaging materials. More importantly, the technical support includes supervision, training on crop management and quality control, flexible pricing strategy with 15% premium price as incentive as well as field inspection and laboratory tests (USAID, 2102).

Nijhof (2010) conducted an inventory on CF in Ethiopia and he clearly put the CF schemes he concluded that the CF schemes were at their infant stages. However, based on the inventory he made, the schemes such as EHPEA (Ethiopian Horticulture Production Enterprise Agency) a Vegetable Company, Beza Mar Agro-Industry PLC, Solagrow Seed Potato Company,

AfricaJuice, Passion Fruit Juice, Tradin (Selet), Organic Sesame, Tiret Barley, EthioFlora, Horticulture and Asella Malt Factory, Malt Barley are some of the successful agribusinesses in Ethiopia. Despite their maturity, these agri-business firms were building a strong base for the successful function of the firms; they are executing their tasks as per the contractual agreement they made with the SHFs. However, transparency and accountability issues of these companies were strong to further their activities or schemes for the mutual interest or benefits of the firms and the SHFs.

There were also agri-business firms that failed in their contractual schemes. First, *Soreti International Trading Company, Oil Seed and Pulses* producing company engaged in the production of oil Seeds and Pulses Trading. Second, *Acos Trading Company, Pulse,* which was a joint venture between Ethiopia and the Italian investors, was to penetrate the EU markets with high quality produce of Haricot beans, Chickpeas, Lentils and other Pulses. Both these companies failed to function because of poor management schemes they followed. Thus, side selling and information gaps created between the agri-business firms and the farmers were challenges of company(Ayelech, 2010 and 2012; Nijhoff and Trienkensen, 2012 and USAID, 2012).

In conclusion, as compared to Ethiopia, the CF scheme in other African countries such as Kenya, Zimbabwe and Ghana have much experience in CF schemes (i.e. in assigning expertise, capacity building, trainings etc) gained much experience in CF business arrangements. Moreover, the management of CF schemes (i.e. supervision of the schemes by the companies, pest management, producing agricultural products with good quality and quantity, bonuses, good at preventing side selling and risk sharing) has been far better than that of Ethiopia. Other African countries have strong implementation capacities (knowledge and skills) in managing the CF arrangements and designing contractual agreements and gained many lessons from CF practices. However, those of Ethiopia still are it their premature stage of development and require drawing some lessons from these African countries for better design of CF arrangements and its implementation (i.e. “win-win model”). Moreover, provisions of the necessary inputs such as: technical assistances, variety seeds for the successful operations and sustainability of CF in terms of economic returns both for the agri-business firms and SHFs engaged in the schemes shall be included in any CF arrangements (USAID, 2012).

1.3.7 Climate change adaptation in Ethiopia

Large bodies of empirical evidences in the areas of climate change and its determinants analyzed the determinants of farm level CC adaptation strategies in more than 12 African countries and Latin America countries based on multinomial choice model (Nhemachena and Hassan 2007). Their results depicted that mono cropping is the agricultural practice, which is most vulnerable to climate change risks because of increased in temperature especially during summer season. However, their results confirmed that better access to markets, extension and credit services, technology and farm assets particularly labor, land and capital are critical for helping African farmers adapt to climate change in Africa (Ginbo, 2014).

Another study by Seo (2010) modeled CC adaptation portfolio using micro econometric selection in the case of Latin America. He relied on 2,000 farmers to conduct his survey collected from Seven South American countries in between 2003 and 2004 to examine whether an integrated farming system, which manages both crops and livestock would be more resilient than those specialized farms when faced with climate change. The result revealed that farmers in a hotter climate prefer mixed farming systems to specialized ones. A study done in Ethiopia by Deressa *et al.* (2008, 2010 and 2011) assessed the determinants of CC adaptation strategies and perceptions of climate change in Blue Nile Basin. They indicated that the common adaptation measures employed in the area are use of different variety of crops, tree planting, soil conservation, early and late planting and irrigation. Their multinomial choice model finds that the level of education, gender, age, wealth of the household heads, access to extension and credit, information on climate, social capital, agro-ecological settings, and temperature all influences the farmers' choice of adaptations. In their analysis, age of the household head, wealth, information on climate change, social capital, and agro-ecological settings have significant effects on farmers' perceptions of climate change. However, Deressa *et al.* (2008) did not clearly indicate whether the adaptations that the farmers employed are autonomous, traditional, planned or location specific measures.

Moreover, a study by Di Falco *et al.* (2012b) examined the climate change impacts, its adaptation practices in same study area (i.e. The Blue Nile Basin) using production function, and the Ricardian approach. The result confirmed that access to information; extension services, household size, age and education of household head have a significant positive impact on

adoption of climate change adaptations options. The study also found that those farmers who adopted climate adaptation strategies such as changing crops, tree planting and soil conservation do have higher food productivity than those who do not adopted.

The perception of farmers' on CCASs differs across time, and scales in different parts of the world. Wood *et al.* (2011) done their study on "Smallholder farmer decision related to climate variability across multiple regions" including Ethiopia in the horn of Africa. Their results revealed that farmers perceived that their farmers' ability to adapt, access to weather information household and agricultural related assets and their participation in local social institutions affects their adaptation. A previous study by Bryan *et al.* (2008) indicated that the farmers' decision to adopt adaptation strategies depends on their farming practices in response to perceived changes in climate. It is clear that farmers' decisions are not based purely on the long-term changes in average climate conditions. Rather, their findings suggested that a number of other factors influence the decision-making process as well, including changes in other climate signals, such as short-term variability, extreme weather events, and rainfall intensity, timing, duration and frequency.

A specific case study on climate change adaptation in Ethiopia indicated that farmers perceived adaptation barriers such shortage of land, lack of access to credit, lack of access to water for irrigation, lack of information about climate change and appropriate adaptation responses. Moreover, lack of access to market and insecure property rights reported as a major constraints to adaptation (Bryan *et al.*, 2008). Another study by Mulugeta (2015) reported that farm level adaptation by farmers in Central Rift Valley (CRV) helped smallholder farmers' adapt to climate change either using rainwater harvesting structure at household level to cope with water scarcity or seasonal shift (i.e. from *Belg to Kiremt*).

To conclude, in CCASs, to curb climate change and CVs depends on the adaptive capacity of farmers and their location. Moreover, the perception of farmers towards climate change impacts, their adaptation practices determines the extent of farmers' adaptations. On the other hand, farmers' are required to understand the various factors determining climate change adaptation options and the adaptation constraint that hinders them to achieve their target of adaptation to climate change and provide solutions to the adaptation barriers.

1.3.8 Theoretical frameworks

1.3.8.1 Agrarian political economy

This research was conducted in the light of the agrarian political economy, where the participation of SHFs in CF practices and their power relations to agri-business firms places a social condition of production analysis in a way that it contributes to CCASs and CVs. As explained in Annika (2014), the agrarian political economy tries to examine the development from point of view of multi-disciplinary approach by borrowing concepts from social sciences such as Sociology, Anthropology and Political Science.

The Agrarian political economy draws its ideas from the original work of Karl Marx's (Marx, 1995) in explaining the relationship between the capitalist mode of production and its relation with labour. Karl Kautsky (1988) and Lenin (1964) developed the analysis and come up with the so-called 'agrarian question' into the field of political economy. In this study, therefore, it is very essential to focus on the relationship between the agribusiness firms and the SHFs who are engaged in the overall production processes of CF including the production of agricultural products and the services provided to the farmers. This of course, needs not only reproduction of means of production, but also requires the current and future involvement in production and the social relation between these actors as well (Bernstein, 2010). In addition to reproducing land (by retaining its fertility), input provision in terms of seeds and farming technology, future generations of producers need to be reproduced as well as the social relations they engage in.

When a society goes through a transition to capitalism, smallholders lose their ability to reproduce their means of subsistence, hence force themselves out of commodity relations (Bernstein, 2010). Bernstein (2010) continued explaining that the SHFs may consider themselves as self-employed in their own farm field. In reality, the farmers are participating in CF arrangements by selling their labour power to the agri-business firms, which can be symbolic for them. However, the agribusiness firms in this context do not displace farmers from their land, but encouraged farmers to enter into some form of agreement or economic relations (Annika, 2014) in a way that up keep their good relations.

The agrarian political economists thought that SHFs have the future in modern agriculture and paving ways for future transformation. Lenin and Chayanov engaged in the classical debate in

agrarian political economy and stated that the class differentiation in the peasants and the trajectories of agrarian change (Annika, 2014). Lenin viewed that agrarian societies were differentiated into classes of farmers, the emergent capitalist farmers or 'rich peasants', those able to reproduce themselves on the same scale of production or 'middle peasants', and finally those struggling to reproduce themselves as capital and labour or 'poor peasants' (Lenin, 1964), SHFs in the context of current study . Chayanov, on the other hand, articulated a distinct theory of the peasant mode of production, one that could co-exists with capitalist development. Seeing peasant societies as an independent class and having logic of their own, the Chayanovian rural society would prosper through peasant production, and of farmers self-organizing into peasant organizations and cooperatives (Chayanov, 1966). Chayanov was not less of a modernizer than Lenin was, but saw the peasant economy as centering on family labour, giving rise to peasant 'self-exploitation' providing their own farmland to agri-business firms (Bernstein, 2009).

Lenin and of Chayanov, surprisingly, provides us with an insight into capitalism's renewed focus on SHFs' agriculture. Whereas, commercial farming emerged from the capitalization of agriculture, capitalism is simultaneously keen on maintaining smallholder production. This is partly due to capital's problematic relationship with the natural process of cultivation. Agriculture in many ways contradicts with the logic of capitalism, since cultivation of forces capital that tied up and unable to realize profit before harvesting, like that of CF (Bernstein, 2010). Another explanation lies on the difficulties that capital faces control the pace of work in agricultural feature that gives an advantage to family labour over wage labour in capitalist agriculture. In using family labour, smallholder farming absorbs some of the costs and risks related to labour supervision and the mode of production in agriculture (Bernstein, 2010). This is an important idea developed by the agrarian political economy approach.

Even though the agrarian political economy approach take into account the relationship between factors of production and production relation, it failed to consider the changing environment, the emerging, diffusion of agricultural technologies and misunderstood the benefits of commercial agriculture to livelihood of SHFs'. It has also another limitation in explaining the sustainability of agriculture and fails to consider soil and water conservation practices, which is a cornerstone in CF and climate change adaptation that enhance production and productivity of SHFs or agricultural families. The relationship between the agribusiness firm and the SHFs were at stake

because of the changing environmental conditions such as agrarian transformation from subsistence to modern commercial agriculture, climate change (shock, drought and floods) and affects CF arrangements. The market situation that have sometimes a negative bearing on SHFs participation in CF Schemes and the power relation between the two, which is termed as a shift in power (Teemu and Carmen, 2018). Hence, addressing these factors, for example, CF related challenges such as imbalance of power and climate change related problems could have a tremendous role for the success of CF. CF as a response to climate change and CVs helps SHFs' in building their power relationship on "win-win" situation for the two parties are very essential for the parties engaged in CF.

1.3.8.2 Farming system theory

Farming system (FS) as a dynamic and basic ingredient of agricultural practice is the result of interrelated often complex set of factors such as farm lands, animals, farm implements, power, labour, capital and other inputs controlled by farming families and influenced by the political, economic, social, institutional and physical forces operating at different levels. FAO (2001) argued that all the household resources and its flows, the interaction of these resources are the necessary components of farming system in agricultural practices. Of course, in this system, the components or the elements are related to directly or indirectly one another or interdependent having some identifiable boundaries (Singh, 2001).

FS bridges CF practices and CC adaptation in terms of its structure and function. The structure may include the land use patterns, production relations, land tenure, size of households and their distribution, irrigation, marketing including the transportation and storage facilities, credit institutions, financial market, research and education (Behera and Sharma, 2007). Thus, for the FS to be effective and efficient, these components (i.e. factors of production and productivity) should align with each other, with the required qualities and quantities of the factors of production: land, labour, capital and management. There is also a farm family function, which primarily determines the capability and resources, the socio-cultural setting and the relationship between these components with the physical and economic factors.

In general as (Behera and Sharma, 2007) summarized that FS focuses on:

- The interdependencies between components under the control of household;

- How these components interact with the physical, biological and socio-economic factors, which is not under the control of household;
- Farm household is the basic unit of farming system and interdependent farming enterprises carried out on the farm;
- Farmers are subjected to many socio-economic, bio-physical, institutional, administrative and technological constraints; and
- The operator of the farming system is a farmer or the farming family.

Hence, one can understand from the FS theory that CF and CCASs require the ingredients or the components of FS and the direct or indirect relationships between the components or the resources that are important for the accomplishment of farming tasks. Thus, we would like to argue that FS theory bridges CF and CCASs and all the components mentioned earlier could help to uncover the implications of the two on the choices of livelihood strategies especially through the factors of production such as labor, agricultural inputs, capital and production relations and agricultural technologies. In the context of SHFs and CCASs, these are the necessary inputs for effective implementation of CF as CC adaptation strategies in the study areas.

1.3.9 A conceptual framework

Contract farming as agricultural practices and climate CCASs depends on understanding of the livelihood context of farmers. SHFs' perception on CF and CCASs laid a foundation to perceive the contribution of CF, overall farmers' livelihood and its relationships with agribusiness firms. Moreover, this requires understanding of farmers' situations and strategies or choices of the SHFs participating in CF and engaged in CCASs. As evidenced in (Eaton and Shepherded, 2001; Bijman, 2008; Minot, 2011; Prowse, 2012; USAID, 2012), CF practices creates opportunities to access factors of production such as land, capital, labour and time, which are the cornerstones for the farmers' and agribusiness firms in commercial agriculture. However, CCASs employed by the farmers and CF practices, rely on the same and similar resources that serve to build their adaptive capacity and contribute the transformation of structures and processes. Therefore, this study modified and relied on the conceptual framework employed by Carney (1998) and that of Ziervogel (2003) to understand the perceptions of farmers on CF practices, the climate change adaptations employed by farmers' in the study areas.

In the context of this study, the success of farmers depends on the way CF is perceived and linked with CCASs, production inputs such as finance, technical knowledge, new production techniques, agricultural technologies and skills were channeled towards agricultural commercialization (Oromia Agricultural Transformation Agency (OATA, 2016). In addition, the perception on CF related problems such as CF design, side marketing, and delays in time, improper application of agronomic practices; pre-harvest and post-harvest losses affect the effectiveness of CF and CCASs. On top of these, there are other factors such as institutional set ups, organizations, soil and water conservation practices, incentives, policies and legislations that shape CF practices, farmers' livelihood, food security and CCASs (Getachew, 2012). Moreover, it also looks the institutions and processes that operate from the lowest level (household) to the national level and at all spheres from NGOs, private to the public determines access to livelihood assets, livelihood activities, livelihood strategies and outcomes likely influences CF practices and climate change induced hazards.

Different CF practices, CCASs and all the necessary assets or inputs as described above would affect the successes of CF schemes and overcoming climate change hazards through various adaptation mechanisms. The various livelihood choices because of CF schemes and climate change adaptations employed, further enhances the adaptive capacities of households, individual farmers, institutions: both government and NGOs. It also supports private agribusiness firms to achieve their goal successfully and build up virtuous circle of the continuum in CF processes. As depicted in figure 1.1 below and clearly indicated in Ford *et al.* (2006), the nature and concerns of farmers, their location, structure and culture impacts CF practices and successful implementation of CCASs. The comparative advantages and the new OATA strategies (i.e. cluster formation: Agricultural Commercialization Cluster) induced commercialization of agriculture in the study areas (OATA, 2016). For example, adoption of new technologies those have the capacity to boost agricultural production, improve the existing markets creating new markets that benefits both the agribusiness and farmers' from CF practices and facilitate CCASs (Ayelech, 2010 and 2012).

Fortunately, one of the advantages of the perceiving CF scheme in the face of climate change adaptations is to enhance the adaptive capacities of farmers and increase the potential abilities to address, plan for and curb the changing climate and reduce the influences of factors that hinders

the successful implementation of CF scheme and CCASs. It is through these gained experiences and a better ways of handling problems related to CF practices that are making a plain ground for providing solutions for CF problems and the changing climate. The adaptive capacities are the major characteristics of the human system including economic wealth, social capital, infrastructure, social institutions and experiences supports and address CF related problems and challenges resulted from climate change and CVs. Furthermore, SHFs' knowledge on the wide range of technologies such as: new varieties of improved seeds, combine harvesters (Threshers), Ayber BBM[i] etc, determines the successful implementations of CF schemes and adaptation to climate change in the study areas. These factors facilitate or constrain the ability of farmers, cooperatives or a community to deal with climate related hazards (Handmer *et al*., 1999; Barnett, 2001; Adger, 2003a; Smith *et al*., 2003; Robards and Alessa, 2004). These determinants are interdependent and influenced by human and biophysical conditions and process operating at various scales from local to global level.

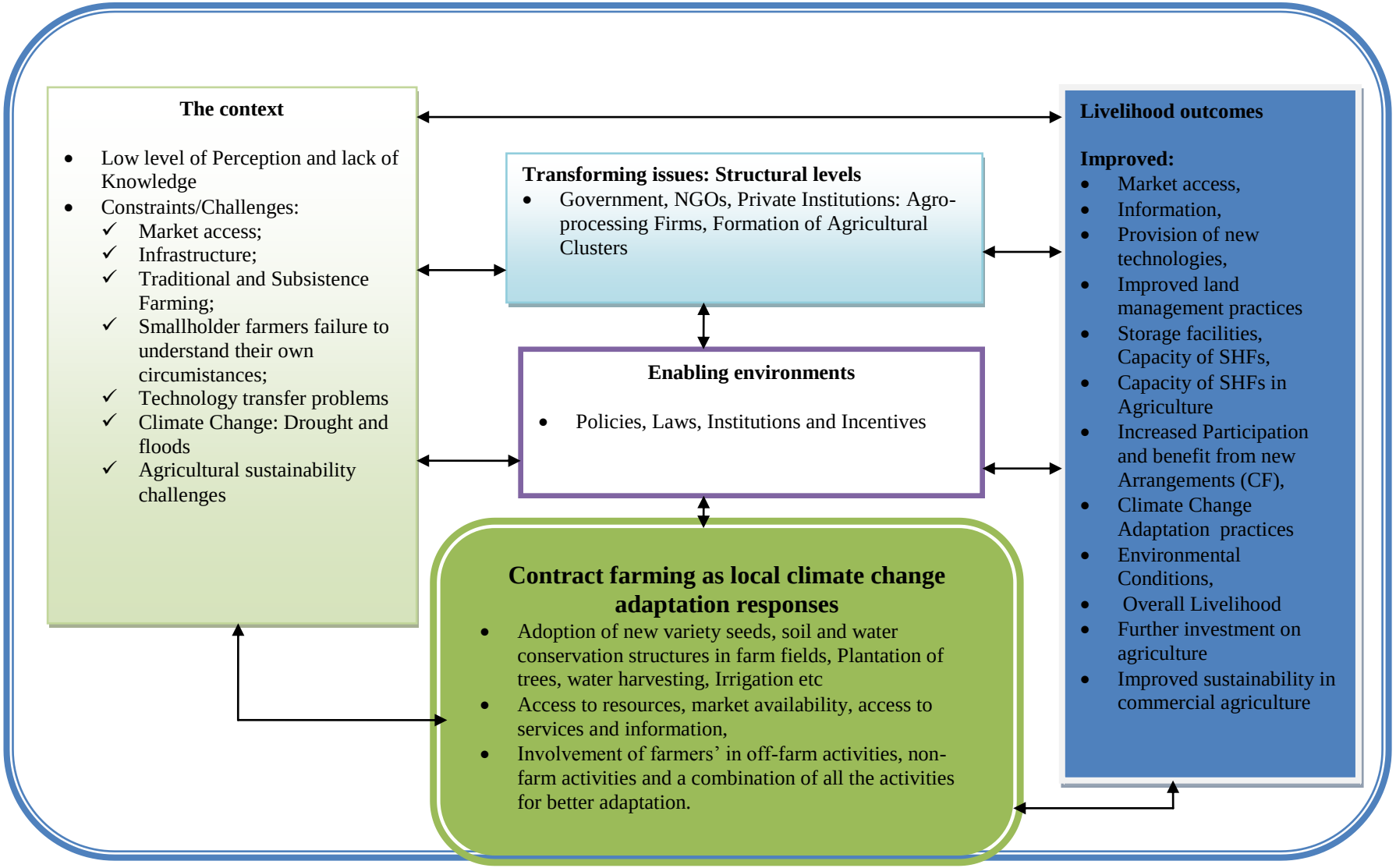


Figure 2.1 A conceptual framework linking contract farming, climate change adaptations and livelihood choices

Source: Modified from Carney (1998) and Ziervogel and Calder (2003)

1.4 Objectives of the study

1.4.1 Main Objective of this study

The main objective of this study was to assess Malt Barley CF and Sugarcane contract farming as a response to climate change and variabilities in West Arsi Kofale District and East Shoa Adama District of Oromia Regional State, respectively.

1.4.2 Specific objectives

The specific objectives of this study were to:

1. Examine how smallholder farmers' engaged in Malt Barley and Sugarcane contract farming perceived Contract Farming as climate change adaptation in the area;
2. Assess the impact of Malt Barley and Sugarcane contract farming on the net-income earned by smallholder farmers' in the study areas;
3. Assess smallholder farmers' adoption of contract farming as climate change adaptation strategies in the study areas; and
4. Identify and examine challenges and opportunities in contract farming arrangements in the study areas.

1.4.3 Basic research questions

The present study tried to answer the following questions:

1. How do SHFs perceive contract farming as climate change adaptation in the area?
2. How contract-farming practices in the area do affects the net-income and livelihood of smallholder farmers?
3. What are the determinants of adoption of contract farming as climate change adaptation strategies in the study locations?
4. What sort of challenges and opportunities with respect to Malt Barley and Sugarcane contract farming in the study areas?

1.5 Research Methodology

1.5.1 The study areas

A. Socio-economic and demographic conditions of Kofale District

This study was conducted in Kofale and Adama Districts of West Arsi and Eastern Shewa of Oromia Regional State in Ethiopia in 2018. The study areas are located in West Arsi Zone and Eastern Shewa Zone of Oromia Regional State of Ethiopia. In West Arsi, Kofale District extends from $06^0$50' to 07^0 09' North latitudes and $38^0$38' to $39^0$04' East longitudes. It consists of a total area of 720Km^2, which is equivalent to 72,000 hectares and located 25Kms away from the Zonal Capital, Shashamene. It has a total population of 179,508: out of these, 90,000 were males and 89,508 were females (Kofale District Finance and Economic Development Office, 2007). Agriculture is the main stay of the District's economy. Around 95% of the populations were engaged in various agricultural activities to generate income for their families. It is only 5% of the people engaged in other forms of livelihood such as petty-trade and other non-farm activities.

B. Climate, vegetation and soil

Climate: As indicated in Hurni (1998) agro-ecological classification in Ethiopia, there is two agro-climatic areas in Kofale district. About 85%of the total area of the district is under "*Dega" or "Baddaa"* agro-climatic zone having altitude between 2600-3000m with annual mean temperature of 15^0C while only 15% under "*Woina Dega" or "Baddaa Daree"* agro-climate with altitude ranging between 2400-2500m with annual mean temperature of 22^0C. The maximum rainfall of June, July, and August months are with 1200mm, the driest months are January and February. The coldest months are December and November with 12°C and 5°C average and minimum temperature, respectively. While April *or "Ebla"* is the hottest month with 15°C average annual temperature and 22°C maximum temperature. On average, the District gets a monthly mean rainfall of 70mm and annual mean rainfall of 1200mm.

Topography: Plains, hill slopes, valleys and gorges generally characterize the district and its altitude extends from 2000 m.a.s.l to 3050 m.a.s.l. There are three major agro-climatic zones due to variation in altitude. These great variations provide wide range of opportunities for the production of different types of crops in a wide ranging warm to cool thermal climate.

Vegetation: Forests provide many social, economic, and environmental benefits. In addition to timber and paper products, forests provide wild habitat and recreational opportunities, prevent soil erosion and flooding, help provide clean air and water and contain tremendous biodiversity. According to the District's agricultural office, the District constitutes both natural and manmade forest. The natural forests constitutes different varieties of tree species of which "*Hindhesa", "Hexo", "Birbirsa", "Suke", "Abayi", "Welensu", "leman", "Ejersa", "Mokonisa", "Danisa", "Hadami", "Reji", "Oda"* mare some to mention. The man–made forests are the source of timer production demarcated area occupying 525 hectares found in PAs of "*Koma Afamo" and "Koma Bitacha"*. However, due to increase in population in the District and increased demand for cropland, woods for construction and firewood, the forest coverage in the area is dwindling from time to time exacerbating the existing CC problems in the area.

Soils: According to FAO (2007) classification, the soil resources of Kofale District consist of Eutric Nitosols, Pellic vertiso, and Orthic Acrisols with the rest being composed of swamps and marshy rocks, stones and sand.

C. Socio-economic and demographic conditions of Adama District

Wonji Shewa Sugar Factory is found in Adama District and it is situated in Rift Valley in Eastern Shewa district of Oromia regional State of Ethiopia. It extends from $8^0$20'0" to $8^0$28'0" North latitude to $39^0$12'0" to $39^0$16'0" East longitude. The topography of the factory is within 1500-2300 m.a.s.l and dominated by the surging plains that involve extensive ridges all along the western boundaries (Tadesse *et al.*, 2013). Most of the portion of the factory is situated in sub-tropical agro-climatic zone. Very flat and regular land characterizes Wonji-Shewa having a general slope varying between 0.02-0.05 percent (Dinka *et al*., 2013). It is one of the densely populated districts in East Shewa zone (CSA, 2007). The total Population of Adama District was estimated around 155,321. Among these, 16.9% of the population lives in urban areas, while 83.1% are rural population (CSA, 2007). The District has more than 43 PAs. Wonji-Shewa is the only Sugarcane out grower schemes found within upper Awash River Basin, Central Rift Valley of Ethiopia.

Climate: A study by Dinka *et al*. (2013) long-term weather data of Wonji Meteorological Station indicated that Wonji Shewa is characterized by erratic rainfall pattern with average annual rainfall of 832mm. The Mean annual minimum m and maximum temperature exhibits 15.2^{0}C

and 27.6^{0}C, respectively. The rainfall in the area shows a considerable spatio-temporal variation, where most of the rainfall for the area is in summer season from June to September. However, there is a considerable monsoon rainfall in the month of March or April because of the Inter-tropical Convergence Zone (ITCZ). The other months shows a dry spell for most of the months. These clearly reveal that the agro-climate in the area is between the transitions of the semi-arid and dry sub-humid zones (Dinka, 2013).

E. Rainfall and temperature situations of Adama and Kofele Districts

As indicated in figure 1.2, the trends of mean annual rainfall of Kofele from 2000-2017 G.C varies from 120mm to 150mm (NMAE, 2018). The lowest mean annual rainfall was observed in 2012 G.C with 70mm of rainfall and the highest and maximum rainfall in 2016/17 G.C with more than 150mm. The computed result, which is the highest amount of rainfall concieded with the discussions made with the FGDs on overall rainfall situations during field survey. They confirmed that there was snow fall and serious flood in between 2014 and 2017 G.C in the study area. The survey collected on overall rainfall situations further confirmed that there were irregularities in raifall pattens in the area and this was resulted in extreme floods and droughts, which clearly indicated that there is climate change and,which infact is affecting the agricultural production in the study area.

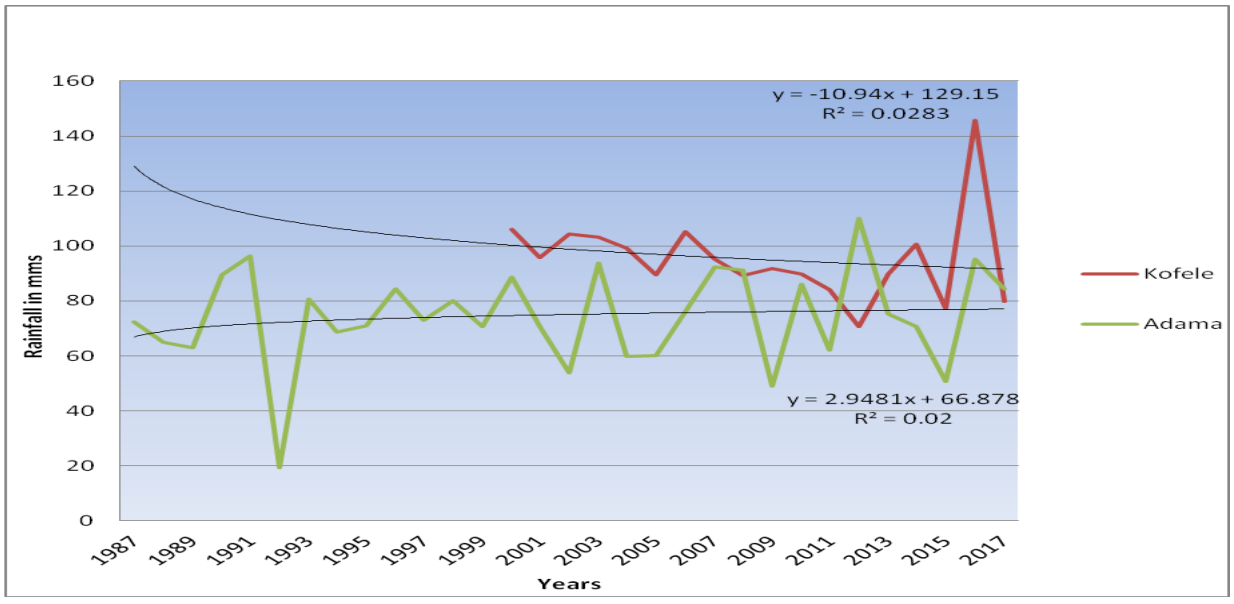


Figure 1.2 Trends in mean annual rainfall at Adama and Kofele Districts

Source: Authors construction, 2018

Regarding the trends in temperature, the metreological data obtained from the Ethiopian National Metrological Agency computed from daily temperature and monthly records indicated that the temperature situation also exhibited an ossilation or long term variability (-0.9^{0}C in 2011 and -0.2^{0}C in 2012 G.C) and sharply increased and fluctuated after 2014 G.C in mean and minimum annual from time to time (NMAE, 2018). The temperature was not consistent, which in turn affects agricultural production and productivity in the study area. The agricultural experts, extension workers, KIIs and the FGDs further confirmed that there are change in climatic elements such as rainfall and temperature leading to climate change, climate variabilities and long term changes in climatic conditions. In addition, the regression result between mean annual rainfall and time, where an increase in one year period for Adama district revealed an increase of mean annual rainfall by 2.9463mms and a decrease of 10.89mms in mean annual rainfall for Kofele District (figure 1.3). This clearly indicated that the rainfall amount and pattern in Kofele District were decreasing and this seriously affected the agricultural production in the area. This of course is consistent with the discussions made with FGD where the time and the amount of rainfall is generally changing from 2000-2017 G.C.

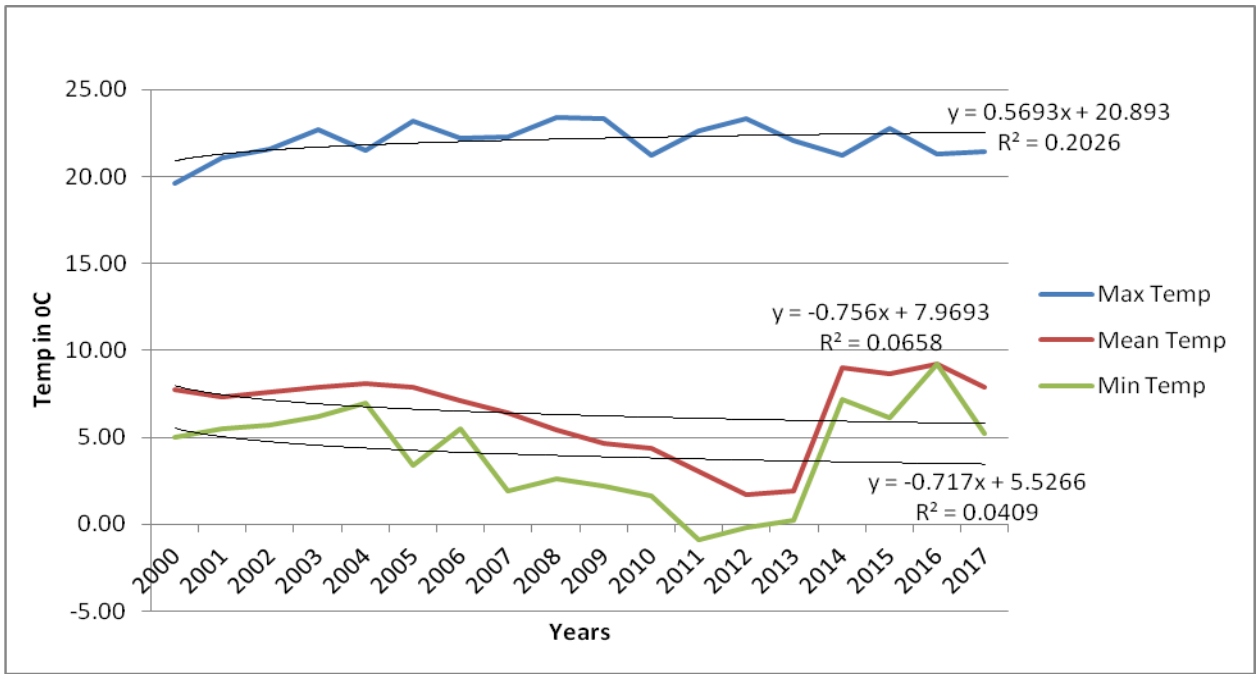


Figure 1.3 Trends in maximum, mean and minimum annual temperatures at Kofele District

Source: Computed from NMAE Data, 2018

Similarly, as depicted in figure 1.4 and 1.5, the trends in mean annual rainfall and mean annual temperature at Adama and Kofele Districts obtained from EMNA suggested that the rainfall was

irregular and revealed differences in distribution across years from 1987-2017 G.C (NMAE, 2018). In between 2000-2017 G.C, the temperature in Kofele shows a decreasing trend. For example, the regression result for minimum and mean annual temperature for Kofele revealed a decrease by 0.717^0C and 0.756^0C, respectively. However, the regression result for maximum annual temperature in one year period for Kofele indicated an increase by 0.5693 ^{0}C. The trends in maximum and mean annual temperature in and around Adama District exhibited a decrease of maximum and mean annual temperature by 0.084^0C and 0.043^0C, respectively. Conversely, the trends in minimum annual temperature from 1987-2017 G.C revealed an increase of temperature in and around Adama District by 0.4309^0C. This computed mean annual temperature is consistent with the discussions made with FGDs and the KIIs interview made with District agricultural experts, where the minimum annual temperature decreased for Adama and its environs because of Sugarcane contract farming microclimate reduced the temperature in the area (see figure 1.4).

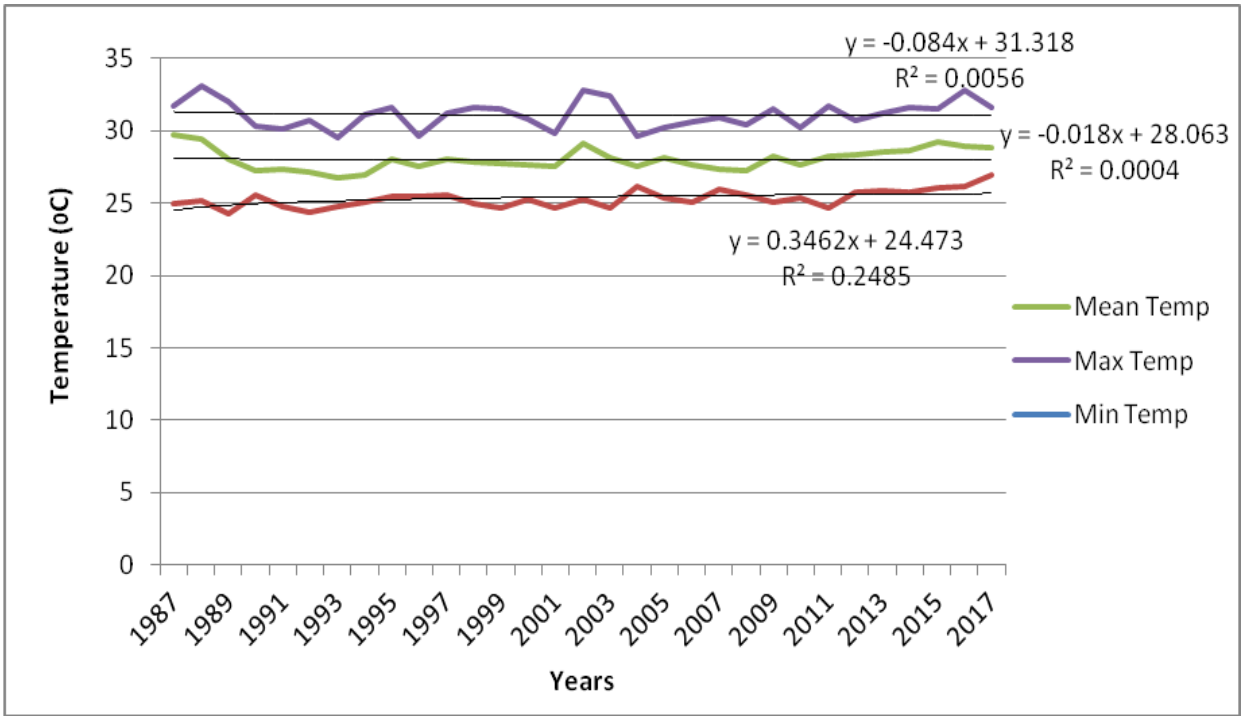


Figure 1.4 Trends in max, mean and min annual temperatures at Adama District

Source: Computed from NMAE Data, 2018

Agriculture: Agriculture is the main livelihood of SHFs in the area. Crop production Mixed agriculture dominated the area where perennial crops like Sugarcane production is well known especially with those farmers having agricultural land following the river banks of Awash River.

There are about seven out grower in the study area. These are "*Kuriftu Hida", "Boku", "Adulala Hake Haroreti", "Wake-Mia", "Wake-Tio", "Bishola", and "Hargitti"*. For the out grower schemes in Adama District, irrigation agriculture is very common diverted from Awash River. There is furrow irrigation practiced during the daytime from the pumped water during the night storage reservoir (Oromia Regional State Adama District Profile, 2011).

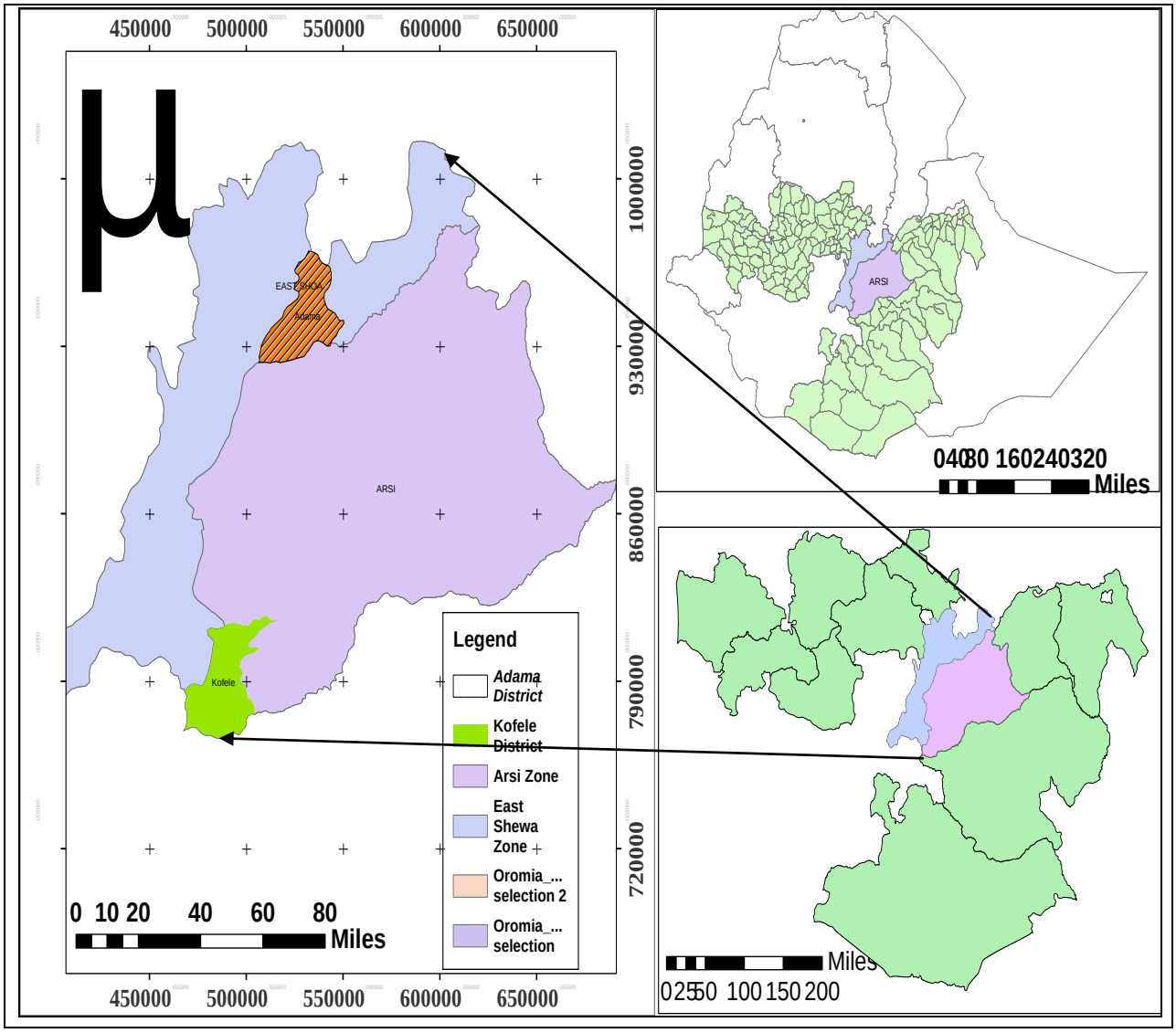


Figure 1.5 Map of the study areas

Source: Own Construction, 2018

1.5.2 Research methodology

The study was employed qualitative and quantitative methods combined in sequential order to incorporate the important information to address the research questions. Using a combination of

the two research approaches, (i.e. the concurrent approach) would help to triangulate the findings or the results of the studies and overcome the problems of relying on one approach over the other.

1.5.3 Research methods

1.5.3.1 Sampling design and sample size determination

A multistage random sampling procedure was employed to draw participant and non-participant SHFs' from the West Arsi Zone Kofele (Germama PA) and East Shea Zone of Adama District (Kuriftu Hida and Adulala Hake Haroreti PAs) were targeted for the survey. The list of participant and non-participant smallholder farmers (i.e. the sample frame) obtained from the Peasant Associations were randomly selected to give a total sample of 383 respondent households.

Finally, the study relied on random sampling to select subjects of the study from Germama PAs of Kofale District; Kuriftu Hida and Adulala Hake Haroreti out grower scheme established in 1975 G.C and 2008 G.C, respectively. Finally, the author applied purposive and proportionate sampling techniques were employed to draw the desired number of simple size in each PAs. As evidenced in Miaoulis and Michener (1976) while selecting the sample size, it is vital to consider three important criteria: *the level of precision, the level of confidence or risk, and the degree of variability to measure the attributes or the variables*.

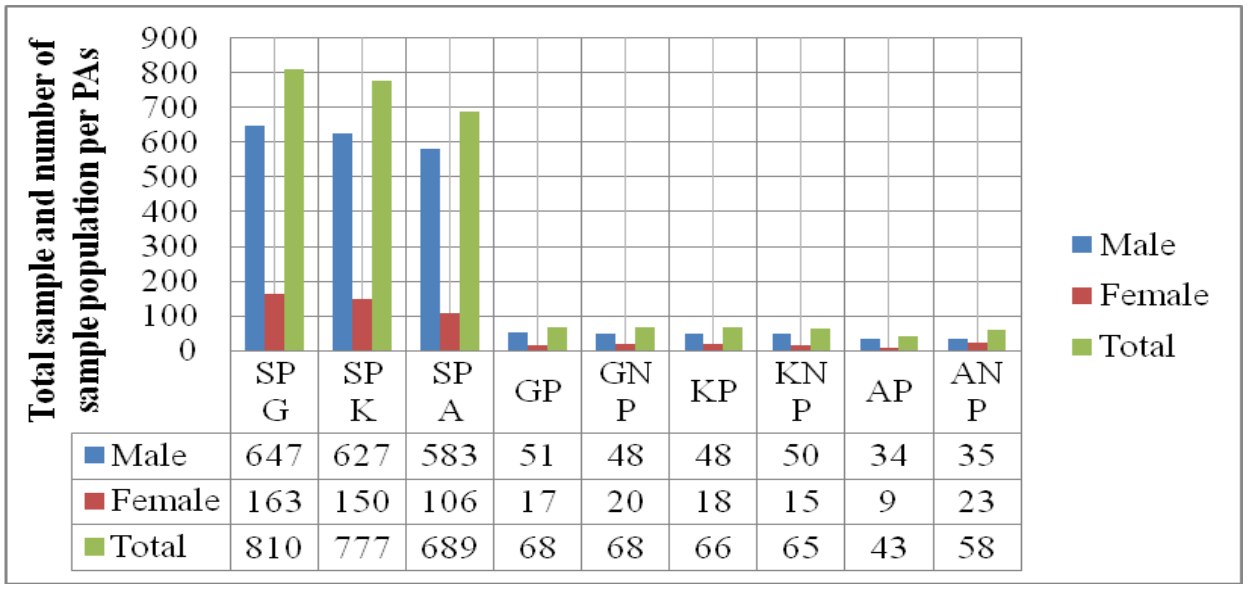
Accordingly, to draw the respondent households for the study utilizes the sample size formulated by Kothari (2004):

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 \ (N-1) + z^2 \cdot p \cdot q}$$

Where: n is the desired sample size for the study; Z is the upper points α/2 of standard normal distribution at 95% confidence level, which is equal to 1.96; e is acceptable error term at a given precision rate (assumed 5%); p is the proportion of households (which is taken as 0.5 or 50%). In most conservative cases, 'n' would be the maximum and the sample would yield at least the desired precision; q is 1-p; N is the total households. Thus, the researcher selected 383 participant and non-participant respondents based on random sampling: purposive and

proportionate sampling techniques were employed to draw the desired number of simple size and the proportion of respondent households for Germama and Wonji Showa Sugarcane out grower scheme, which are 136 and 247, respectively.

Consequently, from Germama PA, 136 sample SHFs engaged in Malt Barley production, two PAs from Eastern Shewa Adama district namely: Kuriftu Hida and Adulala Hake) with 131 and 116 respondent SHFs, respectively. Ultimately, we collected data from 368 respondents.



	SPG	SPK	SPA	GP	GNP	KP	KNP	AP	ANP
Male	647	627	583	51	48	48	50	34	35
Female	163	150	106	17	20	18	15	9	23
Total	810	777	689	68	68	66	65	43	58

Figure 1.6 A graph of sampled household heads

Source: Kofale and Adama District Agricultural Office, 2018

This perception studies were carried out on six important aspects of CF with major focus on farmers' perception on CF as a strategy of livelihood improvement and a mechanism to ensure food security. These are general aspects of CF practices, CF specifications or design, government role in the contract system, the role of private sector, CF and climate change adaptation nexus: and contract farming as a livelihood strategy and ensuring food security. This study was a part of household survey conducted from September 2017 to August 2018 G.C to understand the relationship between Malt Barley and Sugarcane CF practices and climate change adaptations at Germama, Kuriftu Hida and Adulala Hake Haroreti, respectively.

The major concern of this study was to deal with the CF practices as a response to CC and variabilities in West Arsi Zone of Kofale District and East Shoa Zone of Adama District. To this

end, the sampling design combined both the probability and non-probability sampling techniques. Thus, the study relied on multi-stage sampling design procedure.

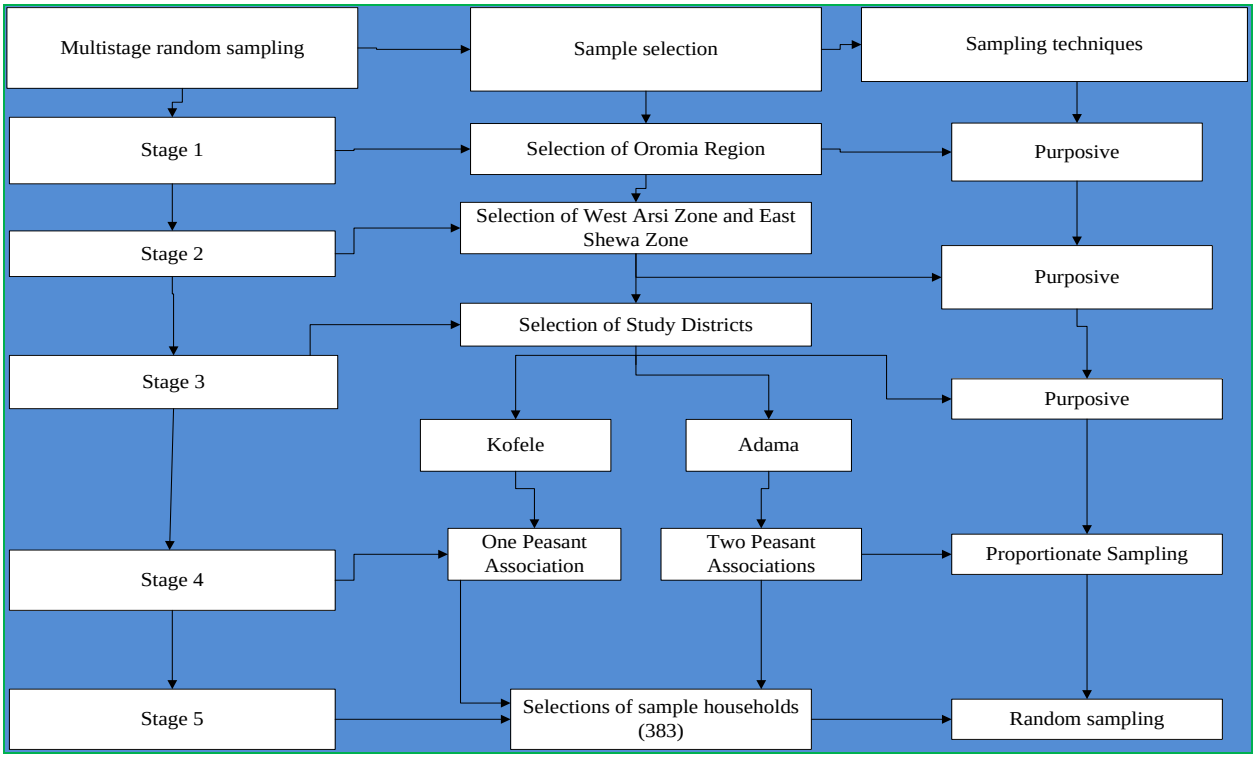


Figure 1.7 Sampling Design, sampling techniques and sample size

1.5.4 Data sources and data collection Instruments

The researcher generated primary data from respondents through household survey sample respondents in Kofale District (Germama) and Adama district (Wonji Showa out-growers). In addition, the researcher gathered primary data from institutions working on the problem under investigation. This was done between September 2017 and September 2018 G.C. Secondary data were collected and reviewed from different sources such as books, research journals and articles obtained from Google scholars, planning documents, quarterly and annual reports of institutions and document at different levels of government, NGOs and ultimately incorporated into the paper. These helped to establish the background information and employed in description of the study area using standardized secondary data collection sheets.

Regarding important primary data sources, the study gathered first hand information from households on: socio-economic and demographic profile of respondents, perceptions of SHFs, over all situations of participation s of SHFs in CF (i.e. farm, income, off-farm income, non-farm income; the SHFs earn income before and during CF). Moreover, data on CC induce adverse

effects and the resultant adaptation practices, adoption of CC adaptation options, challenges and opportunities of CF and the implications of the interface between CF and determinants of adoption of CC adaptations in the study locations were collected.

1.5.5.1 Data collection instruments

This study made use of data collected through various data collection instruments such as household survey combined with Key Informant Interview (KIIs), Focus Group Discussion (FGDs), relied on Case histories (CHs) direct observation with transect walk. Checklists were prepared to manage the KIIs and FGDs; developed and conducted household survey through structured and semi-structured interview schedule.

i. Primary data collection instruments

Household survey (HHS): The researcher employed primary data collection instruments to gather first hand information from the respondents at the time of fieldwork in from SHFs at Kofale District (Germama) and Wonji Showa outgrower schemes (Kuriftu). Data collected includes socioeconomic and demographic characteristics of respondents, perceptions of SHFs on CF practices, CC adaptation strategies practiced in the specific study areas. In addition, data were collected on the income earned by SHFs before CF and during CF. Moreover, the researcher collected data on the overall suggestions of SHFs on CF arrangements, impacts of CF on net income of SHFs, implications of these factors on the SHFs livelihood and food security were gathered. Moreover, household survey as an instrument was used to collect data on: agronomic practices, use of agro-chemicals and climate change induced effects such as drought, flood and hail formation, if any in the study areas. This instrument was used to gather data related to input utilization, land preparation, family labor and hired labor, post-harvest, transportation and pricing issues. Furthermore, we gathered data on crucial information for understanding of opportunities and constraints, benefits of CF practices for the SHFs and agri-business firms. Above all, to check this instrument, the study conduct pilot survey under close supervision of the researcher and made some amendments in the questionnaire, incorporated additional ideas and to remove those irrelevant ones. In addition to these, the researcher picked up some cases to see the particular cases in-depth to understand problem under investigation.

Key informant interview (KIIs)*:* This study was relied on KIIs to undertake with ten individuals at different levels. At Peasant Association (PA) or kebele level, individual interviews

were made with elderly people, PA Chairpersons and Development Agent (DA) who have had sufficient information on CF practices, input utilization, services, whether related (rainfall patterns, temperature, drought, flood), agronomic practices, and livelihood strategies they are employing in the areas. At District level, District agricultural and rural development office, Rural Land Administration and Environmental Protection Office, were consulted and interviewed in the field of agribusiness sector. Checklists were prepared to gather information from the KIIs.

Focus group discussions (FGDs)*:* The researcher conducted four separate FGDs with the stratified categories of respondents (i.e. contract participants and non-participants) into the two study areas. FGDs discussants were selected from participant and non-participant SHFs. Each group comprised of 8-10 individuals in each PA. The discussions focused on overall CF arrangements, they type of CF[ii] arrangement item, the livelihood diversifications, wealth ranking, seasonal calendar, drought and flood, access to agricultural input, and agronomic practices: cropping patterns, weeding, and applications of agro-chemicals, pre-and post-harvesting. To this end, the investigator prepared checklists and collected information from focus group discussants.

Field observation and photograph documentation (FOs)*:* At the time of field survey, the researcher with the guidance of PA chairpersons and other farmers, DAs, enumerators made two transect walks in Germama and Wonji Sugarcane out grower schemes to uncover the various farming practices and observed the overall conditions in the study areas and captured photographs. Moreover, the investigator took some photographs of some crucial aspects of CF practices and CC adaptation practices in the field to substantiated the qualitative information (benefits of CF practices, opportunities and challenges of CF) collected through other data collection methods (i.e. Household Survey).

Case histories (CHs): this is another qualitative data gathering instrument where an informants history on the problem or research topics gathered to have deeper insights about the situation of the case. Accordingly, the situations of an informant: social, economic and environmental aspects picked up and discussed with respect to the discussions narrated with the data gathered through quantitative methods and triangulated with the one dealt with the cases developed in the process.

ii. Secondary data collection methods

Secondary data were obtained through review of books, reports; recorded documented at District level i.e. Agricultural and Rural Development Office, Wonji-Shoa Sugar factory, Rural Land Administration and Environmental Protection Office, DA at PA levels. In addition to this, additional information with regard to CF practices, out grower schemes, legal, policy and institutional issues, benefits of CF, its opportunities and challenges were obtained from Oromia, Agricultural Transformation Agency and FATA. Furthermore, crucial key climatic variables such as daily rainfall and temperature data obtained from National Metrological Agency of Ethiopia (NMEA). To this end, the study utilized 15-30 years **(1987-2018 G.C)** of rainfall and temperature data, established and analyzed the trends across years. As IPCC (2007) defined climate in a wider sense is the state, including a statistical description, of the climate system particularly rainfall (precipitation), temperature and wind.

1.5.5 Methods of data analysis

The data collected through various data gathering tools were coded, entered into Statistical Package for Social Science, Version 20 Software and transferred or saved into Stata Version 14 Software and Microsoft Excel work sheets. Descriptive analysis was employed to discuss the socioeconomic characteristics and demographic compositions of respondent household heads such as mean age, education, marital status, educational status, net income, family size, farm size, access to credits, access to extension service packages, access to agronomic practices, access to agricultural technologies, access to market and so on.

This study aimed to deal with four specific objectives: perception of SHFs on CF related points and CC adaptation; impacts of CF on net income earned by SHFs as an income difference between during CF and Before CF), determinants of adoptions of climate change adaptation strategies and the challenges and opportunities of CF in the study areas. Discussions regarding the empirical methods were done with respect to each objectives based on the problem under investigation.

In general after gathering all the important data from primary and secondary sources, the data was coded, edited and cleaned both manually and by the help of software. Such data were analyzed, generalized and presented with the help of qualitative techniques. According to Bazeley (2009), the quantitative data obtained through KIIs, FGDs, FOs and CHs assigned into

three thematic areas to make it ready for the analysis. Afterwards, the descriptions of data, classifications of data and looking into the linkages between the concepts was done for the purpose of analysis, syntheses and presenting the findings. The results of the qualitative data was described and complimented with the results obtained from the quantitive survey. Accordingly, depending on the nature of the measurements, descriptive statistics such as mean, median standard deviation and coefficient of variations were employed to present the descriptive findings of each objective.

On top of these, the inferential statistics (t-test, chi-square test, ANOVAs, MNLM, PSM methods, techniques and PCA) were employed to answer the study objectives. Furthermore, various software packages such as Excel, SPSS (20), Stata (14) were used to analyze, summarize and discuss the quantitative data collected through different statistical forms. Venism (6.3) and Visio Professional Program (16.0) were employed to model different the statistical outputs and to develop conceptual models. Arc GIS (10.1) was employed to map the study areas. Tables, graphs and figures were employed to present the findings.

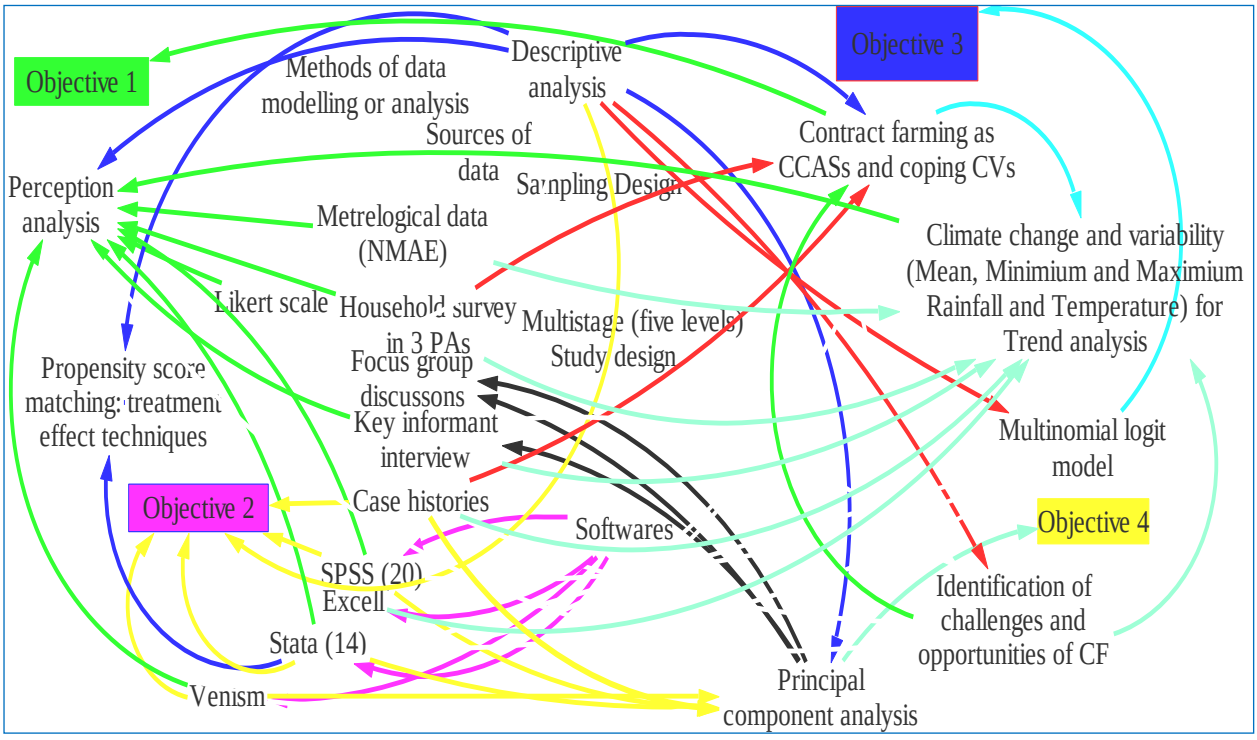


Figure 1.8 Methodological summaries by objective, data sources, and method of analysis

Source: Authors construction, 2019

1.5.6 Significance of the study

This study was theoretically and empirically important to know the current situations of CF in Ethiopia. A careful and thorough understanding of the Malt Barley and Sugarcane CF generated knowledge about the perceptions of SHF on CF and readers understand how CF in the study areas affected net income earned by SHFs. Besides, undertaking assessment impacts of CF on livelihood of SHFs, determinants of adoption of CCASs in the area would understand how SHFs engaged in CF and those not involved in CF adopt various CCASs. Further, examined the major challenges and opportunities in CF arrangements negatively or positively affecting the success and sustainability of CF in the study areas.

Furthermore, conducting such type of study would prompt policy recommendation and serve as inputs for decision makers and policymakers to understand and to get deeper insights into CF arrangements, its contribution to SHFs' income and CC adaptation strategies. To these end, it would provide some policy recommendations on CF practices, CC adaptations, its implications on livelihood choices of SHFs, its benefits for the stakeholders mainly for SHFs, agribusiness owner and other key actors who are engaged in CF arrangements in the study areas.

1.5.7 Scope of the study

This study was carried out on "Contract farming as a response to climate change and variabilities in Ethiopia: empirical evidences from West Arsi Zone, Kofele District and East Shoa Adama District", respectively. It would examine the perceptions of SHFs on CF arrangements and CCASs in the study areas. In addition, it is delimited to the assessment of impacts of CF arrangements on net-income earned by smallholder farmers' in the study areas. Further, it would assess the factors that determine the adoption of various CCASs smallholder farmers' employed to curb climate change in the areas. Furthermore, it would identify and examine the major challenges and opportunities of CF in the study areas.

1.6 Limitations of the study

Owing to analyzing the perception, impacts, adoptions of CF as CCAS and coping mechanisms to CV in the light of the agrarian political economy and FS theories, this study has its own limitations. Some of the limitations are the research schedule or plan that aimed to finalize the dissertation works until the end of June 2018. Because of the popular movement at research areas and the outbreak of Noble Corona Virus (COVID-19) pandemics in the whole world, we are all

lacked down and lagged behind the schedule, the research data were collected in the aftermath of the command post placed on the two conflicts hotspot areas and the presentations of this papers become late, respectively. Besides, rescheduling was very necessary and present it at the midst of COVID-19 pandemics.

The second point was that there was only one metrological station at Adama District and thus it was far better to rely on site-specific metrological dataset at Wonji-Shewa Sugar factory, where the sugarcane outgrower schemes are located. Moreover, it would have been better if Wonji-Shewa agricultural extension experts fully responded to the KII's checklists. However, they refused to explain their relationships with SHFs engaged in CF transparently, the way they address the problems of SHFs engaged in outgrower schemes. Finally, the study did not have enough budgets and being a self-sponsored took extra time in the contrary to the reschedule set forth before in completing the Ph.D.

1.7 Structure of the dissertation

Chapter one provides general background in the introduction of agricultural transformation and contract farming arrangements, agricultural production as a source of earning a living for SHfs', CF considered as an important tool in involving SHFs' in commercial agriculture, its vulnerability to climate change and SHFs' engagement in CCASs. Further, it also stated about the problem under investigation. Furthermore, it dealt with general and specific objectives, research questions, significance and scope of the study. Moreover, there are reviews of relevant and historical literatures based on the problem under investigation. In addition, it focuses on the historical aspects of CF experiences African and Ethiopian, CF concepts and perceptions, CF as an institutional set ups. Moreover, it reviews about CF as an agricultural development tool, Patterns, drivers, and trends of CF as an agricultural technology transfer, opportunities and challenges of CF. It also provides the empirical literature on climate change adaptation and CF in Ethiopia, and a conceptual framework. Furthermore, there are the descriptions of the study areas, climate socioeconomic and demographic factors, climate change, climate variabilities and CCASs in the study areas. It also describes about the research methodologies employed to assess the problems under investigation.

Chapter two deals with the perceptions of SHFs on CF as CCASs employed in the study locations. Chapter three investigates about the impacts of CF on net-income and sustainable

livelihood of SHFs. Chapter four presents the adoption of CF as climate change and climate variabilities and the factors related to it. Moreover, chapter five explained about the challenges and opportunities of CF in relation to Malt Barley and Sugarcane CF and dealt the qualitative aspects of the respected objective. The last chapter is concerned with the synthesis of the key findings, policy implications, future research areas, conclusions and possible recommendations based on the findings.

Chapter 2

2. Perception of farmers' on contract farming as a response to climate change adaptation in Ethiopia: empirical evidences from two Districts of Oromia Regional State

Abstract

The main purpose of this paper is to assess "perception of farmers' on contract farming as a response to climate change adaptation in Ethiopia: empirical evidences on Malt Barley contract farming and Sugarcane outgrower arrangements. Data on farmers' perceptions were collected from a sample of 368 farmers selected through proportionate random sampling. Household survey substantiated through focus group discussions, key informant interviews and field observations were data gathering instruments. Software Package for Social Science (SPSS), Version 20 software were employed to analyze data collected through Likert Scale measurement. Results revealed that participant farmers' have better understanding on overall aspects of CF as compared to those non-participant farmers'. Therefore, the agribusiness firms and cooperatives should focus on lifting up farmers' understanding on CF; provide trainings and technical assistance, which in turn has positive impacts on sustainability of contract farming and livelihood in the study areas.

Keywords: Climate change adaptation, Agribusiness firms, Contract farming, Household survey, Perceptions, Likert scales, Sustainability, Software packages for social science

This paper was published as:

Megersa, G. & Assefa, E. (2019). Perception of farmers' on contract farming as a response to climate change adaptation in Ethiopia: empirical evidences from two Districts of Oromia Regional State. *Journal of Sustainable Development in Africa*: Volume 21, No.4, 2019, *Published by Clarion University of Pennsylvania, Clarion. Pennsylvania: http://www.jsd-africa.com/.*(Published)

2.1 Introduction: Background of the study

Agriculture is the main stay of an economy and a source of livelihood for many smallholder farmers[iii] in Ethiopia. Subsistence farming is a typical farming system, which is very common with a mixed type of agriculture comprising of crop production, livestock rearing, vegetables and fruit production. Thus, it is very essential to include smallscale[iv] farmers into agricultural value chains in Africa (Little & Watts, 1994; Oya, 2012; Prowse, 2012; United Nations Conference on Trade and Development (UNCTAD, 2009) by transforming agriculture from subsistence, traditional farming system to modern agricultural commercialization. Malt Barley is one of the commercial crops with high potential, market oriented and integrated into value chain development as contract farming arrangement in Kofale district of West Arsi Zone of oromia Regional State. The contract was between agribusiness firms and the cooperative unions. The government of Ethiopia seeks to address the growing domestic and international demand for sugar and to earn foreign currency on sustainable basis; Wonji Shewa Sugar Factory incorporated the farmers' farmland into the contract scheme as outgrowers. Similarly, recent initiatives considered by Assela Malt Factory, Diageo and Heineken creating market linkages and a network for farmers' and cooperatives to ensure sustainable and reliable supply of Malt Barley for Malt production by Ethiopian Agricultural Transformation Agency[v] (EATA, 2016). It was with this intention that the SHFs at Kuriftu Hida and Adulala Hake were engage in the contract arrangement in East Shewa Zone of Adama district.

Accordingly, the Malt Barley CF at Kofale District was started its production in 2014 G.C (Gregorian Calendar) and the Sugarcane CF at Kuriftu Hida and Adulala Hake entered into the contract scheme in 2008 and 2011 G.C, respectively. One of the major aims of the government of Ethiopia was to start and expand the Malt Barley CF with the private sectors: Meta Diageo, Heineken, Self Help Africa, Agriterra, SNV (Netherlands Development Organization). Further, Technoserve and GMS[vi] Ethiopia were to fill the production gap created in malting Malt Barley at Assela Malt factory and create market linkages on sustainable circumistances for farmers. Thus, the need to meet the brewing industry's increasing domestic demand and the national stance to replace Barley and Malt imports, which is a major expense for the country (with $9m in imports of raw Malt Barley and $40m+ in annual imports of Malt). Furthermore, because of the presence of competition among the processors to increase Malt Barley production through CF, providing resources (EATA, 2016), inputs and other extension packages were to address the

rapid growth of beer consumption (i.e. 15-20%). On the other hand, the growing demand for Sugar at local market and international level brought forth the Ethiopian government to expand Sugarcane farm creating a platform for the factory to incorporate the farmers' in the surrounding locations of Wonji Shewa Sugar Factory (Adama District Rural and Agricultural Development Office, 2007).

The main aim of this study is therefore, to assess the farmers' perception on CF as CCASs in two study areas namely: Kofele District (i.e. Germama Peasant Association engaged in Malt Barley CF) and Adama District Wonji Shewa Outgrowers: (i.e. Kuriftu Hida and Adulala Hake Peasant Associations engaged in Sugarcane CF). The study has used household survey, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) to expose information from the participant and non-participant farmers' as opposed to the studies by (Ayelech, 2012; Ayelech, 2010; Nijhoff & Trieneksen, 2012; Nijhoff, 2010 and USAID, 2012) done through qualitative studies and review approaches (Prowse, 2012). The current study (i.e. our study) employed a mixed approach namely quantitative approach (i.e. household survey) and qualitative approach (FGDs, KIIs) to investigate the perceptions of SHFs on CF as climate change adaptation strategies in Ethiopia: empirical evidences from Germama (i.e. Malt Barley CF), Kuriftu Hida and Adulala Hake (i.e. Sugarcane CF). There are limited study done in Ethiopia (Ayelech, 2010; Nijhoff & Trienekens, 2012; Nijhoff, 2010; Prowse, 2012; USAID, 2012) in particular and the world in general (Strohm & Hoeffler, 2006).

Many of these studies conducted in Africa, Asia, Europe, Central America, USA, East Asia and other parts of the world focused on the vertical coordination of CF, CF theory and practice, Linking agri-business and farmers, and so on failed to deal with the perception of farmers' on CF as climate change adaptation strategies. Thus, there are lack of empirical investigations and scientific evidences carried out in Ethiopia on the farmers' perception regarding CF as CCASs in general and other aspects of CF in increasing the income of farmers' in Ethiopia in general the study areas in particular. Moreover, there were no studies conducted to examine farmers' perception of on the contract specifications, the role of the government in CF, the role of private sectors on CF, the relationship between CF and CCASs with the ultimate goals in improving the livelihoods of farmers and ensuring food security and sustainable livelihood.

Therefore, this study is the first of its kind to shed some lights on the problem under investigation employing a mixed research approach or design (i.e. a concurrent approach).

Therefore, it is paramount important to assess the farmers' perceptions on CF as climate change[vii] adaptation in the study areas, fills these knowledge gaps and contribute to sustainable agriculture. Consequently, this paper would add some new finding in the area of CF as CCASs[viii] literatures and forward policy recommendations with respect to the perception and knowledge pertaining to CF as CCASs.

2.2 Research methodology

2.2.1 Methods: sampling and data collection

The researcher employed household survey, FGDS and KIIs to gather data from the sample households, farmers who are engaged in Sugarcane farming and those non-participant farmers' in two Districts: Kofale (i.e. Malt Barley CF) and Adama (i.e. Wonji Shewa Sugarcane Outgrowers). In general, 368 farmers' were surveyed in the study areas. The three study PAs in the two Districts, namely: Germama, Kuriftu Hida and Adulala Hake were selected purposively from West Arsi Zone, Kofale District and from East Shewa Zone, Adama District, respectively, based on the their production history. The household surveys were collected from the contracted and non-contracted farmers randomly selected from the sample frame or lists obtained from the PA office during the first visit and carried out in the study areas. Moreover, Six FGDs each group comprising ten (10) participants, more *than 20 KIIs* from various government and NGOs and field observations were conducted with the contracted and non-contracted SHFs' to substantiate the household survey data. Moreover, the primary data obtained through household survey were supplemented with the data collected from secondary sources. Here, the unit of analysis was the sample head of households engaged in CF (participants)[ix] and not engaged in CF (non-participants)[x].

This perception studies were carried out on six important aspects of CF with major focus on farmers' perception on CF as climate change adaptation strategy for livelihood improvement and a mechanism to ensure food security. These are general aspects of CF practices, CF specifications or design, government role in the contract system, the role of private sector, CF and climate change adaptation nexus: and contract farming as a livelihood strategy and ensuring food security. This study was a part of household survey conducted from January 2018 to August 2018 to understand the relationship between Malt Barley and Sugarcane CF practices as climate change adaptations at Germama, Kuriftu Hida and Adulala Hake Haroreti, respectively.

2.2.2 Data analysis and interpretations

The primary data collected from farmers' on farmers' perception on CF as CCASs for livelihood improvement and a mechanism to ensure food security were measured through Likert Scale Measurement (LSM) and analyzed through descriptive statistics: such as frequency, mean and standard deviations using Statistical Packages for Social Science (SPSS Version 20). The descriptive statistics were employed to describe *farmers' perception on overall aspects of CF, contract specifications, and roles of the government on CF, roles of private sectors or development partners on CF, the link between CF and climate change adaptations and the CF as a livelihood improving strategy and a mechanism to ensure food security* in the study areas.

To this end, there were totally 58 items in the instrument explaining the various aspects of CF and climate change adaptation in the view of improving the livelihood and a mechanism in ensuring food security of farmers in the study areas. The responses were collected on five point Likert Scale Measurement[xi], namely:- 'Strongly agree', 'Agree', 'I don't know', 'Disagree' and 'Strongly disagree' by assigning 5, 4, 3, 2 and 1, respectively, on each of the items. The score of each item under different CF perceptions as CCASs were added to get the total score of the informants. Therefore, the minimum and maximum possible scores were 1 and 228, respectively. Based on the scores obtained in the survey, the overall perceptions of smallholder farmers, we the informants categorized into three groups as depicted in the following table.

Table 2.1 Likert scale measurement categories

Category	Criteria
Poor	< (Mean – ½ SD)
Average	Between Mean $\pm$ ½ SD
Better	> (Mean + ½ SD)

Source: Adapted from Tanweer, *et al.,* 2018

In further analysis, the perceptions of farmers on CF as climate change adaptations were carried out by calculating the mean score for each item, which may have the minimum and maximum possible scores on each item were 1 and 5, respectively.

2.3 Results and discussions

This section starts with descriptive analysis of the socioeconomic characteristics of the sampled farmers' engaged in Malt Barley and sugarcane CF in Kofale and Adama districts of West Arsi

Zone and East Shewa Zone of Oromia Regional States. The perception studies focused on six important aspects of CF practices as CCASs. These includes: general or overall situations of CF, CF specifications or design, government's role in contract systems, the role of private sectors in CF, assessments on the perception of farmers' and the relationship between CF as climate change adaptation practices and CF in improving farmers' livelihood and ensuring food security in the study areas.

Descriptive analysis: Socioeconomic characteristics on participation and non-participation in contract farming

Table 2.2 and 2.4 summarized the socioeconomic variables that are supposed to exert influence on the participation of farmers into contract farming. These variables were grouped into household characteristics, economic situations, farm characteristics and institutional factors that are very crucial in affecting contract faming, CCASs and livelihood improvement.

Household characteristics

Age of household is one of the socioeconomic factors that determine the participation of farmers in CF practices in the study locations. The mean age of farmers who participated in the survey is about 43.01 years with standard deviation of 12.25 at Germama. Similarly, the respondents at Kuriftu Hida and Aduala Hake mean age is 43.70 years with standard deviation of 12.09 (see table 2.2 below). The statistical analysis revealed that there is significant difference in mean age among participant and non-participant farmers. Genders of households greatly influence the participation of farmers into contract farming in the study areas. Therefore, it was estimated that 36.7% of the respondents participated in CF were male as compared to those 11.9% of female counter parts. With respect to non-participants, 34.2% of them were male and 17.9% of them were female. From this it is concluded that the majority of the participants and non-participants were male respondents and the Chi^2 test revealed that the difference in the participation of male and female were statistically significant at less than 5% ($p<0.019$).

With regard to education status of households, most of the respondents at least reached 5-8th grade level and can read and write. However, the aggregate of 45.9% of participant households into contract farming at followed education level above grade 5 and this exceeds the non-participants grade level by 13.6%. The mean highest-grade level attained by those farmers in the overall is about 3.16 and 0.92 for all farmers at Germama, Kuriftu Hida and Adulala Hake and

the Chi^2 result indicated that this is statistically significant at 5% level *(p<0.000)*. From this it is concluded that as level of education increases, the probability of participation in CF increases because the respondents with better education have better chance of knowing the benefits and advantages of CF as compared to those at lower grades. Hence, this study is consistent with (Strohm & Hoeffler, 2006), where the better the farmers educational level, the better the participant respondents understand the contract design, agronomic practices, market situations and other contract activities.

Regarding mean family size of the respondent farmers, the mean number of family at Germama was 6.87 persons with standard deviation of 1.49 and 6.51 persons with standard deviation of 1.64 for Kuriftu Hida and Adulala Hake, which is higher than the mean family size of the national average (4.2 persons per household) (CSA, 2007). However, it has been reported that there was significant difference between the family size of participant and non-participant respondent farmers. As depicted in the table 2.1, the respondents at Germama have relatively exhibited large family size and there was significant difference among the study participant and non-participant SHFs' among the study peasant associations.

Table 2.2 Description of socioeconomic characteristics of respondents by peasant associations

Variable	Germama (N=136)		Kuriftu Hida and Adulala Hake(N=232)	
	Mean	Std. Dev.	Mean	Std.Dev.
Mean age of HHs	43.01	12.25	43.70	12.09
Mean of education of HHs	3.16	.79	2.22	.92
Mean of family size of the HHs (number of persons in the HHs)	6.87	1.49	6.51	1.64
Mean of wage labour(man/day/year in ETB Birr)	3415.44	882.38	2732.52	584.61
Mean of Livestock in TLU	7.72	5.38	5.60	4.72
Mean of Malt Barley production (Quintals/hectare)	46.88	8.08	2.85	.57
Mean of Sugarcane production (Quintals/hectare)	-	-	113.73	95.02
Net income per year in ETB Birr	31,082.94	5,199.38	21,784.7	15,733.52
Farming experience in years	1.90	.31	2.32	.57
Farmland size in hectares	1.86	.85	1.72	.69
Access to nearest markets in hours	1.35	.48	1.34	.67

Source: Own Survey, 2018

Economic characteristics

Income of households is a cornerstone for any agricultural activities in Ethiopian. This includes the overall income obtained from agricultural activities, off-farm activities, non-farm activities and combinations of two or all of them. Consequently, the participant respondent households got a mean income of 31,082.94 ETB per year with standardard deviation of 5,199.38 as compared to those non-participant respondent households who obtained a mean income of 21,784.70 ETB per year with standard deviation of 15733.52. The Chi^2 result revealed that the income earning is statistically significant and different at $p<0.000$ among the participant and non-participant respondents because of the fact that the participant households engaged in diversity of income source.

Malt barley and sugarcane productions were the two major cash crops at Germama, Kuriftu Hida and Adulala Hake, respectively, measured in Quintals per hectare. Therefore, the respondent sampled households at Germama produce a mean of 46.88 Quintals per hectare with standard deviation of 8.08. Nevertheless, the sampled households at Kuriftu Hida and Adulala Hake produced a mean of 113.73 Quintals per hectare of Sugarcane with a standard deviation of 95.02.

With regard to Malt Barley production, the discussions made with FGDs and the interview held with KIIs at Germama and Asella Malt factory experts underscored that the standard or Grade level determines the price of Malt Barley. The respective price depends on the moisture content of the grains, seed variety, grain size, residue contents of and other factors (Assella Malt Factory and BGI Ethiopia, 2017 and 2018). From this, one can conclude that the better the quality of Malt Barley, the better the price and the better the income earned from Malt Barley and incentives obtained. For further information, please refer to table 2.3 below.

Table 2.3 Standards and criteria to select qualities of Malt Barley Grains

Variety	**Grade 1**	**Grade 2**	**Grade 3**	
Traveller	1155.00 ETB	1135.00 ETB	1115.00 ETB	**Rejection or Corrective Actions**
Criteria	**Grade 1**	**Grade 2**	**Grade 3**	
Screening: Underseive(<2.2mm)	0-4%	4-6%	6-8%	More than 8% Red or Black Kernels
Color	Normal	Golden, Grey or others	Golden, Grey or others	
Moisture Content	13.5%	13.5%	13.5%	More than 13.5%
Other Creal Grains (Max% by Mass)	0.5%	0.5%	0.5%	More than 0.5%
Foreign Matter	5%	5%	5%	More than 5%
Fusarium on Grains	0%	0%	0%	At least 1 Grain
Variety Purity	Min 97% of the distributed seed variety	Min 94% of the distributed Seed Variety	Min 91% of the distributed Seed Variety	Min 90% of other Seed Variety
Storage, Insects (Weevils etc)	None	None	None	Any Weevil or Storage insect
Smell	Normal	Normal	Normal	Musty or Abnormal Smell

Source: Assella Malt Factory and BGI Ethiopia, 2017/2018

Wage labor is one of the determining factors in the study areas measured in man per day per year. Accordingly, the respondent households at Germama paid mean income of 3415.44 Birr per year with standard deviation of 882.38 as compared to those respondents at Kuriftu Hida and Adulala Hake who paid 2732.52 Birr per year with standard deviation of 584.61 for wage labour. The mean wage labour for the study areas depicted a difference of 682.92 Birr and the wage labour was greater for the respondents at Germama who engaged in Malt Barley CF scheme.

Farming characteristics

Land management systems (LMSs) such as soil and water conservation, crop rotation, agro-forestry, mulching and other related practices were an integral part of sustainable agriculture in the study locations. It played a pivotal role in increasing the production and productivity of those participant respondent households at Germama. To this effect, 45.4% of participant sampled households engaged in LMSs followed by those non-users that accounted about 2.4%. On the

other hand, large proportions of non-participant respondent households that consisted of 53.8% relied on LMSs in the study locations. The 46.2% of the non-participant respondents were non-users of the practice. This further revealed that the participant respondents better engaged in LMSs as compared to non-participant ones. The Chi^2 test depicted that LMS is significantly different for those participants and non-participant sampled households at *($p<0.000$).*

Livestock rearing is one of the important socioeconomic factors that affect the farming system among farming community. As indicated in table 2.3, the survey results pointed out that livestock is a major component of socioeconomic pillar of respondents in the study areas. To this end, there were a mean of 7.72 TLU[xii] with 5.38 at Germama and a mean of 5.60 TLU with standard deviation of 4.72 at Kuriftu Hida and Adulala Hake, which clearly show that the TLU at Germama was greater by 2.12 TLU due to favorable and relatively good access to livestock feed. Another crucial farming characteristic was that affect the participation of farmers in CF. Accordingly, the mean farmland size for Germama was 1.86 with standard deviation of 0.85 as compared to those respondent farmers and reported with a mean of 1.72 with a standard deviation of 0.69. In this report, it revealed that there were a slight difference in farmland size among the respondents at Germama, Kuriftu Hida and Adulala Hake. Above all, the farmland sizes in the study locations were larger than the national average of farmland size, which is below 1 hectare (Amare & Simane, 2017).

Institutional Factors

Institutional factors such as access to credits, access to irrigation, access to market, use of fertilizers, agronomic practices availability of agricultural technologies and access to metrological information are the fundamental ingredient in determining the productivity of agriculture. As stated in FAO (2018), having access to quality inputs and access to credits are among the institutional ingredients responsible to raise agricultural production. Accordingly, the report revealed that despite the time, type, amount and application of extension packages in study areas, all the respondents depends on extension services in their agricultural activities. Thus, 45.4% of the participant respondents reported that they have access to extension services followed by those 2.2% who did not rely on extension, while 16.8% of the non-participant households replied that they employ extension services. The largest proportion of respondent sample households around 52.2% indicated that they did not employ extension service in the study areas. This clearly and further revealed that the largest number of respondent participant

farmers in CF in one way or the other have access and use to extension services. The Chi^2 results further confirmed that there is a significant difference *($p<0.003$)* among participants and non-participant SHFs' in accessing extension services at their locality.

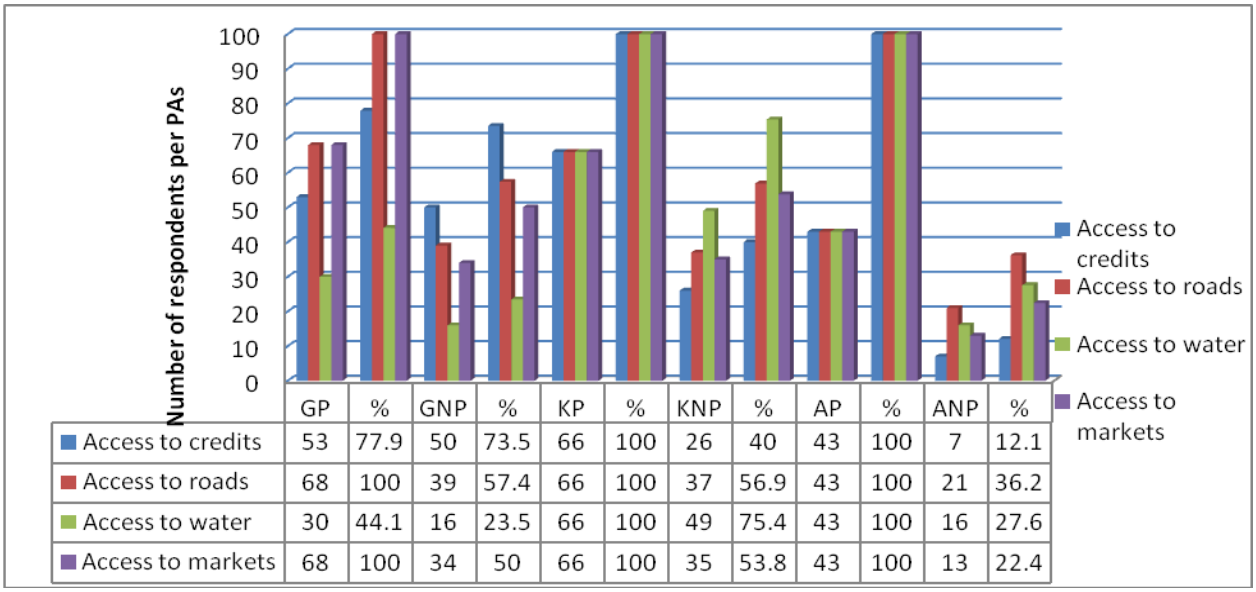
Access to credit and other financial lending facilities are very essential to enhance the ability of households in times of financial need. It is of course an important element in extension service packages and agricultural technology adoption in the view of increasing agricultural production and productivity. The need for access to credits was that it helped the sampled households in ensuring agricultural productivity through modern agricultural technologies such as farm inputs: fertilizers, improved seeds, modern farm mechanizations (Combine Harvesters, Threshers) that have a power to boost agricultural production. In view of these, 43.8% of the participant respondents have access to credits followed by those 4.2% who do not have access to credits, while the remaining 47.3% of the sampled households have access to credits followed by those 4.5% non-participant respondents, who do not. However, the participant households have access to credits from various sources: agri-business firms through government organized cooperative unions as compared to those who have access to credits from private individuals and self sponsored.

Access to irrigation is paramount important in increasing the production especially in areas where rainfall is limited or absent. Thus, 33.2% of the participant farmers reported that they have access to irrigation and employ it on their farmland and used it in agronomic practice. Small proportions of the participants that estimated about 14.6% do not have access to irrigation. With regard to non-participant respondents, 16% of them relied on irrigation for their agriculture followed by those 20.4% of them who do not use irrigation. The Chi^2 result revealed that differences in access to irrigation are statistically significant among the users and non-users of irrigation *($p<0.000$).*

An agricultural activity without market means a soldier without gun and bullet. Access to market is among the institutional factors that immensely determine the success of any agricultural commercialization, especially in the case of CF arrangement. Consequently, 22%, 18.8% and 7.1% of the participant respondent households have access to market through local market, cooperative unions and brokers in the study areas, respectively. The non-participant respondent sampled households estimated about 51.1% followed by those small proportions that accounted about 1.2% were only accessed market through local or spot market and cooperative unions. This

survey result confirmed that access to market is statistically significant among participants and non-participants respondents with Chi^2 test of *p<0.000*.

Access to agricultural technologies is also one of the pillars of agriculture that helps to increase the production and productivity of farmers. Hence, 45.4% of participant respondent households indicated that they have access to agricultural technologies such as agricultural inputs including fertilizers, improved seeds, agro-chemicals, farm implements and other related technologies. However, only small proportions of participant households that accounted about 6.3% do not rely on agricultural technologies to increase their production. In the survey result, 35.3% and 16.8% non-participant respondents do have access to agricultural technologies and do not have access to agricultural technologies, respectively. The Chi^2 result further indicated that there is statistically significant difference in accessing agricultural technologies among participants and non-participant respondent households in the study locations (*p<0.000*).



	GP	%	GNP	%	KP	%	KNP	%	AP	%	ANP	%
Access to credits	53	77.9	50	73.5	66	100	26	40	43	100	7	12.1
Access to roads	68	100	39	57.4	66	100	37	56.9	43	100	21	36.2
Access to water	30	44.1	16	23.5	66	100	49	75.4	43	100	16	27.6
Access to markets	68	100	34	50	66	100	35	53.8	43	100	13	22.4

Figure 3.1 A graph of institutional factors affecting contract farming

Source: Authors construction, 2018

Access to metrological information is another important factor that affects agricultural activities in CF arrangement. The survey result portrayed that from the total sampled households, 40.6% and 52.2% of the participant and non-participant respondent farmers, respectively, have access to metrological information through extension workers, television, radio and cell phones. However, only small proportions of participant that accounted about 6.3% do not have access to metrological information because of absence of television, radio and cell phones. The Chi^2 result

further revealed that there is significant statistical difference among participant and non-participant respondent households in accessing metrological information in the study areas (*p<0.000).*

Table 2.4 Descriptive statistics of socioeconomic variables used in the regression model per farmers participation

Variables		Participants (176)	Non-participants (192)	Chi-Square	Sig.
PAs	Germama	68(18.5)	68(35.4)	1.543	0.462
	Kuriftu Hida	65(17.7)	66(17.9)		
	Adulala Hake	43(11.9)	58(15.8)		
Gender of HHHs	Male	135(36.7)	126(34.2)	5.466	0.019
	Female	41(11.1)	66(17.9)		
Age of HHs in Years	15-30 (Youth)	41(11.1)	26(7.1)	8.334	0.015
	31-64 (Early Elderly)	119(32.3)	155(42.1)		
	65 and above (Elderly)	16(4.3)	11(3)		
Education of HHHs	Illiterate	39(10.6)	18(4.9)	32.809	0.000
	Grade 1-4	45(12.2)	68(18.5)		
	Grade 5-8	73(41.8)	60(19.8)		
	Grade 9-10	15(4.1)	46(12.5)		
	Grade 11-12	4(1.1)	-		
Access to credits	Yes	161(43.8)	174(47.3)	0.082	0.775
	No	15(4.2)	18(4.5)		
Access to agricultural technologies	Yes	167(45.4)	130(35.3)	43.559	0.000
	No	9(2.4)	62(16.8)		
Access to extension service packages	Yes	168(45.7)	192(52.2)	8.921	0.003
	No	8(2.2)	-		
Access to markets	Local	81(22)	188(51.1)	125.981	0.000
	Cooperative unions	69(18.8)	4(1.2)		

	Brokers	26(7.1)	-		
Income in ETB Birr	Mean	24293.75	14310.77	171.164	0.000
Use of land management systems	Yes	167(45.4)	22(5.9)	255.841	0.000
	No	9(2.4)	170(46.2)		
Access to irrigation	Yes	122(33.2)	59(16)	20.024	0.000
	No	54(14.7)	75(20.4)		
Use of fertilizers	Yes	163(44.3)	124(33.7)	9.574	0.002
	No	13(3.5)	-		
Agronomic practices	Yes	160(43.5)	126(34.2)	12	0.001
	No	16(4.3)	-		
Access to metrological information	Yes	153(41.6)	192(52.2)	26.764	0.000
	No	23(6.3)	-		

Source: Authors, 2018

The respondents at Germama were engaged in Malt Barley CF unlike that of respondents at Kuriftu Hida and Adulala Hake, which were involved in sugarcane CF as a major crop in their area. Hence, the survey respondents at Germama produced a mean of 46.88 Quintal per hectare of Malt Barley and that of survey respondents at Kuriftu Hida and Adulala Hake harvested a mean of 113.73 Quintals per hectare. However, as one can understand from the survey result, as there is a difference in production per hectare, the mean income obtained from Malt Barley is by far greater than that of sugarcane producing survey respondents (i.e. Mean income of 9298.24 ETB Birr, which is 40.68% of the income obtained from Malt Barley).

Furthermore, based on the report of the participant and non-participant at Kuriftu Hida and Adulala Hake, all the participants at Kuriftu Hida (i.e. 68(100%)[xiii] were access to credits, roads, water and market. The non-participant respondents that accounted about 26(40%), 37(56.9%), 49(75.4%) and 35(53.8%) respondents at Kuriftu Hida were access to financial services, roads, water and access to market, respectively. Even though they had access to these services, the amount of credits, types of roads, amount and type of water and market situations were different because of their proximity to towns, cooperative union stores and the Sugar factory. This study is consistent with the study conducted by Kirsten and Sartorius (2002) and they noted that CF creates an opportunity to access markets (i.e. market linkages) for farmers who were engaged in CF.

Regarding the participant and non-participant respondents at Adulala Hake, all of the participants (i.e. 43(100%)) of them reported that they were access to the services mentioned above. However, the non-participant sampled households estimated about 7 (12.1%), 21(36.2%), 16(27.6%) and 13(22.4%) were access to the services, respectively. From the entire explanations, one can understand that the difference in access to services between the participant and non-participant respondents were emanated from services offered from the factory through cooperative unions and services from the sampled households' own source in the case of non-participant farmers.

Perceptions of farmers on Contract farming and climate change adaptations

Overall aspects of contract farming in the study Peasant Associations

The findings related to the perceptions on the general or overall aspects of CF of farmers engaged in Malt Barley and Sugarcane CF were portrayed in figure 3 for n=368. It could be seen that 46.2% (63) of farmers involved in Malt Barley at Germama were belongs to average perception category followed by those 33.9% (46) and 19.9% (27) categorized under better and poor perception category, respectively. Regarding farmers involved in Sugarcane outgrower, 81.5% (189) and 18.5% (43) were in poor and average perception category, respectively. From the findings, it was clear that famers in Malt Barley CF that accounted about 80.1 % (109) have average to better perception towards overall aspects of CF in the study areas. The reason why the farmers in Malt Barley contract arrangement were probably due to their educational background, farming experience and the income they obtained from the scheme as compared to the subsistence farming they engaged in before their participation in contact scheme.

Table 2.5 Overall perceptions of smallholder farmers in the PAs

S.N	Levels of perception	Criteria	Respondent smallholder Farmers				Mean	SD
			Germama		Kuriftu Hida and Adulala Hake			
			No	%	No	%	182.91	43.98
1	Poor	Upto 86.95	27	19.9	189	81.5		
2	Average	>86.96-100	63	46.2	43	18.5		
3	Better	>100	46	33.9	-	-		

Source: Survey Result 2018 categorized based on Tanweer *et al.,* 2018

However, the majority of the respondents in Sugarcane CF arrangement at Kuriftu Hida and Adulala Hake were found below the average perception category and belongs to poor perception category as compared to those respondents at Malt Barley contract arrangement. From the above explanation, one could understand that farmers' involvement in Sugarcane contract arrangement was largely by force (i.e. without the willingness of farmers) and the government incorporated them into Wonji Shewa Sugarcane outgrower schemes. This was because of the proximity of SHFs farmland to irrigation scheme near Awash River and factory farms. Thus, the farmers were obliged to take part in the outgrower scheme. In the qualitative analysis of this study, the KIIs and the FGDs conducted with Kuriftu Hida and Adulala Hake discussants explained that it was

mandatory for SHFs to participate in Sugarcane outgrower scheme or leave their farmland for the factory and SHFs were compelled to choose the first option (i.e. to participate in the outgrower scheme). Unless and otherwise, they had to leave their farmland and there was no exit strategies designed for farmers. Furthermore, the perception patterns obtained from farmers' with contract and without contract at Germama were similar and hence the aggregate results were considered in the perception analysis. Similarly, this was also common for farmers with and without contract at Kuriftu Hida and Adulala Hake (i.e. Sugarcane outgrowers), their perception on the six themes were similar regardless of their participation.

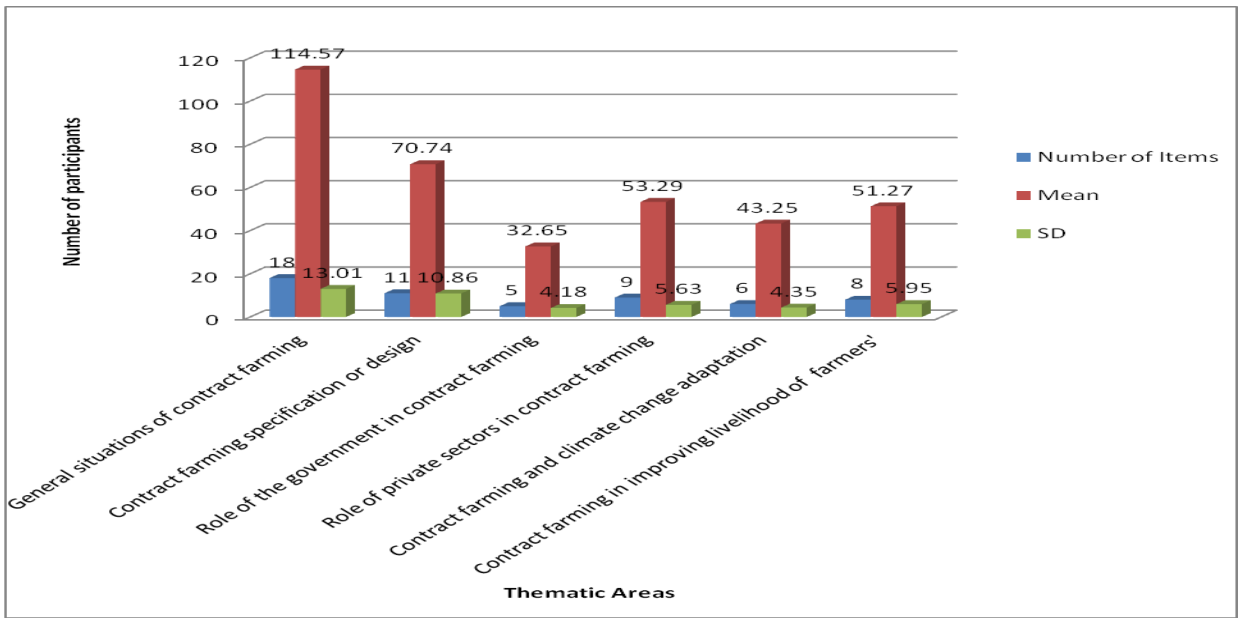


Figure 2.2 A graph of perceptions of farmers' on thematic areas

Source: Survey Result, 2018

Perception on general situations of Contract farming

To understand the importance of CF and its details, it is essential to examine first the perceptions of farmers' on CF. Second; this requires comprehending the benefits CF provides to poor farmers and its contribution to their current livelihood as compared to their livelihood before. The detailed analysis of the perception of farmers' on CF schemes geared toward the understanding of six themes in this study. These themes include (i) overall aspects of CF, (ii) CF design, (iii) the role government in CF, (iv) the role of private sectors or development partners in CF, (v) the link between CF and climate change, and (vi) CF role in improving the livelihoods of

farmers' and food security situations of farmers' in the study areas. Accordingly, as indicated in figure 2.2, the mean score were the highest (i.e. 114.57) for all the respondents at Germama, Kuriftu Hida and Adulala Hake under the general situation of CF.

It was reported that the thematic areas such as CF design, role of private sector in CF, CF in improving livelihoods and ensuring of food security of SHFs, CF as climate change adaptation, and the role of the government in CF scored mean of 70.74, 53.29, 51.27, 43.27 and 32.65 respectively, in descending order on perception of farmers'. In relation to the themes, the mean scores were similar for the farmers' of the three-peasant association irrespective to their crop type (Malt Barley and Sugarcane) and their locations. Furthermore, the perception patterns obtained from farmers' with contract and without contract at Germama were similar and hence the aggregate results were considered in the perception analysis. Similarly, this was also common for farmers' with and without contract at Kuriftu Hida and that of Adulala Hake (i.e. Sugarcane outgrowers), their perception on the six themes were similar regardless of their participation.

Table 2.6 Item based perception of smallholder farmers at Germama Peasant association

S.N	Description of Items	Peasant Association			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean Score	Rank of Score	Mean Score	Rank of Score
I	**Overall Contract farming situations**				
1	It improves agricultural practices	3.73	11	2.34	10
2	It increases labour efficiency	4.50	2	2.30	11
3	It improves family labour utilization.	4.01	6	1.80	17
4	It creates market linkages and market outlets.	4.67	1	2.69	5
5	It increases household income.	4.13	4	2.26	13
6	It reduces poverty and improves food security of households.	4.48	3	1.90	15
7	It creates employment opportunities.	3.92	10	1.74	18
8	It Improves overall livelihoods of a family.	4.06	5	1.90	16
9	It increases use of agricultural inputs and enhances production.	3.95	8	2.28	12
10	It reduces the production of other crops other than contract farming crops.	2.92	18	3.26	1
11	It increases smallholder farmers' know-how and improves climate adaptation.	3.61	15	2.84	2
12	It improves agricultural practices and use of agro-chemicals.	3.71	13	2.75	3
13	Increases the participation of female-headed households and keeps the rights of Women.	3.74	12	2.05	14
14	It increases the user rights of smallholder farmers (land, water etc).	3.98	8	2.45	9
15	It improves the way agro-processing firms' plans, performs and monitors its activities.	3.45	16	2.67	6
16	It improves irrigation water use and other water sources.	3.49	17	2.58	8
17	The price is set by the Agro-processing firms	.01	6	2.74	4
18	The agro-processing firms, cooperatives and representatives set the price from smallholder farmers.	3.65	14	2.59	7

Source: Field Survey, 2018

In this section, as portrayed in the item based perception analyses of table 2.6, there were five top perceived items that ranked 1-5 summarized as follows. Regarding farmers' at Germama, the items perceived were (i) CF creates market linkages and market outlets (1^{st} rank with mean score of 4.67 followed by (ii) CF increases labour efficiency (2^{nd} rank with mean score of 4.50). (iii) CF reduces poverty and improves food security of households (3^{rd} rank with mean score of 4.48), (iv) it increases household income (4^{th} rank with mean score of 4.13) and (v) CF improves the overall livelihood of a family (5^{th} rank with mean score 4.06). Therefore, based on their perception of items the top selected items was that CF reduces the production of other crops other than Sugarcane (1^{st} rank with mean score of 3.26) followed by CF increases farmers' know-how and improves climate change adaptations (2^{nd} rank with mean score of 2.84). Moreover, CF improves agricultural practice and use of agro-chemicals such as weed killer, pesticides and fertilizers, the price was set by the agro-processing firm and CF creates market linkages and market outlets with rank and mean score of 3^{rd} rank (2.75), 4^{th} rank (2.74) and 5^{th} rank (2.69), respectively.

In summary, the perception analysis on items at Kuriftu Hida and Adulala Hake were quite different from the perception pattern of farmers' observed at Germama. From this, one can find out that the farmers' engaged in Malt Barley and Sugarcane CF perceived different items differently based on their farm experience, input provision and location.

Perception of farmers on contract design

Contract farming specification or design is one of the important requirements in CF arrangement (Ayelech, 2010). Eaton and Shepherd (2001) pointed out that the successful implementation of CF depends on the understandings of the farmers' engaged in such schemes. They continued explaining that the way agreements written, the provision of inputs, the pricing and market situations, the roles and responsibilities of each parties participating in CF determines the perception of farmers', which in turn affects the decision to participate or not to participate.

Table 2.7 Item based perception on contract specification

S.N	Description of Items	Peasant Associations			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean Score	Rank of Scores	Mean Score	Rank of Scores
II	**Contract farming specifications or Design**				
1	The agreements or specification only keeps the interests of agro-processing firms	3.79	9	1.91	9
2	The agreement only keeps the interests of smallholder farmers.	3.23	10	2.59	8
3	It protects the interest of both parties (i.e. Agro-processing firms and smallholder farmers).	3.10	11	1.88	11
4	It includes all important items and written in clear languages.	3.99	7	1.97	10
5	Contract farming design governs the whole process in the schemes.	3.92	8	3.19	6
6	It includes the roles of agro-processing firms, smallholder farmers and cooperatives.	4.29	5	3.18	**5**
7	It facilitates trainings on extension packages and timely supply of production and use of agronomic practices	4.46	3	3.70	**2**
8	Contract farming helps in risk sharing and solves market Problems.	4.51	2	4.33	**1**
9	There are strong supervision systems in place.	4.24	6	3.27	**4**
10	There are good working environment and relationships in place.	4.33	4	3.19	6
11	There are conflict resolution mechanisms included in the design	4.63	1	3.54	**3**

Source: Own Survey, 2018

Data collected on the perception of SHFs on CF specification at Germama (i.e. Malt Barley) revealed five best items. Their perception pattern in descending order of conflict resolution mechanisms (i.e. best among all), risk sharing, solving market problems with rank and respective mean scores (i.e. 1st 4.63, 2nd 4.51). CF facilitates trainings on extension packages and timely supply of production inputs and use of agronomic practices followed by CF that created good

working environment and put relationships in place with their rank and mean scores of (3rd (4.46), 4th (4.33), and 5th (4.29), respectively.

Similarly, at Kuriftu Hida and Adulala Hake (i.e. Sugarcane outgrowers) exhibited almost similar pattern in perceiving the items pertaining to CF specifications or design. Hence, the perception of farmers' on contract specification or design reported a rank and mean score of 1st (4.33) and 2nd (3.70) for replying that CF helps in risk sharing and solves market problems, CF facilitates trainings on extension packages and timely supply of production and use of agronomic practices, respectively. Furthermore, the 3rd (3.54), 4th (3.27) and 5th (3.18), CF has a conflict resolution mechanisms that is included in the design, strong supervision systems in place and the roles of agro-processing firms, farmers' and cooperatives. In both cases, one can conclude that the farmers' perceived the inclusion of CF specification in the contract arrangement in similar ways. The mean scores of the five best-selected items indicated similar perception patterns emanated from understanding of how important the contract specifications that could make differences.

Perceptions of farmers' on the role of the Government

The role of the government plays a pivotal role for the success and failure of CF arrangement in commercial agriculture (Prowse, 2012). Here the government plays a significant role in raising the awareness of farmers' on CF and provide the necessary support through development agents and agricultural experts apart from designing policies, guidelines, laws and legal frameworks that guides the overall implementation of CF practices. According to (Eaton & Shepherd, 2001; Simmons, 2005 & Simmons, 2002) the government plays two significant roles in improving the drawbacks of CF. First, it may regulate the market situations in designing contract policies, strategies, rules and regulations that geared towards CF and the government may sanction contractors not to abuse market. Second, the government facilitates conditions for contractors or agri-business firms to initiate new contracts and provide farmers' support, train them and make them suitable for contract selection.

Table 2.8 Farmers' perception on the role of Government in contract farming

S.N	Description of Items	Peasant Associations			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean	Rank of Score	Mean	Rank of Score
III	**The role of the government in Contract farming Systems**				
1	They play a significant role in resolving conflicts that arises between agro-processing firms and cooperatives representing SHFs.	4.60	1	3.34	1
2	There is clear and precise contract farming policies, legal framework and laws that guides all contract farming processes.	4.13	2	3.15	2
3	The contract farming policy, legal frameworks and laws are strategically in application.	3.60	4	3.03	3
4	Marketing guidelines on contract farming were designed and implemented in a way it supports all parties engaged in contract farming.	3.49	5	1.83	4
5	There are strong involvement of cooperative unions and basic cooperatives for the successful implementation contract farming schemes in the study areas.	3.70	3	1.78	5

Source: Computed from Field Survey, 2018

The perception studies portrayed in table 2.8 revealed that all of the item responses in the mean scores and their respective ranks almost follow similar trends for all the peasant associations included in the study. The data describes that for the study areas (i.e. Germama, Kuriftu Hida and Adulala Hake) the first and second top mean scores belongs that the government plays a significant role in resolving conflicts that arises between agro-processing firms and cooperatives representing farmers' with rank of 1 and 2 with mean score of 4.60 and 3.34, respectively. The last two items, namely marketing guidelines on CF could be designed and implemented in a way that it supports all parties engaged in CF and there are strong involvement of cooperative unions and basic cooperatives for successful implementation of CF schemes in the study areas with rank 5 (3.49) and 5(1.78), respectively. From the list of items indicated in the table above, agricultural

policies designed and implemented in Ethiopia (Agricultural Development Led Industrialization (ADLI), PASDEP, Growth and Transformation Plan (GTP) 1 and GTP2) with limited scope on agricultural commercialization. There were no specific strategies, rules, regulations, legal frameworks designed to guide and address CF in Ethiopia in general, and Oromia Regional State (MoFED, 2015 & MoFED, 2006).

Table 2.9 Farmers' perception on the role of private sectors in contract farming

S.N	Description of Items	Peasant Associations			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean	Rank of Score	Mean	Rank of Score
IV.	**Role of private sectors or development partners in contract farming schemes**				
1	Development partners involve in contract farming in providing trainings.	4.01	8	2.84	2
2	There are good technical supports in place.	4.29	6	1.66	8
3	There are provisions of agricultural input supply in time, in the required amount and in the right quality.	4.49	4	1.84	7
4	There are inspections on quality of agricultural products.	4.66	2	2.87	1
5	There are introduction of new varieties of seeds to smallholder farmers.	4.54	3	2.52	3
6	Contract farming had introduced new technologies and facilitated its adoption in their areas.	4.71	1	1.96	6
7	There are good provision of credits and financial Services in contract farming.	4.31	5	2.20	5
8	There are good logistics and transportation services in place.	4.12	7	2.25	4

Source: Computed from survey result, 2018

Perception on the Role of Private sectors or Development Partners

In realizing the successful implementations of CF, private sectors and/or development partners plays a prominent role. One of the key role that the private sector and/or development partners supports CF practice building the capacities of farmers', cooperative unions, basic cooperatives and experts working in the field of CF (Nham, 2012). Thus, it is very crucial to investigate the

perception of farmers' on the role of private sectors or development partners in the study areas (See table 2.10 below).

Regarding the perception of farmers' on the role of private sector or development partners on CF, described and ranked based on their mean score. Consequently, the Germama smallholder farmers' reported that: (i) contract farming had introduced new technologies and facilitates its adoption in their areas (1st rank with mean score of 4.71) and inspections were in place on the quality of agricultural products (2nd, 4.66). Contract farming introduced new varieties of seeds to smallholder farmers' (3rd, 4.54) and it facilitated the provision of agricultural input supply in time, in required amount and in the right quality (4th, 4.49) followed by provisions of credits and financial services (5th , 4.31).

The SHFs at Kuriftu Hida and Adulala Hake reported the perceived role of private sectors and or development collaborators as shown below. To this end, the top five items in CF where inspections on quality of agricultural products was the first (1st, 2.87) followed by development partners involve in CF in providing trainings for farmers', cooperatives, agricultural experts and development agents (2nd rank with mean score of 2.84). It was also reported that CF introduces new varieties of seeds to farmers' (3rd, 2.52), CF provides good logistics and transportation service (4th, 2.25) followed by those reported that it provides credits and financial services for farmers' (5th, 2.20). From the overall reports, one can find out that the perception of farmers' on the role of private sectors among the study peasant associations differs in their rank and mean scores exhibiting different perception patterns, that emanated from their understanding on the role of private sectors and/or development partners.

The role of contract farming in climate change adaptation

CF as a business arrangement and a tool for agricultural transformation has opportunities in increasing the income and has the capacity to improve the livelihoods of farmers' by increasing crop productivity, maximizing economic efficiencies, searching market outlets (Agarwal, 2008; ATA, 2012; Dhillon and Singh, 2006; Eakin, 2005 & 2003; Eaton & Shepherd, 2001;). Moreover, CF allows transfer of new technologies and facilitates its adoption such as introduction of new varieties of seeds and other modern inputs to improve farmers' agricultural practices. It is, therefore on this ground that the systematic agricultural transformation though CF

by creating a conducive ground for addressing climate change related challenges (ATA, 2012 and CRGE, 2011).

Table 2.10 Perception on the role of contract farming in climate change adaptations

S.N	Description of items	Peasant Associations			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean	Rank of Score	Mean	Rank of Score
V	**The role of contract farming in facilitating climate change adaptations**				
1	Resources for contract farming serves as inputs for climate change adaptations.	4.57	3	2.44	6
2	Contract farming facilitates climate change adaptations.	4.65	1	2.61	5
3	Participant families in contract farming schemes could better adapt to climate change.	4.59	2	2.65	4
4	Contract farming reduces risks emanated because of climate change.	4.52	4	2.99	1
5	Contract farming could raise additional income that subsidizes other crop production.	4.50	5	2.84	2
6	Contract farming reduces drought and reduces the effects of erratic rainfall through irrigation and use of other water sources.	4.10	6	2.83	3

Source: Field Survey, 2018

As reported in table 2.10, the farmers' perception on the role of CF in facilitating climate change replied in terms of the responses of the farmers'. Thus, the farmers' at Germama (Malt Barley) perceived that CF facilitates climate change adaptation (1st rank with mean score of 4.65) followed by participant families in CF schemes could better adapt to climate change (2nd, 4.59). Besides, in the (3rd, 4.57) and 4th (4.52), SHFs perceived that resources for CF serves as inputs for climate change adaptations and contract farming reduces risks emanated because of climate change, respectively. Finally, in the (5th, 4.50), smallholders perceived that CF raise additional income that subsidizes other crop production.

Conversely, the farmers' at Kuriftu Hida and Adulala Hake responded to the items based on their existing CF situation. To this end, they reported that CF reduces risks emanated because of climate change and it could raise additional income that subsidizes other crop production with (1^{st}, 2.99) and 2^{nd}, 2.84), respectively. In the (3^{rd}, 2.83), (4^{th}, 2.65) and (5^{th}, 2.61) farmers' perceived that CF reduces drought and reduces the effects of erratic rainfall through irrigation and use of other water sources, participant families in CF schemes could better adapt to climate change and CF facilitates climate change adaptations, respectively. In conclusion, one can find out that when one observes the mean scores and their respective ranks, 1-3 ranks for Germama were in items 2, 3, 1, respectively and vice versa for Kuriftu and Adulala. This clearly pointed out that the situation of drought; erratic nature of rainfall and risks emanated from climate change has given priority among farmers' at Kuriftu Hida and Adulala Hake.

Perception on contract farming as a livelihood improvement strategy and ensuring food security

As evidenced in (Bijman, 2008; Eaton & Shepherded, 2001; Minot, 2011; Prowse, 2012; USAID, 2012) CF arrangement requires access to factors of production such as land, capital, labour technical assistance, technologies and time, which are the cornerstones and basic inputs for the agribusiness firm and the farmers' over all livelihoods. CF increases incomes of farmers' by improving labour efficiency, increasing productivity, which ultimately improves the livelihoods of farmers in the schemes (FAO, 2001; Fan *et al.*, 2007; Kirsten & Sartorius, 2010; Kirsten & Sartorius, 2002; Priscilla, *et al.*, 2012).

Table 2.11 Perception on the role of contract farming in improving livelihoods of farmers

S.N	Description of Items	Peasant Associations			
		Germama		Kuriftu Hida and Adulala Hake	
		Mean	Rank of Score	Mean	Rank of Score
VI	**The role of contract farming in improving livelihoods and ensuring food security of farmers**				
1	Contract farming enhances livelihoods of smallholder farmers by reducing cost of agricultural production.	3.65	7	2.33	3
2	It reduces unnecessary delay in inputs supply and resource delivery.	3.77	6	2.46	1
3	It creates good cooperation among participant smallholder farmers in contract farming.	4.13	5	1.90	7
4	Contract farming creates a favorable condition for capacity buildings.	4.36	3	2.19	4
5	It creates good working relation with development agents, improves livelihood through improving agricultural activities, increase income and meeting food security.	4.58	1	2.42	2
6	Contract farming raises smallholder farmers' awareness on modern agricultural production.	4.54	2	2.13	5
7	It increases production and productivity through strengthening family relationships or bondages.	4.21	4	2.00	6

Source: Household Survey, 2018

At Germama (Malt Barley) the report of the farmers on perception of the role of CF in improving livelihoods of farmers' clearly pointed out that CF creates good working relation with development agents, improves livelihood through improving agricultural activities, increase income and meeting food security (i.e. 1st, 4.58). In the second and third rank, CF raises farmers' awareness on modern agricultural production (2nd, 4.54) followed by CF creates a favorable condition for capacity buildings (3rd, 4.36). The farmers' reported that in the 4th rank (4.21) and 5thrank (4.13), CF increases production and productivity through strengthening family relationships or bondages and creates good cooperation among participant farmers' in CF (i.e. inter and intra household relations manifested through *"Debo", "Wenfel" and "Jigi"*, respectively.

Concerning the study of perceptions of farmers' at Kuriftu Hida and Adulala Hake, the study report indicated that CF reduces unnecessary delay in inputs supply and resource delivery(1st, 2.46) followed by CF increases production and productivity through strengthening family relationships or bondages and creates good cooperation among participant farmers' (2nd, 2.42). Moreover, it was reported that CF enhances livelihoods of farmers' by reducing cost of agricultural production (3rd, 2.33) and then creates a favorable condition for capacity buildings (4th, 2.19) followed by CF raises farmers' awareness on modern agricultural production (5th, 2.13).

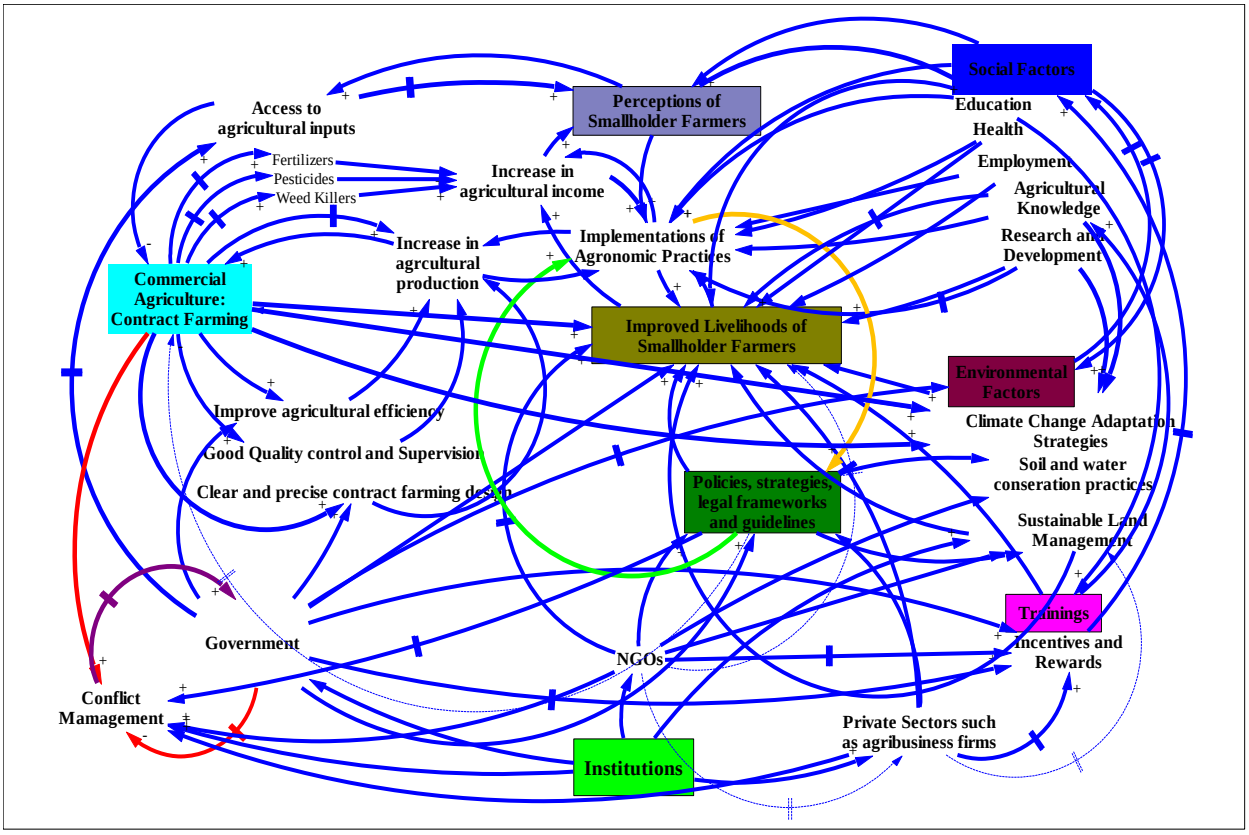


Figure 2.3 The interaction and integration between factors related to Perceptions of farmers on contract farming, climate change adaptation and livelihoods

Source: Own Construction, 2018

Based on the field data, we tried to depict the interactions of various institutions that may affect the perceptions of SHFs on CF schemes and climate change adaptation actors in a system environment. As revealed in figure 2.3, the system approach in studying perceptions of farmers

engaged in Malt Barley and Sugarcane contract farming were conducted in Kofale districts and Adama district of Oromia National Regional State. The (+) sign denotes the positive relationship between elements in the system. This is because, the perceptions of SHFs, government and NGOs on the relationships among various factors as shown in figure 6 immensely affect the sustainability of agricultural commercialization process operating at different scales. This means that the better the perceptions of various actors, the better the sustainability of agricultural practices, agricultural production and the existence of sustainable market in a particular location. The (-) sign shows the negative relationships that existed among the factors in the system. In addition, the broken line depicts loose relationships between different factors that contribute towards perceptions of farmers. The green, red, purple and orange show the loop that back and forth system linkages that existed among the factors in the system. The arrows with the parallel line at the middle depicts the delay occurred in the integration and relationship among the factors or the institutions in the system. Because of the delay between the systems, for instance delay in agricultural inputs ultimately hinders the entire contract farming schemes and CCASs.

Moreover, the interaction between the main system and the subsystem portrayed that there are complex relationships between them, whereby particular systems affects the other systems positively and the other one negatively in the overall perception studies. From the figure for instance, there are loose integration between policies, strategies, legal frameworks, guidelines and contract farming. These clearly suggested that the systematic integration of policies, strategies, legal frameworks, guidelines for successful implementations of contract farming and conflict management plays a pivotal role improving perceptions of farmers that ultimately have a bearing on livelihoods of farmers. Understanding all the interplay among the factors better reduces the potential conflict between the stakeholders (i.e. interested and supportive) those engaged CF, since the continuous discussion between them help to build a solid ground that lay a foundation for solving problems whenever it arises. The better the perception of farmers on th links between the overall system, the better the farmers integrate the factors explained in the figure and employ CF as a response to climate change adaptation and improve their livelihood. Furthermore, the state and non-state actors that collectively known as stakeholders could also reap benefits out of integrating all these factors for better CF implementation and address climate change induced effects such as drought, flood and other climate change related impacts. Above all, the systematic link among institutions: the government, private sectors and the NGOs played

a significant role in realizing the success of contract farming arrangement and its integration with CCASs that aimed to enhance perceptions of farmers through trainings, awareness raising, technical assistance and creating access to agricultural inputs, financial services and improves overall sustainability situations of agricultural commercialization.

2.3 Conclusions and recommendations

This paper focuses on analyzing the farmers' perception on CF as a response to climate change adaptations by taking into account Malt Barley CF at Germama, Kofale district of West Arsi Zone of Oromia Regional State. Moreover, it also studied two Sugarcane outgrower schemes at Wonji Shewa sugar factory with special attention on Kuriftu Hida and Adulala Hake PAs. The overall understanding of the whole CF processes, sustainability of commercial agriculture including the impacts of CF on livelihoods of farmers, contract design, and benefits obtained out of CF, the roles and responsibilities of the government, private sectors including the agribusiness themselves. The respondents including the non-participant farmers with mean score 114.57 and standard deviation of 13.01 reported that they have better perception on general situations of CF and this clearly shown that the perception of farmers' on other categories were limited and one can conclude that their perception on the other segments were very low as compared to first one. Therefore, it is very essential to understand the details of contract situations, where farmers engaged in Malt Barley CF have perceived CF as it was very essential in improving their income and food security of farmers' and ensure sustainability in agriculture, which in turn contributing to their sustainable livelihoods and climate change adaptations in the study areas. The farmers engaged in Malt Barley CF have better understanding on the CF as compared to those farmers' engaged in sugarcane CF arrangements. This was because of the following critical conditions for farmers' to engage in CF schemes.

i. The farmers have perceived that input provisions such as improved variety of seeds, fertilizers, agrochemicals, technical assistance by extension workers, technology transfers, full packages of agronomic practices are better in CF arrangements and hence these improves agricultural activities on sustainable basis, which in turn improves livelihoods of farmers continuously in the study areas;

ii. As a result of use of full agricultural packages, the income obtained from Malt Barley CF was far better than the income obtained from other crops (Wheat, Oats, Pea etc) outside CF. Thus, at Germama the non-participant farmers have perceived CF situations in similar way as that of participant ones;

iii. Both participant and non-participant famers' perceived that there are better access to market, good pricing mechanisms and incentives for Malt Barley with better standards or grades. Besides, the participants have better access to credits, extension services, markets and this why the participants and non-participants are interested in CF arrangements; and

iv. They consider CF as a profitable business model whereby their income is increasing from time to time and these is immensely helping sustainable commercial agriculture.

Most of the respondents belong to productive age group (i.e. 31-64 years) and this clearly indicated that those active, abled and energetic productive farmers were interested to engage in CF arrangement.

Despite these perceived importance and advantages of CF as a response to CCASs to farmers, there are problems of delay in payments and collection of their produces. This situation has created side selling (i.e. hunting for spot markets) by some of the contracted farmers and also affected the sustenance of commercial agriculture like in CF. This was further affecting the relationship between the cooperative unions and the agribusiness firms including Assela Malt Factory. Moreover, most of the respondents engaged in Malt Barley at Kofale (Germama) were successful in terms of earning income and other benefits they obtained from CF as compared to those farmers' engaged in Sugarcane outgrower at Wonji Shewa: Kuriftu Hida and Adulala Hake. The income earning was higher for participant respondent households engaged in CF of Malt Barley (i.e. the participants earn more a mean income of 31082.94 Ethiopian Birr (ETB) per year as compared to those participant respondent households in sugarcane with mean income of 21784.70 ETB per year. Unfortunately, participant and non-participant farmers at Kuriftu Hida and Adulala Hake perceived and considered CF as if it was not a profitable and successful business model. This was because:

i. Almost all of the respondents in Sugarcane outgrower perceived that the participation was not based on the interest of farmers', rather they were compelled either to leave their

farmland to the factory or organize themselves into basic cooperatives and engage in Sugarcane outgrower and use their family labour and sell their produce to the factory through cooperative union. Hence, this is playing a pivotal role in improving agricultural sustainability in their areas.

ii. The farmers' perceived that the pricing situation was not enough and the income earned from Sugarcane was limited to 60 ETB Birr per Quintal and exacerbates the existing food insecurity situations. Moreover, despite the use of agricultural inputs and agronomic practices, the production of the Sugarcane lasts from twelve up to fourteen months and its production decreased from time to time affecting the income obtained from it;

iii. Both the participant and non-participant farmers' perceived that the Sugarcane CF scheme as a business model was not profitable and they are interested to end their agreement interested to stop planting Sugarcane. They are rather very fond of covering their farmland with other crops if the factory allows them peacefully and they are interested to engage in other crops such as Teff, Maize and Chickpeas, onions and obtain better income.

Therefore, it is paramount important not only to reconsider the contract agreement and specifications, but also it is essential to work on CF and employ it schemes as a response to CCASs in the study areas. Moreover, strengthening the role of the government and private sectors in CF, CCASs and CF in improving the livelihood and ensuring food security of farmers and improve the pricing situations of the respective agricultural produce (i.e. Malt Barley and Sugarcane) are essential. Thus, it is recommended that equipping farmers with necessary knowledge and skills through trainings (i.e. basics of agricultural sustainability: Standards or grades of agricultural produce, extension services, proper input and agrochemical application, agronomic practices etc), provision of technical assistance on continuous basis, technology transfer and work to raise income of farmers'. It is also very essential to strengthen or capacitate the extension workers that are engaged in supervising in implementation processes of CF in the study areas.

Chapter 3

3. The pursuit for enhancing the net income and sustainable livelihood for smallholder farmers: the case of contract farming in Oromia Regional State, Ethiopia

Abstract

This study aims at analyzing the impacts of CF on the net income of SHFs. It gathered household level primary data collected through household survey, focus group discussions, key informant interview, field observation and case histories. It relied on propensity score matching (PSM) and the average treatment effect techniques such as Nearest Neighbour Matching (NNM), Radius Matching RM), Kernel Matching (KM) and Stratification Matching (STM) to quantify the impacts of CF on net-income earned by SHFs. The result revealed that sampled households heads that participated in CF arrangements experienced a decrease in income by 24.3%, 29.6%, 30.2% and 28.3% as measured by NNM, RM, KM and STM, respectively. The overall impact of the treatment effect measurement on the net-income revealed that the net income of the participant SHFs CF faced a reduction of net-income by 28.1% on average. Therefore, the findings suggest that in order to increase the income earned because of participation of farmers in CF arrangement, the policy measures should focus on better CF specifications that have the capacity to raise net-income of SHFs. In addition, raising the knowledge and skills of farmers', increase the prices of products per quintal and reduce the production costs incurred in the overall production, which ultimately increases the net-income obtained from CF arrangements is paramount important. Above all, there is no policy and legal framework that governs over all processes in CF. Thus, it is paramount important to design specific CF arrangement policy and legal frameworks that scrutinize the overall contract farming processes in general and income obtained from CF arrangements.

Keywords: Impact, Income difference, Matching, Propensity score matching, Smallholder farmers, Treatment effect

This paper was published as:

Megersa, G. & Assefa, E. (2019). The pursuit for enhancing the net income and sustainable livelihood for smallholder farmers: the case of contract farming in Oromia Regional State, Ethiopia. Journal *of Sustainable Development in Africa*: Volume 21, No.4, 2019, *Published by Clarion University of Pennsylvania, Clarion. Pennsylvania: http://www.jsd-africa.com/.*(Published)

3.1 Introduction: Background of the study

Contract farming[xiv] or outgrower schemes as an integrated and vertically coordinated business arrangement refers to an agreement made between the farmers and the agribusiness firms. It involves an agricultural production for the benefits of all under certain predetermined agreement on price, market facilitation, production system, input supply, provisions of technical advice, trainings and even incentives arrangements (Ayelech, 2010; Eaton & Shepherd, 2001). The successful arrangement of such a business model should take into account the quality of the agricultural products up to standards and the required quantities of commodities as per the agreement within a specific time interval (Priscilla et al., 2012). It paves a way for sustainable agricultural commercialization and sustainable livelihood. Sometimes the direct business arrangements in such business hampered through various production risks that emanated from the agribusiness firms, either the SHFs or the nature of natural risks that may have the capacity in affecting the business arrangement. For example:- defaulting, side selling, problems of transparency, unclear or imprecise languages, labour exploitation, indirect land appropriation (Daniel, 2015) that may be termed as "land grabbing"[xv]. In fact, the balanced business arrangements take into account the benefits or as Singh (2015) termed it "equal share" of benefits for farmers, agribusiness firms', basic cooperatives, cooperative unions, and other development partners working on CF schemes.

Sustainable agricultural commercialization as a means of improving agricultural production, income (Wendimu *et al.,* 2017) plays a crucial role in shaping livelihood of SHFs through better access to inputs, access to credits, technical assistance and market facilitation. Agricultural productivity in sub-Saharan Africa has received an increasing attention from international donors, Non-government Organizations (NGOs) and governments (GOs). Because, it has seen as an essential precondition for sustainable economic development (Collier and Dercon, 2014). Except few farmers that are privileged to use irrigation, the rest of the majority of the farmers rely on rain-fed agriculture of which the distribution of rainfall is often erratic. Despite the fact that these two study areas were affected by severe drought and famine caused by recurrent climatic irregularities, the production methods used by farmers are also very traditional, characterized by subsistence mode of production. Agriculture is a dominant SHFs' livelihood; it comprised more than 40% of the Gross Domestic Product (GDP) and more than 80% of the

employment in Ethiopia (Climate Resilient Green Economy (CRGE), 2011). SHFs by their very natures faces several interrelated socioeconomic challenges including insufficient access to markets, infrastructure and technology; high marketing and transport costs; and limited resources (land and human capital) (World Bank, 2008 and Hazell *et al.*, 2007).

This study employed an impact evaluation methods i.e., Propensity Score Matching (PSM). The impact evaluation studies are not a simple task in any projects that aimed to improve the livelihood of farmers through enhancing the income earned from the scheme on continuous basis. First, as evidenced in Nijhoff and Trienekens (2012) there are no or few researches conducted on CF practices as a systematic agricultural practice in Ethiopia; no researches done on impacts of CF as a practice in enhancing of livelihood of SHFs on sustainable basis, which were overlooked by researchers, policymakers and development practitioners.

Second, even though there are many studies conducted in the field of CF practices in different corners of the world, though little evidences documented in Ethiopia. For example, Nijhoff and Trienekens (2012) conducted their study on "Critical factors for contract farming arrangements: the case of Ethiopia". Ayelech (2010 & 2012) has also done exploratory studies on "Contract farming in Ethiopia: An overview with focus on sesame value chain, and "Contract Farming: Business Models that Maximizes the Inclusion of and Benefits for Smallholder Farmers in the Value Chain", respectively. She only confined to explore Sesame value chain in which it's marketing run under the guidance of Ethiopian Commodity Exchange (ECX). USAID (2012) also conducted an assessment on "Contract Farming and policy options in Ethiopia". This study focuses on policy briefing aspect and failed to examine impacts of CF schemes or arrangements on the livelihood of farmers. For these reasons, all these studies did not explicitly discussed about Malt Barley and Sugarcane CF arrangements. All of these studies were concerned in the analysis of value chains of limited crops such as Sesame, Oil and pulses and Wheat. They did not discussed about Malt Barley and Sugarcane CF arrangements.

Third, there was no research done that tried to look into the importance of contract farming as an agricultural arrangements to explore the effect of CF on net income. For example, an empirical study by Minot (2011) only dealt with the overall aspects of challenges and opportunities of CF in Africa, but it did not relate to its impacts on income. Moreover, Barret *et al.* (2012) conducted a study on "SHFs participation in CF Schemes". However, they did not mention how CF

contributes in enhancing SHFs income that in turn improves the livelihood of SHFs on sustainable basis. Consequently, none of these studies considered Malt Barley and Sugarcane CF schemes as an integrated business model in enhancing income, improve livelihood sustainability of SHFs in the context of Ethiopia in general, and study areas in particular.

Fourth, farmers can get access to farm inputs such as credit, fertilizers, agro-chemicals, technical expertise (Bijman, 2008 and Minot, 2011) and other services that broaden income bases through SHFs participation in CF schemes. SHFs can also very easily rely on these resources to raise their productivity and increase their income (Prowse, 2012). Moreover, CF creates an opportunity for agro-processing firm to acquire land and labor without displacing SHFs from their farmland (Bijman, 2007). Finally, in Ethiopia there are also few studies conducted on CF schemes itself as pinpointed in Nijhoff and Trienekens (2012) and all the studies as discussed above lacks comprehensive understanding of the problem under investigation.

Consequently, the current study aims at analyzing the impacts of CF arrangement on the net-income of SHFs in the context of Malt Barley and Sugarcane CF practiced in Kofele and Adama districts of Oromia Regional State. This study also tries to examine the differences among the participants and non-participant and the determinant factors that affect the impact of such CF on the net income of SHFs. The primary data collected through field survey was organized through SPSS version 20 and Stata version 14. It employed an econometric model: Propensity Score Matching (PSM) to evaluate the impact of CF schemes on the net income and its ultimate effects on the livelihood of SHFs. Thus, it analyzed the impacts of CF on the net income based on the findings obtained from this study.

3.2 Research methodology

3.2.1 Research Methods: Sampling procedures and data collection

Primary data were collected from the selected farmers using quantitative data administered through household survey. In the qualitative study, Six Focus group discussion that consisted of ten participants each, twenty key informant interview were conducted, three field observation and case histories were undertaken in the study PAs.

Table 3.1 Proportion of sample smallholder farmers by sex and peasant associations

Sample Population	Germama Peasant Association (PA)		Kuriftu Hida PA		Adulala Hake PA	
	P	NP	P	NP	P	NP
Male	51	48	48	50	34	35
Female	17	20	18	15	9	23
Total	**n=68**	**n=68**	**n=66**	**n=65**	**n=43**	**n=58**

Source: Kofale and Adama District Agricultural Office, 2010

A multistage random sampling technique was employed to select a sample of 383 SHFs from the Districts. Three PAs were selected purposively from the Districts in these two Zones (i.e. one PAs from West Arsi Zone, Kofale district and two PAs from Adama District). The proportionate sampling techniques were employed and randomly selected the participant and non-participant SHFs from the lists obtained from PAs. From Germama PA, 136 sample SHFs engaged in Malt Barley production, two PAs from Eastern Shewa Adama district namely: Kuriftu Hida and Adulala Hake Haroreti) with 131 and 116 respondent SHFs, respectively, were selected randomly from the lists taken from the PAs. Accordingly, the PAs were selected based on their crop production history, where households at Germama started Malt Barley CF at Kofale District in 2006 E.C, Kuriftu Hida and Adulala Hake Haroreti villages started Sugar cane CF in 1975 G.C and 2008 G.C, respectively. Consequently, the heads of households engaged in CF was the unit of analysis in the study. However, data were collected from 368 respondents and the rest of them did not respond to the questionnaires.

We analyzed the quantitative data obtained by household survey through a Statistical Packages for Social Science (SPSS Version 20) and Stata version 14. The quantitative data gathered through household survey were substantiated with the qualitative data: - transcribed, narrated and used in the analysis.

3.2.2 Participation situations

This study tried to explore impacts of CF on the livelihood of farmers in the light of income they obtained from their participation (i.e. Income difference between before their participation and during their participation in CF schemes). The impact analysis includes the difference between

the net-income (i.e. denoted as income diff) the participants get before and during their participation in CF. To evaluate the impacts of participation of farmers in CF and its impact on net-income it is very essential to consider the participant and non-participant SHFs. Thus, we came up with the new data set by assigning variable equal to 1 if the households participate in CF and 0 if the households did not participate in CF scheme. Thus in this study, the participants are considered as the treatment group and the non-participants as the control group. Based on this categorization, the study revealed that 47.8% of the households engaged in CF are falling in participant groups and 52.2% of them are non-participants sampled households.

3.2.3 Theoretical framework

In development projects, impact assessment is an approach that helps to assess impacts of an intervention (African Impact Evaluation Initiative, 2010). This approach attempts to see the "before and after" or the "with and without" an intervention of CF. Similarly, this study adopted a methodology developed by (Priscilla *et al.*, 2012) to assess the impacts of CF "before and after or during" on livelihood of SHFs taking net-income difference as a dependent or outcome variable. In this approach, the statistical methods were employed to evaluate whether there is a significant change in some variables observed or not. The major variables in the study would be compared the comparison groups or control group as a proxy for what would have happened on the livelihood considering net-income difference of farmers because of their participation in CF. Moreover, the treatment variable employed in this study is the situation of the participations of smallholder farmers in CF (i.e. participant and non-participant denoted as PNP in the model).

This impact evaluation relies on econometric and statistical models. As stated in (Priscilla *et al.*, 2012), there are three types of impact evaluation designs. These are experimental, quasi-experimental or non-experimental, respectively, associated with the comparison groups, control groups (non-participants in CF). In this regard, Baker (2000) approached such impact evaluation through econometric methodologies, which include differences, reflexive comparison, instrumental variables methods and matching methods.

Consequently, as indicated in Ali and Abdulai (2010), most recently the matching techniques are gaining to much acceptance in impact evaluation studies. The most widely used type of matching is Propensity Score Matching (PSM), in which the comparison groups is matched to the

treatment group based on a set of observed characteristics in the form of a "propensity score". The propensity score is the predicted probability of participation in CF given the observable characteristics of the farmers. Under this approach, the closer the propensity scores for the treatment and the better the match for the control (Priscilla *et al*., 2012).

Now days, PSM in many academic literatures have become the popular methods in research related to impact evaluations. In many agricultural project impact evaluations, this type of methods has become common (Ali and Abdulai, 2010; Becceril & Abdulai, 2010). It has been widely employed in evaluating impacts of labour policies and other diverse fields of study (see Dehejia & Wahba, 1999 & Heckman *et al.*, 1998). This was applied in studies that have treated individuals and untreated individuals. Some authors, therefore, argue that this method is the best method for selecting a matched or re-weighted comparison groups in specially evaluating the impacts of CF on net-income of farmers in order to understand the livelihoods of farmers (Ali & Abdulai, 2010; Barbara, 2009; Becerril & Abdulai, 2010). To this end as Heckman (1979) underscored that, impact of an intervention is an estimation of treatment effect in policy analysis. Nevertheless, the change in the outcome of the treatment is a function of multiple endogenous and exogenous factors (Priscilla *et al*., 2012). However, Priscilla further noted that the problem might emanate from the change in the outcome variable (i.e. net-income) due to treatment of the population under study (Priscilla *et al*., 2012). Therefore, it is very crucial to see the counterfactual impacts and the decisions made by the farmers to participate and not to participate in the treatment, which may be associated with the net benefits obtained from the participation (i.e. the issue of self-selection). In this study, we employed the PSM technique in order to evaluate the impact of CF on the net-income they obtained before and during CF. The first step in estimating the treatment effect is to estimate the propensity score. To obtain this score, any standard probability model could be used (for example:- logit, probit or multinomial logit) in this study (Rajeevet *et al*., 2007).

3.2.4 Empirical methods: Econometric model specifications

In this study, the dependent variable is estimated to assess the factors of participating in CF is binary; assigning the value of 1 if a SHF participated and 0 for non-participant farmers. At the end of the day, a probit regression model was used. As explained in Priscilla *et al*. (2012), different authors relied on probit regression model to estimate binary dependent variable

regression models. Both the probit and logit models estimate parameters using maximum likelihood ratio and come up with similar results. The probit model take in to account normally distributed error term, while the logit model assumes a logistic distribution of the error term. As a result, the probit model assumed the error term in equation has a normal distribution (Ravallion, 2001 & Baker, 2000).

To assess the impact of CF participation on livelihood in terms of net-income[xvi] of farmers, PSM is used with aim of balancing the observed distribution of covariates across the groups of participants and non-participant farmers (Priscilla *et al*., 2012; Wendimu *et al*., 2016). First, we estimated the propensity score separately through discrete choice model. To estimate the participation probability, the default probit model with maximum likelihood method is employed to estimates the parameters associated with the assumption that the error term in equation has a normal distribution (Ravallion, 2001; Baker, 2000). Moreover, as underscored by Caliendo and Kopeinig (2005) because of high-density mass in the probit model the mass in bounds could be employed to estimate the propensity score $p(X)$. Second, matching algorithm was selected based on the data at hand after conducting matching quality test.

We employed PSM to evaluate the impact of contract farming on the livelihood (in terms of net-income) of farmers engaged in Malt Barley and Sugarcane CF (i.e. their net-income before and with their participation in CF) as the treatment. Therefore, based on the Heckman (1979) model, the impacts of participation in CF on farmers (Y) can be expressed as a function of explanatory variables (X_i) and a participation dummy variable (R) specified as:

$$Y = \beta Xi + ARi + \mu i \text{ ………………………………… ………………….. (3.1)}$$

Where R_i =1 for contracted farmers and 0 for non-contracted farmers or 1 for before and 0 otherwise, μ_i is the error term, β and A are coefficients.

Whether farmers participate in contract farming or not is dependent on the characteristics of SHFs and farms, hence the decision of a farmer to participate in CF was based on each farmer's self-selection instead of random assignment. Assuming a risk-neutral farmer, the index function to estimate participation in contract farming is therefore, written as:

$$Ri* = \Upsilon Xi + ei \text{ …………………… …… ……………………………. (3.2)}$$

Where R_i = is a latent or hidden variable denoting the difference between utility from participating in CF (U_{iA}) and the utility from not participating in CF (U_{iN}). The SHFs' may participate in CF, if $Ri* = UiA - UiN > 0$. The term ΥX_i provides an estimate of the difference in utility from participating in CF ($UiA - UiN$), using the household and farm-level characteristics such as farm size, household size, input application, access to credits etc, as explanatory variables, while e_i is an error term. In estimating equations (1) and (2), it should be understood that the relationship between participating in CF and the outcome (net-income) could be interdependent. Thus, participating in CF can increase output and as such, the farmers endowed with broader livelihood asset base may be better willing toward participating in CF. Thus, treatment assignment is not random, with the group of farmers being systematically different. Specifically, selection bias occurs if unobservable factors influence both the error terms of the income equation, and that of the participation choice equation, thus resulting in correlation of the error terms of the outcome and participation choice specifications (Greene, 2003). In that case, estimating equation (1) with ordinary least squares will lead to biased estimates. Thus, this cannot be employed in the calculations.

To address the above selection bias, the researcher employed several strategies. Since, the PSM is a non-parametric method; it does not require assumption about the functional form in specifying the relationship between outcome and the predictors of outcomes. As proposed by Rosenbaum and Rubin (1983), PSM was used as treatment effect correction model to reduce self-selection bias in the model.

3.3 Methods of data analysis: Impact estimation strategies

Hence, to evaluate the impact of participation of Malt Barley and Sugarcane CF on net-income difference, all observable characteristics have to be the same between contract farmers (i.e. the treatment group) and the non-contract farmers (i.e. the control group). The Average Treatment Effect (ATT) here is therefore, the difference between the actual incomes before and during CF if the farmers did not participate in CF. Thus, this is shown as:

$$ATT = E(Y1i - Y0i/Pi = 1) \quad \text{(3.3)}$$

Where Y_{1i} denotes income when the i-th farmer participates in contract, Y_{0i} is the income of i^{th} farmer when he does not participate in contract, and Pi denotes the contract participation, 1 =

participate, 0 = otherwise. ATT is called conditional mean impact, which is the mean difference between observable and control is, thus written as:

$$D = E(Y1/Pi) = 1) - E(Y0/Pi = 0) = ATT + \mathcal{E}) \quad \text{(3.4)}$$

Where $\mathcal{E}$ is the bias, and written as:

$$\mathcal{E} = E(Y0i/Pi = 1) - E(Y0/Pi = 0) \quad \text{(3.5)}$$

From equation (4) and (5), it is possible to come up with the true parameter of ATT, which is only identified as the outcome of the treatment and control under the absence of contract are the same. This is given as:

$$E(Y0/Pi = 1) = E(Y0/Pi = 0) \quad \text{(3.6)}$$

Here, it is very crucial to check for the validity of the outputs of PSM methods based on the satisfaction of two basic assumptions. The first is the Conditional Independent Assumption (CIA) and the Common Support Condition (CSC) (Sascha and Andrea, 2002). CIA is also termed as Confoundedness Assumption, which states a set of observable covariates that are not affected by treatment (in this case participation of SHFs in CF), and the outcomes (net- income difference[xvii] measured in terms of Ethiopian Birr (ETB). This assumption means that the households and the potential outcome (Amare and Simane, 2018) only base the selection on observable characteristics and the variables that affect the treatment assignment, which is made by the participation decisions. Therefore, the common support condition entails the existence of sufficient overlap in the characteristics of the treated and untreated units to find adequate matches or a common support.

Four commonly employed matching algorithms namely the nearest neighbour matching, radius matching, kernel-based matching and stratification or interval matching were used to assess the impacts of CF on income (i.e. the difference in income by farmers' earned before and during CF). The Nearest Neighbor Matching (NNM)[xviii] method was used to match each farmer's from the participant group (treated) with the farmers from non-participant groups (control) having the closest propensity score. The matching was done with or without replacement of observations. However, NNM faces the risk of bad matches if the closest neighbour is far away, which means

that it depends on the propensity range (i.e. the shorter the matching range to the NNM, the better the match is). However, this risk can be reduced by using a Radius Matching (RM) method, which imposes a maximum tolerance on the difference in propensity scores and matching within the default radius. Here, some treated units may not be matched if the dimension of the neighbourhood (i.e. the radius) is too small to contain control units. To avoid such problems, the Kernel-based Matching (KM) method is used, which is a weighted average of all farmers in the participant group to construct a counterfactual. The major advantage of the KM method is that it produces ATT estimates with lower variance since it utilizes greater information; its limitation is that some of the observations used may result in poor matches. Finally, stratification matching or interval matching as underscored in (Caliendo and Kopeinig, 2005; Rosenbaum & Rubin, 1983) was conducted to divide and put in range the propensity score in interval. Thus, the treated and the control units have on average the same propensity score (Sascha & Andrea, 2002). Sascha and Andrea (2002) further stated that the blocks identified in the algorithm that estimates the propensity score can be employed and within each interval because both the treated and the control units are there. In the end, the difference between the treated and the control is computed to obtain the average ATT of each block with weight given by the distribution of treated units across blocks. However, one of the drawbacks of this method is that it may discard the observations in blocks where both the treated and the control units are absent.

In the third stage, some overlapping common support conditions is identified while applying PSM. As clearly stated in Priscilla *et al*. (2012) that the common support area is the area where the balancing score has a positive density for both treatment and comparison units. In the fourth stage, the treatment effect was estimated based on the matching estimator selected on the common support region.

Table 3.2 Definitions and values of variables considered in the propensity score matching

Variable	Definition	Values and units of measurement
Outcome variable		
Income difference	Income difference computed from income earned from After and during CF	It is a natural log of income difference
Treatment variable		
PNP	Participant and non-participant	Contract Participant and non-participant stallholder farmers
Independent variables or predictors		
Peasant Association	Peasant association by Kebeles	It is a categorical variable where 1 = for Germama; 2 = for Kuriftu Hida and 3 = for Adulala Hake
GenderHHHs	Gender of household heads	It is a dummy variable which takes value of 1 for male and 0 otherwise
AgeHHHs	Age of household heads	It is a continuous variables measured in years
MaritalstaHHs	Marital status of household heads	It is categorical variable that takes 1 = married; 2 = not married; 3 = divorced; 4 separated; and 5 = widowed.
EducHHHs	Educational level of household heads	A categorical variable that takes 1= Illiterate; 2 for Grade 1-4; 3=Grade 6-8; 4=Grade 9-10; 5=Grade and 6=Above Grade 12)

Family Size	Number of Persons in a family	A continuous variable refers to Total number of people who are currently living within a family
HeadsCattle	Number of cattle owned by household heads	A continuous variable measured in Total Livestock Units using conversion factor
Access Credit	Access to credit and financial services	A dummy variable that takes 1 if the household heads have access to credits and 2 for not receiving credits
AccExtnPack	Access to Extension packages	A dummy variable 1 if Access to extension packages and 0 Otherwise
Size of farmland	Hectares of cultivated land	A continuous variable measured in hectares
AccetoAgrTec	Access to Agricultural technologies	A dummy variable that takes 1 for access to agricultural technologies 0 Otherwise
WealthstatHHHs	Wealth status of household heads	A categorical variable that takes 1 for Poor; 2 for medium and 3 for rich

Source: Based on Wendimu *et al.,* 2016 and Priscilla *et al.,* 2012

3.4 Results and discussions: Socioeconomic features of respondents

In this section, we briefly discuss about the general background of socioeconomic features of respondents (i.e. Contract and non-contracted farmers) as depicted in table 3.2 and 3.3 below. The data in table 3.2 revealed that there was significant difference in age of participant and non-participant SHFs in terms of age of households, family size of households, and total number of livestock as measured in Total Livestock Unit (TLU) and the net-income obtained from CF and non-CF practices. For example, the mean age of participant respondents is 42.64213 with standard deviation of 11.838 as compared to 43.36612 with standard deviation of 0.4961 of those non-participant respondents. Moreover, the average number of family size of participant households is 6.87 as compared to that of on-participant respondent households, which is 6.51. Regarding the total number of livestock, the participant households on average owned 7.3934 and that of non-participant respondent is 6.38855. In table 3.3, it is revealed that education of household heads, access to agricultural technologies, access to extension service packages, access to markets, use of different land management systems, access to irrigation, use of fertilizers and relying on different agronomic practices significantly differ among the participant households and the non-participant ones.

Table 3.3 Descriptive statistics of continuous variables used in the regression model

Variable	**Participants (N= 192)**		**Non-participants (N=176)**			***t*-value**	***Sig.***
	Mean	**SD**	**Mean**	**SD**	***Difference***		
Age of hhhs (Years)	42.64213	11.838	43.36612	0.4961	1	57.064	0.000
Family size of hhhs	6.87	1.49	6.51	1.64	0.36	86.438	0.000
Total number of livestock in TLU	7.3934	4.8545	6.3885	3.2615	1	24.129	0.000
Net income (in Birr)	24389.56	14.2582	10256.20	7.2562	14,133.36	27.100	0.000

***Significant at 1% level

(Source: Authors calculation based on field survey, 2018)

Table 3.4 Descriptive statistics of categorical variables used in the regression model

Variables		Participants (192)	Non-participants (176)	Chi-Square	Sig.
PAs	Germama	68(35.4)	68(38.6)	1.543	0.462
	Kuriftu Hida	65(33.9)	66(37.5)		
	Adulala Hake	43(22.4)	58(32.9)		
Gender of HHHs	Male	135(70.3)	126(71.5)	5.466	0.019
	Female	41(21.4)	66(37.5)		
Age of HHs in Years	15-30 Youth	41(21.4)	26(14.8)	8.334	0.015
	31-64 Early Elderly	119(61.9)	155(88.1)		
	65 and above Elderly	16(8.3)	11(6.1)		
Education of HHHs	Illiterate	39(20.3)	18(10.2)	32.809	0.000
	Grade 1-4	45(23.4)	68(38.6)		
	Grade 5-8	73(38)	60(34.1)		
	Grade 9-10	15(7.8)	46(26.1)		
	Grade 11-12	4(2.1)	-		
Access to credits	Yes	161(83.9)	174(98.9)	0.082	0.775
	No	15(7.8)	18(10.2)		
Access to agricultural technologies	Yes	167(87)	130(73.9)	43.559	0.000
	No	9(4.7)	62(35.2)		
Access to extension service packages	Yes	168(87.5)	176(100)	8.921	0.003
	No	8(4.2)	-		
Access to markets	Local	81(42.2)	176(100)	125.981	0.000
	Cooperative unions	69(35.9)	4(2.2)		

	Brokers	26(13.5)	-		
Use of land	Yes	167(87)	22(12.5)	255.841	0.000
management systems					
	No	9(4.7)	170(96.6)		
Access to irrigation	Yes	122(63.5)	59(33.5)	20.024	0.000
	No	54(28.1)	75(42.6)		
Use of fertilizers	Yes	163(84.9)	124(70.5)	9.574	0.002
	No	13(6.8)	-		
Agronomic practices	Yes	160(83.3)	126(71.6)	12	0.001
	No	16(8.3)	-		

*,**,*** Significance at 10%, 5% and 1% level.

(Source: Authors computation from field survey, 2018)

3.4.1 Estimation of propensity score through probit model

After conducting the propensity score, the NNM, the RM, the KM and the STM were used to match the control group (non-participant) to that of the treated groups (participants) based on their propensity score results, which is similar for both. For successful matching processes, all the four matching methods used avoided the unmatched non-participants that lead to the reduction in the sample size for the post-matching impact analysis. Thus, the area or the region of common support is *[0.08701617, 0.99926507]* and to this end the balancing property was satisfied.

Table 3.5 Result of propensity score through probit regression model

PNP[xix]	**Coef.**	**Std. Err.**	***z*-value**	***Sig.***
Peasant associations	-1.55489	0.2190956	-7.10	0.000
Genderhhhs	0.2451455	0.1939662	1.26	0.206
Agehhhs	-0.0098797	0.0066723	-1.48	0.139
Marstathhs	-0.2951113	0.0939054	-3.14	0.002
Educhhhs	-0.4746961	0.1010539	-4.70	0.000
Family size of hhhs	0.1178503	0.0494407	2.38	0.017
Total Livestock in TLU	0.0096038	0.0173068	0.55	0.579
Size of Farmlands in hectares	-0.6815597	0.1525837	-4.47	0.000
Access to extension packages	3.025842	0.417926	7.24	0.000
Access to agricultural technologies	-1.348069	0.3357604	-4.01	0.000
Access to credits	1.028179	0.4075705	2.52	0.012
Wealth status of hhhs	-0.0002502	0.1337624	-0.00	0.999
_cons	3.19295	1.192521	2.68	0.007
Probit regression model				
Number of obs. = 368				
LR chi2(12) = 169.31				
Prob > chi2 = 0.0000				
Pseudo R2 = 0.3341				
Log likelihood = -168.76714				

Source: Computed from field survey data, 2018

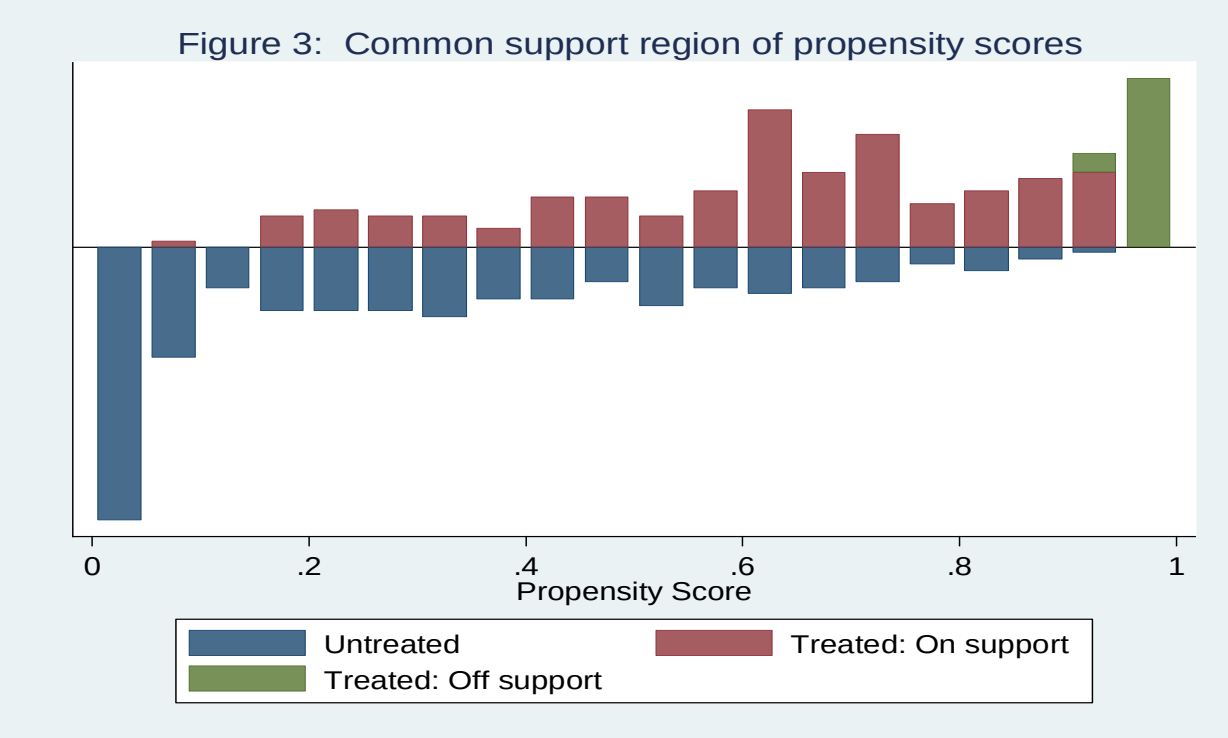


Figure 4.1 Common support region of propensity scores

Source: Constructed from Survey data, 2018

The result approved that there is a considerable overlap in common support. As depicted in figure 3.1, the distribution of the propensity scores of the matched and unmatched individuals in both groups (i.e. treated and untreated groups) clearly exhibited an overlap. The result also indicated that there are individuals out of the common support. Moreover, there are untreated, treated (on support) and treated (off support) individuals. Thus, these indicated that there was a sufficient overlap in the propensity score among the participant and non-participant smallholder farmers. Fortunately, one can observe that the upper half of the graph is for the treated or participant groups and the bottom half portrayed the untreated and the non-participants showing the densities of the scores are on the y-axis and the common support regions on the x-axis.

3.4.2 Evaluation of Income Difference through treatment effects by matching methods

Table 3.6 indicated the impact on the net-income in terms of income difference before and during SHFs participation in CF in the study areas. The impact evaluation was estimated through the four impact estimation or evaluations models namely: the NNM, the RM, the KM and the

STM) models. Based on the post matching result, the NNM revealed that the participation in CF negatively and significantly affected the net-income obtained from their participation in CF. This means, the estimation of NNM indicated that the involvement of SHFs into CF reduced their net-income by 24.3% (i.e. 7236.226 Ethiopian Birr). In the same token, the RM model conducted to measure the impact was negatively and significantly affected the net income earned by the respondent farmers. The RM result shows that as compared to the before participation situation, their in CF reduced their income by 29.6% (i.e.7946.533 Ethiopian Birr). The discussions made with the FGDs further confirmed that the net-income obtained from CF is reducing from year to years affecting farmers' interest to engage in CF for the future. This reduction in net-income is because of unclear and transparency problems (for example: - pricing, languages for wording the agreements) in the CF design or specification, low level of knowledge, awareness problems from the side of SHFs, the higher production cost incurred in CF processes. In addition, due to lack of policy and legal frameworks related to CF, it immensely contributed towards the reduction in the net-income respondents earned from their participation in CF.

Moreover, the results obtained in the KM model is negatively and significantly affect the income the farmers get from their participation in CF. The result further revealed that the net-income SHFs got from CF was reduced by 30.2% that is approximately around 8866.499 Ethiopian Birr. Furthermore, the stratification or interval matching model indicated that it reduced net-income by 28.3% (i.e. 8350.758 Ethiopian Birr). This study is incongruent with the study empirical study done by FAO (2015) on CF and USAID (2015) that SHFs engagement of SHFs in CF has increased their income. Unfortunately, the reduction in net-income of SHFs negatively affected the livelihood of SHFs. This implied that their livelihood improvement on sustainable base is in greater challenge.

Table 3.6 Impacts evaluation through treatment effects

Outcome indicators	Matching algorisms	Matched samples		Impact (ATT)	Standard error	*t*-test
		Affected	Not-affected			
Income Difference	Nearest neighbour matching	176	67	-0.243	0.061	-4.003
	Radius matching	176	130	-0.296	0.073	-4.051
	Kernel matching	176	130	-0.302	0.038	-7.862
	Stratification matching	176	130	-0.283	0.041	-6.756

Source: Computed from survey data, 2018

Therefore, one can conclude that the impact of participation in Malt Barley and Sugarcane CF result in the 28.1% on average in reducing net-income SHFs obtained from their involvement in CF schemes in the study locations. This study is incongruent with the empirical study done by FAO (2015) on CF and USAID (2015) where SHFs engagement of SHFs in CF has increased their income up to 44 per cent. However, this does not mean that CF is not contributed to overall livelihood in terms of new ways of production, input utilization, technology transfer and other spillover effects (i.e. fertilizer use:-150-200 Kg per hectare based on the size and fertility of farmland). The FGDs and the KIIs underscored that high production cost in terms of high credits on agricultural inputs deducted from the income earned from SHFs contributed for the net-income reduction.

Thus, the results suggested that in order to increase the participation of SHFs in Malt Barley and Sugarcane CF arrangement, the policy makers and agro-processing firms should design better CF specifications. In addition, raising the knowledge, skills and technical capacities of farmers', increase the prices of products per quintal (i.e. 1115 ETB per Quintal for Malt Barley and 60 ETB per Quintal for Sugarcane) and reduce the production costs incurred in the overall production, which ultimately increases the net-income obtained from CF arrangements. The SHFs should also work closely with the agricultural experts and development agents working in the areas of Malt Barley and Sugarcane CF schemes.

3.4.3 Impact of contract farming on net-income

The study analyzed the impacts of CF on the net-income earned by farmers from their participation in CF. Table .3.5 and 3.6 presented the *t* test and *Chi-square* results comparing the participant, and non-participant sampled farmers in CF. Results revealed that there are positive and significant differences in age of household heads, family size of household heads, and heads of cattle in TLU. Moreover, the net-income that participants and non-participants earned revealed that it is positive and significantly affect the participant and non-participant sampled households' livelihood. Furthermore, the participants and non-participant sampled households differ in the type of CF arrangements in peasant associations: Malt Barley for Kofele: Sugarcane CF for Kuriftu Hida and Adulala Hake. The results also show that the participants and non-participant farmers significantly differ in the mean-income they earned where the participants earn a mean of 24,389.56 ETB with standard deviation of 14, 2582 ETB and the non-participants get 10, 256.20 ETB with standard deviation of 7.2562. The *t* test results also indicated that there are statistically significant differences among the participants and non-participants in earning net income in the study areas.

However, the discussions made with FGDs and the KIIs revealed and underscored that in both CF arrangements (i.e. Malt Barley and Sugarcane) the participants in CF earns less income. The results of the propensity score impact analysis (treatment effects) of the impact of CF on the net-income before CF as compared the net-income during CF, their participation in CF reduced their net income by 28.1%. Despite the differences on types of CF, this study was not consistent with some studies conducted on CF studies with regard to increase in net-income (Abebe *et al.*, 2013; Bellemare *et al.*, 2012; Jones and Gibbon 2011; Miyata *et al.*, 2009; Saigenji & Zeller 2009 and Wainaina *et al*. 2012). However, this study is consistent and comparable with Wendimu *et al.* (2016) that focused on the analysis of a compulsory CF scheme in Ethiopia. In their study, they found that the participation of SHFs in CF significantly reduced their income because of 'forced" CF arrangement.

3.4.4 Determinants of participation of farmers in contract farming

Because of the nature of participant, non-participants and the CF arrangements in the study areas, it is paramount important to consider and control the effects for reliable impact estimates. In order to provide information on the decision of sampled households to participate and not to

participate in CF scheme and improve their income, the probit model was used in the analysis. As depicted in table 3.6 of the result of the parameter estimates revealed estimation of propensity score through probit regression model. Three important determinant factors such as the socioeconomic, institutional and policy environments affected CF in the study areas.

The Socioeconomic factors

These includes the peasant associations, age of household heads gender of household heads, educational status of household heads, marital status of household heads and family size, farmland size, heads of Cattle and wealth status of households are among the socioeconomic factors that that impacted CF in the study areas.

The result of the probit model estimates indicated that gender of heads of sampled households is positively and not significantly associated to the income obtained because of their participation in CF. This is statistically not significant due do the fact that both male headed and female headed households have similar chance of getting into the CF arrangement. This is, however, incongruent with the study done by (Priscilla *et al.*, 2012), where gender is positively affected the likelihoods of participation in CF arrangements. The results of the probit model indicated that family size of household heads positively and significantly influenced the participation decision in CF schemes. This is statistically significant at 5% ($p<0.017$).

Peasant associations, age of household heads, marital status of household heads, educational level of household heads, and size of farmlands were negatively and significantly affected the likelihood to participate in CF arrangement. The results revealed that an increase in years of education by 1 year would reduce the likelihood of respondent households' participation in CF by 0.47, taking other factors constant. This is because educated sampled respondents' are more likely have a better understanding on CF design or specifications; the risks and challenges associated with participating in CF schemes. Contrary to the current study, Arumugam *et al*. (2011), Escobal and Cavero (2012) found that level of education positively and significantly attributed to the participation in CF. While, the studies by Miyata *et al.* (2009) and Wiainaina *et al.* (2012) are consistent with our finding and found that education of household heads negatively and significantly affect CF participation decisions.

Size of farmland is another variable considered in the estimation of propensity score. The results showed that a unit increase in size of farmland resulted in a decrease of the probability of participation in CF by 68.2%. Likewise, the study by Kiwanuka and Machethe (2016), is consistent with this study and revealed that an additional hectare to a farmland size decreases households participation in CF. The probit model result indicated that farmers' decision to participate in such CF is negatively and significantly influenced by the size of farmland they owned ($p<0.000$). The FGDs clearly pointed out those farmers with large farmland size do not interested to participate in CF; rather they are more interested in profitable fruits and vegetable production in the areas.

Gender of household heads, heads of cattle as measured in TLU (Total Livestock Unit) and wealth status of households are not statistically significant determinants of respondent SHFs' participation in CF. More males participate in CF as opposed their females headed counter parts. This finding is consistent with Priscilla *et al.* (2012) that the likelihood of participation of male and female-headed households is about 0.25. However, the difference is insignificant and very small. Regarding gender of household heads, there are some incongurencies. A studies by Arumugam *et al.* (2011) and Freguin-Gresh *et al.* (2012) indicated that gender have insignificant effects on participation into CF.

On the other hand, Bellemare (2012) established and documented that younger household heads were more likely participated in CF. However, Katchova & Miranda (2004) reversed the story and documented the insignificant relationship. This findings clearly depicted that SHFs have access to agricultural land and own farmlands in the study areas. Total livestock as measured in TLU was another factor that was not affecting the participation of respondent households in CF. This was because the existing family labor was employed on the CF fields and farm related activities and no one taken care of livestock in the study locations. Furthermore, wealth status of household heads was not statistically significant and not affected the participation situation and the net-income obtained from CF. Because, most of the sampled heads of households do not employ their wealth basis for their participation in CF. The studies by Wainaina *et al.* (2012) and Arumugam *et al.* (2011) revealed wealth of households as productive assets insignificantly affected CF participation. These studies are in consistent with our study. Conversely, few studies claimed that households with better wealth endowment are likely to involve in CF than

those with relatively poor wealth ground (Escobal & Cavero, 2012), while (Bellemare, 2012; Wainaina *et al.,* 2012 & Wang *et al.,* 2011) established an insignificant link between CF participation and wealth status of SHFs.

In general, various studies conducted at different corners of the world examined the effects of CF on net-income earned by SHFs. This study report revealed a substantial positive impact on total income of households. This study is incongruent with the studies by (Michelson 2013; Bellemare 2012; Kalamkar 2012; Wainaina *et al.,* 2012; Miyata *et al.,* 2009; Xu & Wang, 2009). This study is also inconsistent with the studies conducted by (Leung *et al.,* 2008; Zhu 2007; Ramaswami *et al.,* 2006; Birthal *et al.,* 2005; Simmons *et al.,* 2005; Tripathi *et al.,* 2005; Singh, 2002; Warning & Key, 2002).

This study revealed a decrease in net-income. It affected the net-income of SHFs obtained from Malt Barley and Sugarcane CF, because the Malt Barley and Sugarcane CF participants encountered the overall reduction of net-income by 28.1%. There were imbalance of payment between cost of production as compared to agricultural income earned from CF. The FGDs underscored that most of the time the cost of productions (i.e. cost of inputs, transportation cost, storage cost and so on) is by far greater than the income obtained from agricultural crop in the contract. The FGDs discussions and the interviews made with KIIs underlined that those farmers with better wealth were more or less interested to involve in other horticultural activities, non-farm and off-farm activites other than CF. Even though the wealth status is negative, it is not statistically significant in affecting the participation of farmers' in CF. However, the overall result of this study is inconsistent with the study conducted by Priscilla *et al.* (2012) where the impact of CF on the income of SHFs engaged in poultry contract farming have a positive influence on the net-income or revenue in particular and welfare of SHFs in general. Ramaswami *et al.* (2006) underscored that the impact and influence of various determinant factors on participation of CF may emanate from the difference in types of commodities in the CF arrangement (i.e. Malt Barley and Sugarcane in the case of current study).

The Institutional Factors

Access to extension packages, access to credits and financial services and access to agricultural technologies were the major determinant factors that affected CF in the study locations. Access

to extension packages was another explanatory variable that positively and significantly related to the participation of respondent households into CF arrangements. Thus, having access to extension service packages increased the likelihood of participation by 3.03, other things being constant. It was statistically significant at 1% probability level ($p<0.000$). Similarly, having access to credits and financial services positively and significantly affected the participation of respondent households into CF arrangements ($p<0.012$). The results revealed that SHFs with better access to credits increased the probability of participation by 1.03 than those who do not have access to credits and a financial service, which means CF excluded the poor farmers to engage in CF.

Moreover, access to agricultural technologies negatively and significantly influenced the participation situations. The results revealed that the likelihood of participation for having access to agricultural technologies is reduced by 1.35 and it is statistically significant at $p<0.000$. Thus, it negatively and significantly affected the likelihood to participate in CF arrangement. A result of study by Kiwanuka and Machethe (2016) revealed that access to production enhancing facilities, extension service and improved agricultural technologies negatively affected the participation situation in CF. This study is congruent with the study by Kiwanuka and Machethe (2016).

Policy environments

Public policies, strategies, legal frameworks and presence of guidelines influence the market strategies and forms of transaction used between SHFs' and agro-processing firms (Ton *et al*., 2015). As KIIs explained and document review, there were no specific policies, guidelines, regulations and legal frameworks that scrutinizes CF arrangements in Ethiopia. During FGD discussions made with participants of FGDs, there were policies, legal frameworks and guidelines that help to manage contracts with respect to CF arrangement in Ethiopia. The findings obtained from the FGDs and KIIs were consistent with the previous studies done by Nijhoff (2010), Nijhoff and Trienkesen (2010) and USAID (2012), where CF arrangement in Ethiopia lacks policy strategies and legal frameworks that are specifically designed to address CF business arrangement.

According to USAID (2012), there are only two countries namely Morocco and Spain that have Ad hoc legislation on CF and Ethiopia does not have such enabling policy environment. As a result, either of the parties (i.e. be agri-business firms or SHFs) can easily breaches the contract that in turn affects the sustainability of CF business arrangement. In the case of Sugarcane CF arrangement, the absence of policy strategies and legal frameworks seriously affected SHFs' participation in CF. Thus, the absence of such policy ground paves ways for all parties (i.e. the agri-business firms, cooperative unions and SHFs) to very easily breach the agreement they agreed in the CF arrangement.

3.5 Conclusions and policy recommendations

Agricultural commercialization as a means of improving agricultural production and income plays a crucial role in shaping livelihood of SHFs through better access to agricultural inputs, access to credits; technical assistance, market facilitation and networking perhaps ensure sustainable development goals. However, there is hardly any evidences that deals with the contribution of CF) as a practice of sustainable agricultural commercialization. This study employed primary data to analyze the impacts of CF on the net-income (i.e. income difference before CF and during CF) earned by SHFs and its subsequent effects on the overall livelihood and sustainable agricultural commercialization. We conducted the current study to evaluate the net-income earned and livelihood improvements taking the case of Malt Barley and Sugarcane CF at Kofele and Adama Districts of Oromia Regional State of Ethiopia. Consequently, the study identified the determinant factors that affected the participation of SHFs in CF arrangements. Moreover, the study employed propensity score matching (PSM) to analyze the impact of CF on the net-income earned by SHFs and measured in terms of income difference among the treated and the untreated groups because of their participation in CF schemes.

The overall result revealed that sampled households heads that participated in CF arrangements experienced a decrease in net-income. The overall impact of the treatment effect measurement indicated that the net-income of the participant SHFs, who participated in CF faced a reduction of net-income by 28.1% on average. This was attributed to the high production cost deducted at the time of supplying the output to the cooperatives or agribusiness firms. However, it served as a tool in accessing family labour and getting access to farmland in the study areas. Thus, there are two sides of argument, where policy makers perceived CF as a means of labour use

(Bellemare, 2012). ADS (2014) strongly argued and considered CF as a way out in promoting agricultural commercialization through CF.

Thus from the results, we argue that if CF arrangement is not designed and managed well, it would result in a decrease of net-income earned by farmers and well designed and managed CF immensely raise the net income of SHFs (USAID, 2012). In order to increase the participation of SHFs engaged in CF arrangement, the policy measures should focus on better CF specifications or design and good management that have the capacity to raise the net-income of SHFs. In addition, enhancing the knowledge and skills of farmers', increase the prices of products per quintal and reduce the production costs incurred in the overall production, which ultimately increases the net-income obtained from CF arrangements is paramount important. Thus, it is very important to conduct researches on: why the SHFs were not interested to continue their participation, especially in Sugarcane CF? Despite their access to agricultural inputs, supply of agricultural technologies, technical assistance and access to credits, their interest to discontinue their participation may emanate from the low level of income earned and the imbalances of power between the agribusiness firms and the SHFs engaged in CF in the study locations. These of course affected sustainable livelihood of SHFs and negatively affect agricultural commercialization. Furthermore, there is no policy and legal frameworks designed specific to oversee and guide the overall processes in CF arrangements at regional and country level. Thus, it is paramount important to design specific CF arrangement policy and legal frameworks that scrutinize the overall contract farming processes and challenges emanated from the implementation of any CF arrangements.

Chapter 4_____

4. Sustainable agricultural solutions for overcoming climate change: adoption of contract farming as climate change adaptation strategies in Oromia Regional State, Ethiopia

Abstract

Even though agriculture is the major livelihood base for many populations in Ethiopia, it is rainfed and affected by climate change and variabilities. This study aims at exploring the factors affecting SHFs contract farming as adoption of CCASs employed in Kofele and Adama Districts of Oromia Regional State. Data collected from 368 randomly chosen SHFs, used multinomial logit model and complimented it with FGDs, KIIs, field observations and case histories to explore the adoption of CF as CCASs in the study areas. The results revealed that age of household head, educational status of household head, family size, livestock holding, access to credits, access to agricultural technologies and metrological information significantly affected the adoption of various CCASs. The result suggested that promoting sustainable agriculture, fair and well-structured CF, good agronomic practices, livelihood diversifications, soil and water conservations (SWC) are better helpful to combat CCASs in the study areas.

Keywords: Agronomic practices, Climate change adaptation, Contract farming, Multinomial Logit Model, Sustainable agriculture

This paper was accepted as:

Megersa, G. & Assefa, E. (2020). Sustainable agricultural solutions for overcoming climate change: adoption of contract farming as climate change adaptation strategies in Oromia Regional State, Ethiopia. *Journal of Sustainable Development in Africa*: *http://www.jsd-africa.com/, Published.*

4.1 Introduction: Background of the study

Agriculture is the major livelihood base (i.e. more than 80%) for many populations in Ethiopia (CSA, 2008). It is rainfed and predominantly affected through climate change and variabilities (Getachew, 2010). According to CRGE (2011) and CSA (2008), agriculture is the main stay of the country's economy and believed to continue as the dominant sector to bring about sustainable economic growth in the country. However, Ethiopia in general and the study areas in particular are located within tropical Africa. This makes it vulnerable to influences of climate change and variabilities (Inter Academy Council (IAC), 2004; Dixon *et al.,* 2001; Houghton *et al.,* 2001). These changing climates and climate variabilities manifest itself in rainfall fluctuation, poor on set, late and early cessation and temperature changes compounded with poor agronomic practices and in appropriate input utilizations including poor technology adoption. This in turn affected SHFs' production and productivity by reducing crop yield that threaten livelihood of those engaged in such agriculture (Deressa *et al.,* 2010). However, CF as CCASs is expected to curb climate change and variabilities, it provides opportunities for SHFs to participate in value chain and access the global markets (FAO, 2015).

Moreover, climate has changed and will continue to do so in the coming decades and these needs to understand how SHFs'[xx] or farmers[xxi] (SHFs) are striving to perceive and adapt to the changing climate (Deressa *et al.*, 2010). This is very important in understanding further SHFs' adaptations and plan to adapt to climate change and climate variabilities. A study by Amare and Simane (2017) underscored that despite considerable policies and strategies set to facilitate adaptation strategies to curb climate change adverse impacts of climate change, the negative impacts continued to hamper the agricultural sector. This is highly affecting sustainable agriculture in developing countries like Ethiopia. Empirical studies by (Reidsma *et al*., 2009; Kurukulasuriya and Mendelsohn, 2008; Stern, 2006) focused on the study of impacts of climate change and suggested some policy implications. Nevertheless, they failed to address what specific driving forces or determining factors that initiated the local SHFs to adopt CCAS pertinent to their location (i.e. socioeconomic, institutional and environmental conditions of the study locations). Given the difference in socioeconomic, institutional and environmental settings, the adoption of climate change adaptation requires understanding of location specific realities of the SHFs situations.

As discussed earlier, apart from studies conducted by Asrat and Simane (2018), Amare and Simane (2017) and Deressa *et al.* (2010) on adoption of CCASs specific to Blue Nile, the scope of their work or research is limited to the Nile Basin and it lacks comprehensive coverage. Due to limited scientific investigations in this aspect, there is a need to consider areas with commercial agriculture (i.e. Malt Barley and Sugarcane Contract Farming Areas). Thus, it is paramount important to look into the adoption choices of SHFs in CF areas and deal with sustainable solutions for sustainable agricultural activities with respect to adoption of CF as CCASs to draw some lessons from the current study.

Therefore, the objective of this study is to examine what driving forces or determinant factors that are affecting sustainable agriculture and SHFs adoption[xxii] of CCAs SHFs employed the changing climate and the variabilities in the study areas. Moreover, to analyze sustainable agricultural solutions or CCASs, SHFs of Kofele and Adama Districts of Oromia Regional State, Ethiopia are relied sustainable agricultural solutions to curb climate change and variabilities.

4.2 Research methodology

4.2.1 Research Methods: Sampling procedures and data collection

Primary data were collected from the selected farmers using quantitative data was administered through household survey. In the qualitative study, Six (6) Focus group discussions that consisted of Ten (10) participants each, Twenty (20) key informant interview were conducted, Three (3) field observation and case histories were undertaken in the study PAs.

A multistage random sampling technique was employed to select a sample of 383 SHFs from the districts. Three PAs were selected purposively from the districts in these two Zones (i.e. one PAs from West Arsi Zone, Kofale district and two PAs from Adama District). The proportionate sampling technique was employed and randomly selected the participant and non-participant SHFs from the lists obtained from PAs. From Germama PA, 136 sample SHFs engaged in Malt Barley production, Two PAs from Eastern Shewa Adama District namely: Kuriftu Hida and Adulala Hake Haroreti) with 131 and 116 respondent SHFs, respectively, were selected randomly from the lists taken from the PAs. Accordingly, the PAs were selected based on their crop production history, where households at Germama started Malt Barley CF at Kofale district in 2006 E.C, Kuriftu Hida and Adulala Hake Haroreti villages started Sugar cane CF in 1975

G.C and 2008 G.C, respectively. Consequently, the heads of households engaged in contract farming was the unit of analysis in the study.

4.2.2 Sampling procedure and sample size determination

We selected purposively the Two districts: Kofele and Adama, because of their engagement in Malt Barley and Sugarcane CF arrangement. Three Hundred Eighty Three (383) households in the Districts were considered as the survey population. However, 3.92% (15 respondents) of the households did not respond to the questionnaires and the data was analyzed based on 96.08% (368) of the households. The units of analysis were he participant and non-participant heads of households selected in the sample in the study areas.

4.2.3 Methods of data analysis

We analyzed the quantitative data obtained by household survey through a Statistical Packages for Social Science (SPSS Version 20) and Stata version 14. The quantitative data gathered through household survey from the participant, non-participant SHFs were substantiated with the qualitative data such as FGDs, KIIs, field observations, and case histories that that ultimately transcribed narrated and used in the analysis.

The descriptive statistic were used to explain the perception of sampled households on rainfall patterns and temperature changes over two decades and the role of CF in CCASs employed by contracted and non-contracted farmers. The multinomial logit model (MNLM) was used to estimate the adoption options in the study areas. Ultimately, marginal effects computed from the MNLM were employed to look into the expected change in the probabilities among the adoption choices made with respect to a unit change in the predictor variables and analyzed the specific climate change adaptation strategies in the study areas.

4.2.4 Econometric model specifications: The multinomial logit model

The logit and probit models are the two most important functional forms employed in adoption modeling. These models have distinct statistical properties as their probabilities are in between 0 and 1. It is obvious that the adoption model on climate change adaptation could be grouped broadly in to two categories based on the number of adoption choices to an economic agent (Greene, 2000) with a choice decision by SHFs' with a multivariate decision. This is because, the

farmers decide on the adoption of various strategies as a CCASs involves a multiple response that the dependent variable is separate from the independent variable to more appropriately treat factors that affect the choice of adoption of climate change adaptations as a multiple choice decision. Thus, in this paper, either multinomial logit or probit model could be employed, since both of them have the power to estimate the effects of independent variables on the dependent variable taking into account multiple choices with unordered response categories (Greene, 2000). However, this study employed the multinomial logit model as an empirical analysis model because of the computational ease and its superior capacity to predict the adoption choices that households engaged used CF as CCASs in the study areas.

According to Komba and Muchapondwa (2012), the decision to adopt or not to adopt CF and other adaptations mechanisms as CCASs could fall under the general framework of utility maximization employed by Greene. Based on Greene (2000), suppose the *i*th respondent encountered with *j* choices; we specify the utility choice *j* as:

$$\mathrm{U}ij = \mathrm{Z}ij\beta + \mathcal{E}ij \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{(4.1)}$$

Here, if the farmers make choice *j* in particular, then we consider that U_{ij} is the maximum among the *j* utilities. Therefore, the statistical model is derived by the probability that choice *j* is made. This is written as:

$$\mathrm{Prob}(\mathrm{U}ij > Uik) \text{ for all other } K \neq j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4.2)$$

Where, U_{ij} is the utility to the *i*th respondent from adoption of climate change adaptation $_{j,}$ *Uik* the utility to the i^{th} respondent from the adoption of climate change adaptations *k*.

Apart from calculating the probability of the utilities, the household's maximizes its utility defined over income realizations. Thus as stated in Brown *et al.* (2006), the household is simply the optimal allocation of its asset endowment to choose adoption of CCASs that maximizes its utility. To this end, the $\boldsymbol{i}^{th}$ household's choice can be therefore, modeled as maximizing the expected utility by selecting the *i*th adoption of CCASs among *J* discrete adoption factors, given as:

$$\mathrm{Max}j = E(Uij) = fj(xi) + \mathcal{E}ij; \text{ where } j = 0 \ldots J \qquad \ldots\ldots..(4.3)$$

In general, for an outcome variable with J categories, let the jth adoption that the i^{th} household selects to maximize its utility could take 1 if the i^{th} household chooses jth adoption factor and 0 otherwise. Therefore, the probability that a household or a farmer with charactestics x chooses adoption factor j, P_{ij} is modeled as:

$$\frac{\exp(X'i\beta j)}{1+\sum_{j}^{J}=0 \exp(X'i\beta j)}, J = 0 \ldots 3 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4)$$

With the requirement that $\sum_{j}^{J} = 0 \ Pij = 1$= 1 for any i, where P_{ij} = probability representing the ith respondent's chance of falling into category j; X = predictors of response probabilities; β_j = Covariate effects specific to ith response category with the first category as the reference.

By computing equation (4.4), it is possible to normalize and removes an indeterminacy in the model assuming that β_1 = 0,; this arises because the probabilities sum to 1, so only J parameter vectors are required to determine the J + 1 probabilities (Greene, 2003), so that $\exp(X'_i \beta_1)$ = 1 implying that:

$$\Pr(\gamma i = \frac{1}{Xi}) = Pij = \frac{\exp(X'i\beta j)}{1+\sum_{j}^{J}=1\exp(X'i\beta j)}, \quad for\ j = 0,2 \ldots J \quad and$$

$$\Pr(\gamma i = \frac{1}{Xi}) = Pi1 = \frac{1}{1+\sum_{j}^{J}=1\exp(X'i\beta j)}, \quad \ldots\ldots\ldots\ldots\ldots\ldots (4.5)$$

Where y = A is a polytomous outcome variable with categories coded from $0 \ldots J$. Ultimately, the probability of P_{i1} is derived from the constraint that the J probabilities sum to 1. That is:

$Pi1 = 1 - \sum pij \ldots$, which is similar to binary logit model implying that it can be computed for J log odds ratios and it can be specified as:

$$\text{in}[\frac{Pij}{dpijx}] = x'(\beta - \beta) = x'\beta J if\ J = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots (4.6)$$

Coefficient Interpretation

The MNL model is the extension of the binary logit model, interpreted as binary logit model (Gujarati, 2003). The major difference is that the reference category no longer the other choice as

in binary logit model. Probability in the MNL model could be computed similar to that of binary logit model, with the only modification being made for multiple sets of β estimates. The meaning of logit (log odds) and odds term is the same in both cases. In the binary case, the comparison is among category 1 and category 2 (i.e. the first versus the last category). In MNL case, the comparison is between category j and J or any category versus the last one.

Hence, the predicted probabilities are better-interpreted using the marginal effects of the MNL model (Greene, 2003). Here, every sub-sector of β enters every marginal effect of both probabilities and through weighted average that appears in δij. By differentiating equation (6) with respect to the covariates, it can be found that the marginal effect of the individual characteristics on the probabilities (Greene, 2003). Thus, the marginal effects (βij) of the characteristics on the probabilities can be specified as:

$$\delta \text{ij} = \frac{\partial Pij}{\partial xi} = Pij[\beta j \sum_{k=0}^{J} Pik\beta k] = Pij[\beta j - \beta] \qquad \text{.....(4.7)}$$

Where, δij is the marginal effect (the coefficient) of the explanatory variable on the probability that alternative j is chosen.

Before running the model, it is very useful to look into the problem of multicollinearity among the continuous variables and confirm the degree of relation between the hypothesized qualitative explanatory variables. The presence of multicollinearity will definitely affect the parameter estimates. If it turns out to be significant, the simultaneous presence of highly variables will reinforce the individual effects of these variables. To detect these problems of multicollinearity among the continuous variables the Variance Inflation Factor (VIF) was used in this study. Each continuous variables is regressed on all the other explanatory variables, the coefficients of determination R^2 being constructed in each case. If the linear regression exists among the explanatory variables then will result in large value of R^2 in at least one of the tested regressions. A popular measure of multicollinearity associated with VIF is defined as:

$$\text{VIF}(X) = 1/(1 - \text{R2}) \qquad \text{..... (4.8)}$$

Where X shows the variables regressed on other explanatory variables and R^2 is the coefficient of determination for each independent variable.

Thus, the rise in the value of R^2 revealed an increase in the degree of multicollinearity, which does indeed lead to an increase in the variance and standard errors. Guajarati (1995) underscored that a VIF value greater than 10 (this will happen, if R^2 exceeds 0.90), was used as a signal for presence of severe multicollinearity. Moreover, there may be interaction between dummy variables that can lead to the problem of multicollinearity. For dummy variables: if the value of coefficient is greater than 0.75, the value is then collinear. To test this problem, the Coefficient of Contingency (CC) would be computed from the survey data. Then, the CC is calculated as follows:

$$CC = \left[\frac{\sqrt{\chi 2}}{n+\chi 2}\right] \qquad \text{.....(4.9)}$$

Where CC is coefficient of contingency, $\chi 2$ is Chi-square test and n is the total sample size in the study.

The multinomial logistic (MNL) model essentially depends on the independence of Irrelevant Alternatives (IIA) assumptions in order to get unbiased and consistent estimates from the model (Wooldridge, 2001). This assumption depends on the household's capacity in using certain adoption mechanisms needed to be independent of other choices employed by the same household. However, the validity of this was conducted through Housman test to check whether it is appropriate or not. Thus, Tizale (2007) explained that the estimated coefficients of MNL reveal only the direction of effect of independent variables and it estimate not the actual magnitude of changes and the probabilities. Finally, Stata version 14 was employed to obtain the parameter estimates or marginal effects to measure the expected change in the probability of a particular choice being made with regard to a unit change in predictor or independent variable (Greene, 2000).

4.3 Results and discussions

For agricultural practices to be sustainable and to curb climate change and climate variabilities, SHFs needs to engage in modern agriculture that has the capacity to increase agricultural production and productivity. Thus, this section deals with the discussions of the findings pertaining to this study. It tried to explore how adoption of CF as CCASs would immensely help

the farmers for overcoming climate change and climate variabilities. Regarding adoption of various adoption strategies to curb climate change, the SHFs employed about six (6) adoption strategies including the no adoption options. Consequently, among all the respondent SHFs that accounted about 16.6%, 20.7%, 29.9%, 16.8%, 5.4% and 10.6% relied on: no adoption, adoption of CF, agronomic practices, soil and water conservation strategies, shift in livelihood and livelihood choices (combinations of on-farm, non-farm and off-farm activities), respectively in their locality. Among the adoption of CCASs as depicted in figure 4.4, agronomic practices, CF, SWC[xxiii] practices and those employed nothing were ranked from 1-4 , respectively. These 1-3 in the rank are the dominant climate change adaptation strategies employed by respondent SHFs' in the study areas.

4.3.1 Rainfall and temperature situations of Adama and Kofele Districts

As indicated in figure 4.1 below, the trends of mean annual rainfall of Kofele from 2000-2017 G.C varies from 120mm to 150mm (NMAE, 2018). The lowest mean annual rainfall was observed in 2012 G.C with 70mm of rainfall, the highest and maximum rainfall in 2016/17 G.C with more than 150mm. The computed result, which is the highest amount of rainfall concieded with the discussions made with the FGDs on overall rainfall situations during field survey. They confirmed that there was snow fall and serious flash floods (i.e. between 2014 and 2017 G.C) in the study area. The survey collected on overall rainfall situations further confirmed that there were irregularities in rainfall pattens in the area. This was resulted in extreme floods and droughts, which clearly indicated that there is climate change and variability,which infact is affecting the agricultural production in the study area.

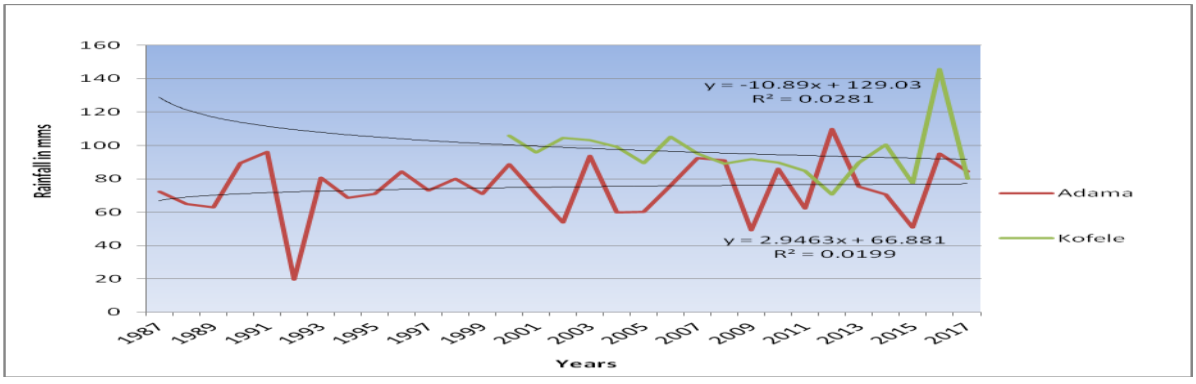


Figure 5.1 Trends in Mean Annual Rainfall at Adama and Kofele Districts

Source: Authors construction, 2018

Regarding the trends in temperature, the metreological data obtained from the national metrological agency computed from daily temperature and monthly records indicated that the temperature situation also exhibited an ossilation or long term variability (-0.9^{0}C in 2011 and -0.2^{0}C in 2012 G.C) and sharply increased and fluctuated after 2014 G.C in mean and minimum annual temperature from time to time (NMAE, 2018). It was not consistent, which in turn affects agricultural production and productivity in the study area. The FGDs and KIIs further confirmed that there are change in climatic elements such as rainfall and temperature leading to climate change, climate variabilities resulting in recurrent drought and sometimes heavy floods. In addition, the regression result between mean annual rainfall and time where an increase in one year period for Adama District revealed an increase of mean annual rainfall by 2.9463mms and a decrease of 10.89mms in mean annual rainfall for Kofele District (See figure 4.1). This clearly indicated that the rainfall amount and pattern in Kofele District were decreasing and this seriously affected the agricultural production in the area. This of course consstent with the discussions made with FGD where the time and the amount of rainfall is generally changing from 2000-2017 G.C.

Figure 4.2 Trends in Maximum Mean and Minimum Temperature at Kofele District

Source: Computed from NMAE Data, 2018

Similarly, as depicted in figure 4.1 and 4.2, the trends in mean annual rainfall and mean annual temperature at Adama and Kofele Districts obtained from Ethiopian metrological agency suggested that the rainfall was irregular and revealed differences in distribution across years from 1987-2017 G.C (National Metrological Agency of Ethiopia (NMAE), 2018). In between 2000-2017 G.C, the temperature in Kofele has shown a decreasing trend. For example, the regression result for minimum and mean annual temperature for Kofele District revealed a decrease by 0.717^0C and 0.756^0C, respectively. However, the regression result for maximum annual temperature in one year period for Kofele District indicated an increase by 0.5693 ^{0}C. The trends in maximum and mean annual temperature in and around Adama District exhibited a decrease of maximum and mean annual temperature by 0.084^0C and 0.043^0C, respectively. Conversely, the trends in minimum annual temperature from 1987-2017 G.C revealed an increase of temperature in and around Adama District by 0.4309^0C. This computed mean annual temperature is consistent with the discussions made with FGDs and the KIIs interview made with District agricultural experts, where the minimum annual temperature decreased for Adama and its environs decreased because of Sugarcane contract farming microclimate, which reduced the temperature in the area (see figure 4.2 above). This is to mean that the use of irrigation because of sugarcane plantation, the climate in the area is modified due to decrease in temperature.

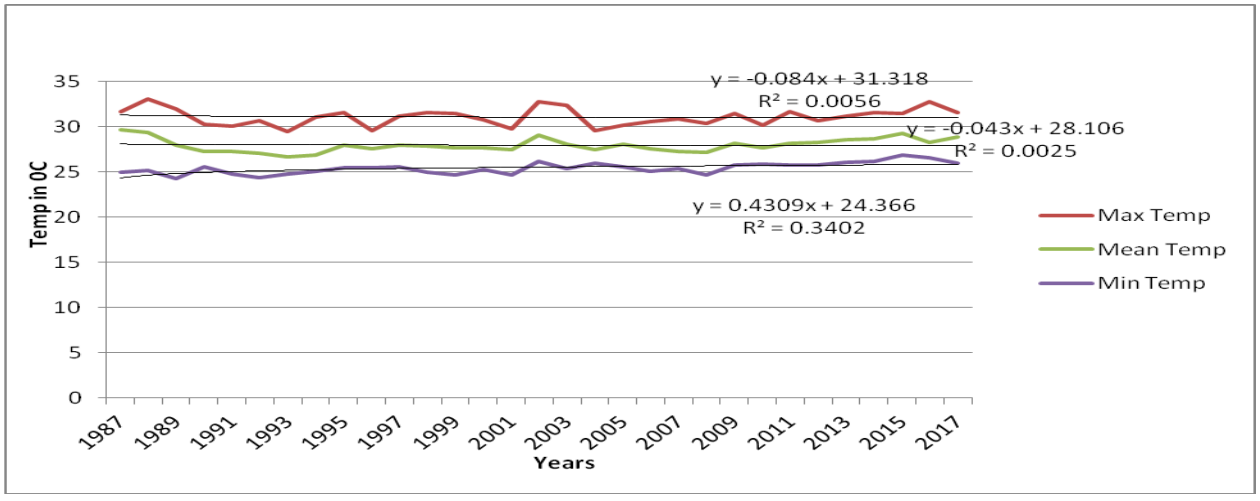


Figure 4.3 Trends in Maximum, Mean and Minimum Temperature at Adama District

Source: Computed from NMAE Data, 2018

Agronomic practices are the first most important CCASs and CF is the second one, where CF from its design to its contribution aims at reducing challenges related to agricultural commercialization. This is to say that CF facilitates conditions for the provision of agricultural inputs, market facilitation through basic cooperatives and cooperative unions. The third most crucial climate change adaptation was SWC practices such as half moon, stone bunds, soil bunds, hedges, terraces and drainage was especially done at the hilltops of farmland areas to protect soil erosion because of floods. These SWC practices at Kofele District were very common SWC structures that protect soil erosion from farm fields.

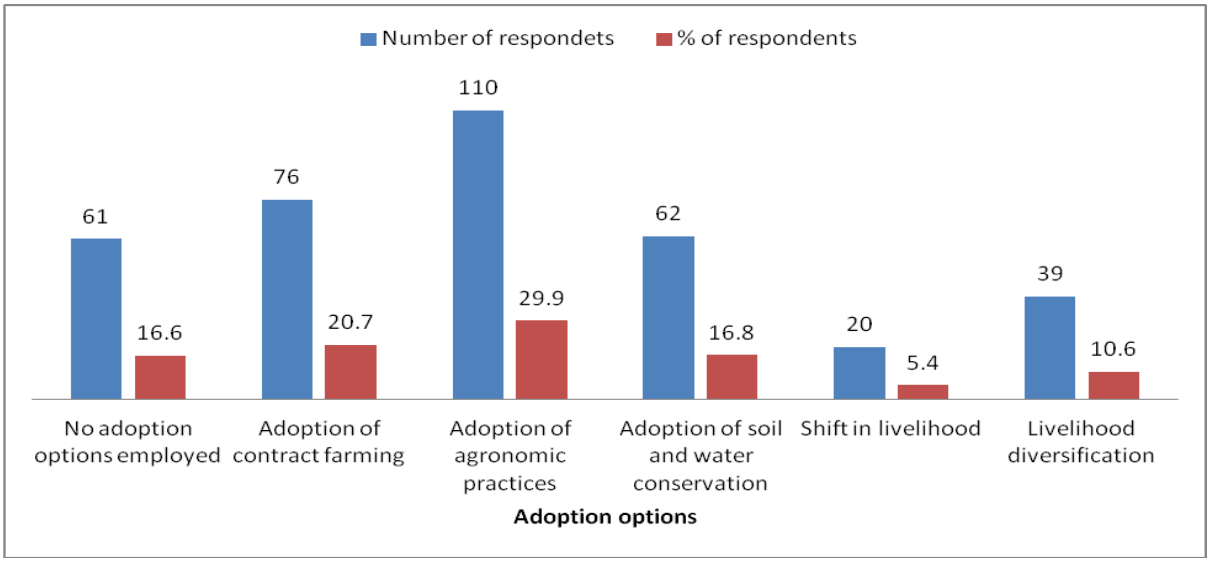


Figure 4.4 Adoption options employed by Smallholder Farmers

Source: Computed from survey result, 2018

4.3.2 Socioeconomic determinants of adoption of climate change strategies

Adoption of various CCASs employed by participants and non-participant SHFs needs to understand the socioeconomic determinants of the adoption of climate change adaptations in the study locations. As revealed in table 4.1 and 4.2 below, the socioeconomic determinants that are supposed to exert influence on adoption options are age of households, gender of households, educational status of households, family size, Livestock owning situation, farmland size and net peasant associations, access to credits, net-income, access to agricultural technologies, access to extension services and access to metrological services.

Age of household heads: Age of household is one of the socioeconomic factors that determine the adoption of CCASs in the study locations. Those farmers who employed the no adaption options, CF, agronomic practices[xxiv], SWC, shift in livelihood, livelihood combinations or diversifications constituted about mean age of 47.7, 41.1, 42.3, 43.1, 46.9, and 46.4, respectively. From this, one can understand that the respondents with higher mean age preferred to employ no adoption of any strategy, shift in livelihood and depend on various livelihood choices. This is a reflection of the enriched experience in using various CCASs and may be a fear in changing their livelihood. However, those with lower age groups employed adoption strategies such as CF, agronomic practices and SWC. Above all, the Chi^2 result revealed that there are statistically significant difference among adopters and non-adopters in using various CCASs at $p<0.079$. Therefore, it is paramount important for policy makers to find a way and promote young farmers to employ CCASs to reduce the adoption gaps created as a result of age of respondents in adoption of CCASs focusing on those energetic, abled young farmers to employ various CCASs.

Gender of household heads: This is another determinant factor that affected the adoption of various CCASs in the study areas. The significant number of respondent households that employed various CCASs were male (i.e. 43.5%) as compared to those female respondents that accounted about 17.8%. This clearly indicated that the female respondents engagement in adoption of various CCASs were less as compared to their male counterparts, where larger proportion of male used various adoption mechanisms to curb climate change and climate variabilities in their study areas. Even though the number of male adopters and female adopters vary greatly, this shows statistically significant difference among the adopter and non-adopter males and females in the study areas ($p<0.047$). The reason behind this according to the FGDs was that the female respondents engaged less in the adoption process or hire male daily laborer in addressing climate change and climate variabilities through either one of or a combinations of these CCASs discussed above.

Education of household heads: Educational status of respondents plays an immense role in adoption of any CCASs. The mean educational status of respondents ranges between 2.1 to 3.2 grade level with the overall mean of 2.67 grade level. However, those respondents with mean of 3.1 and 3.2-grade level employed CF and shift in livelihood as the best adoption of CCASs. The Chi^2 result further indicated that educational level of adopters and non-adopters of any CCASs

were statistically significant at ($p<0.000$). From this, it is possible to conclude that as level of education increases, the probability of participation in CF increases because the respondents with better education have better chance of knowing the benefits and advantages of adoption of CCASs. Hence, this study is consistent with (Strohm and Hoeffler, 2006), where the better the farmers' educational level, the better the respondents' probability to know the benefits of various adoptions and the ways of adopters adopt various CCASs increases.

Family size: Regarding mean family size of the respondent SHFs, the mean number of family of adopters and non adopters was 6.57 persons with standard deviation of 1.49 and 6.51 persons, which is higher than the mean family size of the national average (4.2 persons per household) (CSA, 2007). However, it has been reported that there is a significant difference between the family size of adopters and non-adopters ($p<0.016$). As depicted in the table 4.2, the mean family size of the adopters and non-adopters exhibited significant difference among the types of CCASs employed in the study locations. Above all, all the survey respondents comprised of more than 6 family members depend on more than one adoption options. For instance, respondent families with larger family size that consisted of 7.1, 6.7 and 6.6 employed CF, agronomic practices and livelihood diversification as CCASs, respectively. This means that those respondent families with larger family size have large labour size better engaged in CCASs, because there were no problems of human resource. From these, one can conclude that the large family labour pool facilitates CCASs that specially require labour force.

Livestock rearing: Livestock rearing is one of the important socioeconomic factors that affected the farming system among farming community in the study areas. As indicated in table 4.2, the survey results revealed that livestock is another major component of socioeconomic pillar of respondents that played a prominent role in adoption of CCASs in the study areas. To this end, the adopters and the non-adopters of the strategies portrayed a mean of 6.23 TLU in using the different CCASs. The Chi^2 result further indicated that there is a significant statistical difference among the adopters and non-adopters in using livestock as one of the socioeconomic factor affecting the overall adoption mechanisms ($p<0.000$). This means that, the greater number of the heads of cattle, the better the respondents adapt and employ various adoption strategies in their locality.

Farmland size: As revealed in table 4.2, the adopters and non-adopters of different CCASs get hold of 1.73 hectares of farmland. Thus, the farmland sizes in the study locations were larger than the national average of farmland size, which is below 1 hectare (Amare and Simane, 2017). However, the Chi^2 revealed that the farmland holding situation among the adopters and non-adopters of any CCASs indicated significant statistical difference at 1% level *(p<0.000).*

Net-income of households: This one of the continuous variable that is computed or transformed to the natural log of income and it was the aggregate income (on-farm, off-farm and non-farm income) obtained from the difference between total income and total expenditure. The mean income was about 9.72 that were estimated above 12000 Ethiopian Birr (ETB). The study revealed that income affected the adoption of CCASs employed by the adopters and non-adopters. The Chi^2 result further revealed that income obtained from various sources significantly affect the adoption of CCASs and it was statistically significant at 1% (*p<0.000*) is consistent with the study done by Deresse *et al.* (2010), whereby the greater the income, the better the SHFs employed various adoption mechanisms of climate change strategies. Thus, broadening income base of SHFs immensely facilitates adoptions of various CCASs in the study locations.

Member of peasant association: Being a member of peasant association helps the farmers or respondents to access the basic resources in the area. According to this study, most of the respondents at Germama (Malt Barley CF), Kuriftu Hida and Adulala Hake Haroreti (Sugarcane outgrowers) employed different CCASs such as including no adoption of any options. Hence, the three (3) PAs have used CF, agronomic practices and SWC. Those respondents in sugarcane out growers revealed that small proportions of respondents employed shift in livelihood and livelihood diversifications as CCASs. The Chi^2 result revealed that it is statistically significant among the adopters and non-adopters at 1% level (*p<0.000*).

Access to credits: Access to credits as an institutional factor plays an important role in adoption of CCASs. It facilitated and supported the overall adaptation processes. As pointed out in Amare and Simane (2017) and Deressa *et al.* (2010), access to credit helps to access agricultural inputs and technologies that aimed to increase agricultural production and productivity. Moreover, it helps respondents in ensuring agricultural productivity through accessing modern agricultural technologies such as farm inputs: fertilizers, improved seeds, modern farm mechanizations

(combine harvesters, threshers) that have a power to boost agricultural production. Thus, significant proportions of respondents have access to credit (i.e. 55.8%). It was only 5.5% of the respondents did not have access to credits and failed to adopt all the other CCASs except agronomic practices and SWC. The rest of the adopter have got access to credits and employed CF, agronomic practices, SWC, shift in livelihoods and livelihood choices or diversification[xxv] as the major adoption of CCASs. The Chi^2 further indicated that these were statistically significant at 1% level ($p<0.000$) among the adopters and non-adopters of CCASs. The policy implications here are in order to help those non-adopters because of not accessing resources, there is a need to design and include a mechanism to put in place financial provisions.

Access to agricultural technologies: Access to agricultural technologies is also one of the pillars of agriculture that increase the production and productivity of farmers. Hence, 49.5% of participant respondent households indicated that they have access to agricultural technologies such as agricultural inputs including fertilizers, improved seeds, agro-chemicals, farm implements and other related technologies. However, only small proportions of participant households that accounted about 7.1% did not rely on agricultural technologies to increase their production. In the survey result, it is indicated that having access to agricultural technologies immensely helped the respondents to relay on and adopt a combination of all CCASs. The Chi^2 result further indicated that there is statistically significant difference among the adopters and non-adopters in accessing agricultural technologies and adapting to climate change at 1% level of significance ($p<0.000$).

Access to extension services packages: Access to credit and other financial lending facilities are very essential to enhance the ability of the households in times of financial need. The overall extension package includes inputs, technical support and trainings, supervision etc, which have the capacity to enhance agricultural production and productivity. It is of course an important element in extension service packages and agricultural technology adoption in the view of increasing agricultural production and productivity (Deressa *et al.,* 2010). The need for access to extension service packages was helped the sampled households in ensuring agricultural productivity through modern agricultural technologies such as farm inputs: fertilizers, improved seeds, modern farm mechanizations (i.e. Combine Harvesters, Threshers) that have a power to boost agricultural production. In the light of climate change adoption strategies, 60% of the

respondents that have access to extension service packages have adopted CF, agronomic practices, SWC, shift in livelihoods and livelihood diversifications including adoption options. It was 1.3% of the respondents that have no access to credits adopted only agronomic practices as CCASs. The Chi^2 further confirmed there are statistically significant difference among adopters and non-adopters in accessing to extension service packages and adaptation to climate change in the study areas ($p<0.002$). Therefore, the policy makers should work on strengthening the provision of extension service packages for SHFs engaged in CCASs and promote the use of various agricultural inputs that enhances the capacity of farmers.

***Access to metrological information*:** Access to metrological information could better help to understand climate change processes, plan and implement CCASs. Accordingly, the majority of the respondents that accounted about 57.8% who have access to metrological information better adopted: CF, agronomic practices, SWC, shift in livelihood and livelihood diversifications employed no adaptation options as CCASs in their study locations. This study is consistent with a study done by Deressa *et al.* (2010) on climate change adaptation in Southern and Eastern Ethiopia indicated that better access to climate change information could have significant effect on the likelihood of various CCASs including use of various crop varieties. Likewise, in this study we found that access to metrological information such as temperature, rainfall, humidity, wind and other climatic elements significantly and positively affect the adoption of various adaptation strategies, which is statistically and significantly different among adopters and non-adopters of climate change adaptations at 1% level ($p<0.032$).

Table 4.1 Descriptions, definitions and values of variables employed in the empirical model

Variable	Definition	Values and units of measurement
Dependent variable		
Adoption of options	Adoption options	It is a categorical variable which takes a value of 1= not adopting any adoption strategy, 2= contract farming adoption, 3= adoption of agronomic practices, 4= adoption of soil and water conservation practices, 5= adoption of shifting in livelihoods and 6= livelihood diversifications
Independent variables or Predictors		
AgeHHHs	Age of household heads	It is a continuous variable measured in years
GenderHHHs	Gender of household heads	It is a dummy variable which takes value of 1 for male and 2 for female
EducHHHs	Educational level of household heads	A categorical variable that takes 1= Illiterate; 2 for Grade 1-4; 3=Grade 6-8; 4=Grade 9-10; 5=Grade and 6=Above Grade 12)
Family Size	Number of Persons in a family	A continuous variable refers to Total number of people who are currently living within a family
HeadsCattle	Number of cattle owned by household heads	A continuous variable measured in Total Livestock Units using conversion factor
Access Credit	Access to credit and financial services	A dummy variable that takes 1 if the household heads have access to credits and 2 for not receiving credits
Access Market	Distance to markets from home	Walking Distance to the Nearest Market from home in hours
Size of farmland	Hectares of cultivated land	A continuous variable measured in hectares
Agronomic Practices	Relying on agronomic practices	A dummy variable that takes 1 for relying on Agronomic Practices 2 Otherwise
Access MetroInfo	Access to metrological information	A categorical variable that takes 1 for having access to metrological information and 2 Otherwise
SWCPractices	Soil and water conservation practices	A categorical variable that takes 1 for employing Soil and Water Conservation Practices; 2 Otherwise
ShiftLH	Shift in livelihoods	It is a categorical variable that takes 1 for shifting in livelihood; 2 otherwise.
LHChorDiver	Livelihood choices or livelihood combinations or diversifications	It is a categorical variable that takes: 1=On-farm; 2=Off-farm; 3=Non-farm; 4=On farm+ non-farm + Off farm incomes

Source: Based on Survey Result, 2018

Table 4.2 Difference of continuous explanatory variables between adopters' and non-adopters' respondents based on one way **ANOVA**

Continuous variables	**Adaptation options**							
	No adaptation	**Contract farming**	**Agronomic practices**	**Soil and water conservation**	**Shift in livelihood**	**Livelihood diversification**	**Average mean**	**Sig.**
Mean age of HHs	45.7	41.1	42.3	43.1	46.9	46.4	44.25	0.079
Mean of education of HHs	2.9	3.1	2.1	2.2	3.2	2.5	2.67	0.000
Mean of family size	6.5	7.1	6.7	6.2	6.3	6.6	6.57	0.016
Mean of Livestock in TLU	4.9	10.3	5.4	5.4	4.9	6.4	6.23	0.000
Mean of farmland size	1.4	2.2	1.6	2	1.4	1.8	1.73	0.000
Mean of net - income	9.8	9.9	8.5	9.8	10.1	10.2	9.72	0.000

Source: Computed survey result, 2018

Table 4.3 Difference of dummy explanatory variables between adopters' and non-adopter respondents

Dummy variables	**Adaptation options**								
	No adoption	**Contract farming**	**Agronomic practices**	**Soil and water conservation**	**Shift in livelihood**	**Livelihood diversification**	**%**	**Chi^2**	**Sig.**
PAs									
Germama	30	68	19	19	-	-	22.6	293.333	0.000
Kuriftu Hida	13	-	45	53	-	20	21.8		
Adulala Hake	18	8	65	9	1	-	16.8		
Gender of HHs									
Male	43	57	76	45	16	24	43.5	3.344	0.047
Female	18	17	34	17	4	15	17.8		
Access to credits									
Yes	53	61	110	62	14	35	55.8	39.944	0.000
No	8	15	-	-	6	4	5.5		
Access to Agricultural technologies									
Yes	37	67	109	59	4	21	49.5	116.061	0.000
No	24	9	1	3	16	18	7.1		
Access to extension services									
Yes	61	76	102	62	20	39	60	19.181	0.002
No	-	-	8	-	-	-	1.3		
Access to metrological information									
Yes	59	67	106	56	20	39	57.8	12.249	0.032
No	2	9	4	6	-	-	3.5		

Source: Computed from survey result, 2018

4.3.3 Factors affecting adoption of climate change adaptations strategies in the study locations

This section of the finding focuses on the multinomial logit model (MNLM) parameter estimates on adoption of different CCASs employed by respondent SHFs' in the study areas. One of the major purposes of MNLM was to estimate the coefficients and provide only the direction of effects of predictors. The estimates represent neither the actual magnitude of changes nor the probabilities (Tizale, 2007). In addition, the parameter estimates or the marginal effects measures the expected change in the probability of a particular choice made with respect to a unit change in independent variable (Greene, 2000).

In the MNLM analysis, the no adoption option was taken as a base category in the analysis. The multicollinearity test was conducted through variance inflation factor (VIF), which is the inverse of Tolerance (T). The VIF result revealed that, the VIF is less than the value of 10 that indicates all the explanatory variables have with less multicollinearity problems among the dummy variables. Based on these, both the continuous and dummy variables were included in the MNL model. However, before the estimation of MNL the Hausman test was conducted to check for the validity of independence of the irrelevant alternative (IIA) conditions. Thus, the result indicated that both the tests accepted the null hypothesis of independence of adoptions of CCASs, suggesting that the use of MNL parameter estimate is the appropriate statistical model for this study. Furthermore, the likelihood ratios revealed by the Chi^2 statistics are highly significant with $p<0.000$, suggesting that the model has a strong explanatory power in explaining the adoption options employed by SHFs' in the study locations.

The results of MNL model revealed that being member of peasant association, age of household heads (HHHs), gender of HHHs, education status of HHHs and family size significantly affected the adoption choices made. Moreover, livestock holding, size of farmland, access to agricultural technologies, access to credits, distance to markets and access to metrological information significantly affect the adoption of various CCASs in the study locations.

Member of peasant association

Peasant association (PA) or locations of the respondent households positively and negatively affect the adoption of CCASs. With respect to Malt Barley CF (i.e. Germama PA), the location of the PA significantly affects the agronomic practices (such as farmland preparation, keeping planting or sowing date, fertilizer applications, use of appropriate agro-chemical, early harvesting, late harvesting etc), SWC, shift in livelihoods and livelihood diversifications (i.e. farm, off-farm, non-farm activities) with 1% significance level. In the same token, this study revealed that the respondent's decision to adopt CCASs have a significant impact on sampled HHHs engaged in sugarcane outgrower schemes. Thus, they adopted CF and shift in livelihood (i.e. from agriculture to trade, daily laborers and the like) as CCASs. However, the sugarcane producing HHHs did not decide to adopt livelihood diversifications as a mechanism to adapt to climate change in the area because of the limited benefits obtained from sugarcane production schemes. This study is consistence with the studies by Lobell *et al.* (2008) and Asrat and Simane (2017a) where agronomic practice significantly affects CCASs employed to curb climate change problems on agriculture. Thus, this has negative impact on the respondents where livelihood diversification activities were not practical in the eyes of SHFs at Wonji Shewa sugarcane outgrower schemes.

The SHFs decision of sugarcane outgrower scheme to adopt CF was most probably due to better provision of agricultural inputs, presence of irrigation water, technical assistance and better supervisions in place. However, there were no similar studies conducted on the decisions of farmers to adopt CF as a CCASs and confirmed whether CF practices positively or negatively affect climate adaptations employed to curb climate changes. However, there are studies that revealed the farmers decision to adopt agronomic practices, SWC and livelihood diversifications as a CCASs that positively contributed towards adaptation to climate change (Amare and Simane, 2017; Deressa *et al.*, 2011).

Age of household heads

This study shows that age of HHHs negatively and significantly affected the adoption decisions of the respondent SHFs. Even though the probabilities to adopt various CCASs expected to increase as age increases, this study the adoption decision was less as the age of respondents'

increases. This was for the reason that any agronomic practices and SWC requires energy and labour of the adopter (i.e. labour intensive), which were the major challenges in the study locations. The discussions made with FGDs clearly revealed that as the age of the household heads increases, the chance of employing various CCASs decreases because of decrease in labour force, labour capacity, where the energy required engaging in any agricultural activities weakened to discharge the adaptation practices.

Gender of household heads

Gender is one of the determinant factors that negatively and significantly affected the adoption of climate change at 1% significance level. This means that the male-headed households adopted CF as CCASs compared to those female-headed households in the study areas. The discussions made with FGDs during fieldwork clearly indicated that female-headed households were limited in number and they were economically less empowered in the society; handle more household chores; less access to information; and less constrained with labour. The results of MNL model of adoption of climate change revealed that being male-headed households reduced the adoption of CF by 25.3%. Some empirical studies on CCASs such as Amare and Simane (2017), Asrat and Simane (2018), Asrat and Simane 2017b, Guteta and Abegaz, 2015b, Deressa *et al*., 2011 and Buyinza and Wambede, 2008) were consistent with this study and confirmed that gender of household heads negatively and significantly affect the adoption of CCASs.

Educational status of household heads

Education of household heads plays a positive and significant role in adopting CCASs employed by sampled HHHs in the study areas. This study shows that most of sampled HHHs adopted CF because of the provisions of agricultural inputs, technical assistance, extension workers assistance, agricultural experts support, and availability of water and irrigation water facilities in the case of sugarcane outgrower schemes. From this, it is possible to point out that as the level of education increases, the SHFs decision to adopt CCASs increases. These was due to the SHFs better know how, experiences and access to various information related to market, use of different agricultural technologies (improved varieties of seeds), agricultural practices and use of extension service packages increases. However, level of education of households positively and significantly affected the adoption of CF, agronomic practices, SWC and livelihood

diversification or combinations as CCASs. This study is congruent with the study conducted by (Asrat and Simane, 2018; Amare and Simane, 2017; Deressa *et al.,* 2009; Asrat *et al.,* 2004), where education of household heads positively affect the adoption of agronomic practices, SWC and livelihood diversification as CCASs. This was due to that fact that the higher the level of education of the HHHs, the better the knowledge and capacity to understand and apply agronomic practices, SWC and the more they diversify their livelihood.

Family size

Family size is one aspect of the adoption process in this study. This study revealed that family size positively and significantly affected adoption of CF and SWC as CCASs at 1% and 5%, respectively. This is because, CF and SWC practices are labour intensive and require the participation of those abled and working population who are the member of households. The empirical studies by Deressa *et al.* (2010) confirmed that the households with large family size have better labour endowments and thus have better opportunities in adapting the changing climate. According to Kassie *et al.* (2009), large family size attributed to labour endowments that help to engage family labour in labour intensive activities CCASs such as CF, agronomic practices and SWC practices. Thus, all the studies mentioned here are consistent with our study.

Livestock owning situation

Livestock as measured in Total Livestock Unit (TLU) positively and significantly affect the adoption of CCASs at 1% significant level. Owning livestock increased the probability of adoption CF as CCASs by 25.4%. This revealed that apart income from CF, the income obtained from selling livestock and livestock products immensely support the SHFs to adapt to the changing climate in the area. Empirical studies by Asrat and Simane (2018) and Simane (2016) is in agreement with this study finding and revealed that the household heads with larger number of livestock increases the probability of adoption of CCASs.

Size of farmland

This is the size of cultivated land or farmland covered with crops in the study areas. This study revealed that size of farmland positively and significantly related to adoption of CCASs. Sizes of farmland are positively and significantly affect adoption of CCASs through CF and livelihood

diversification. The probable reason for size of farmland that affects CF as CCAS was the having larger farmland size helps to produce many hectares of agricultural production especially in the case of Malt Barley production at Kofele district. This further increase the income earned from CF schemes and could help to adapt to climate change relate problems. In the same token, as indicated in the study result size of farmland improves and helps to diversify livelihood bases and adapt to climate change in the area. On the other hand, SHFs with larger farmland size mostly invest their time on agricultural land not on SWC. This is negatively affected the adoption of SWC as CCAS by 92.8%. Incongruent to this study, Deressa *et al.* (2010) emphasized that the size of farmland negatively attributed to climate change adaptations where the focus was not on the size of farmland, but the fertility aspect (i.e. fertility of the farmland) that determine the adoption of CCASs.

Access to agricultural technologies

Access to agricultural technologies is positively and significantly associated with CF, agronomic practices shift in livelihoods and livelihood diversification as adoption of CCASs. On the other hand, access to agricultural technologies is inversely related to SWC. In the case of Malt Barley such as access to Threshers or Combine Harvesters, improved variety of Malt Barley (i.e. Traveller) engaged in producing high quality Malt Barley increased the income of SHFs by more than 50%, which in turn improved the CF and agronomic practices as adoptions of CCASs. In addition, access to agricultural technologies saves time and enhances agricultural production and productivity. From this, it is possible to conclude that those HHHs with better access to agricultural technologies could better adopt CF, agronomic practices, shift in livelihood, diversify their livelihood and better adapted to climate change. Thus, this study is compatible with previous empirical studies such as (Asrat and Simane, 2017b; Simane *et al.*, 2016; Asrat *et al.*, 2004). The study confirmed that access to agricultural technologies could better help SHFs to adapt to climate change, climate variabilities and increases the sustainability of the adaptation strategies employed by SHFs. Regarding access to technologies; one of the case informant in Kofele district Germama PA stated that:

> *More recently, the use of Threshers that manually operated helped us a lot in harvesting our Malt Barley on time as compared to the year before we entered to CF*

scheme or arrangement. We collected our production very easily and provide it for Assella Malt Factory (Case informant: 46 Years old, MHHH, Germama PA).

Form the explanations of this informant, one can understand that having access to modern agricultural technologies its use immensely facilitated SHFs agricultural activities. Moreover, it helps better to adapt to the changing climate and climate variabilities in the areas. The case informants in Wonji Shewa Sugarcane outgrower schemes tried to compare the access to agricultural technologies before they entered to outgrower scheme and during also indicated that:

Our access and use of agricultural technologies is far better now than before. We are now planting Sugarcane in rows. We are transporting our agricultural produce to the factory through vehicles. Before this, we took load it on pack animals like Mule and Donkey (Case informants: 56 and 60Years old FHHHs, from Kuriftu Hida and Adulala Hake Haroreti PAs).

Table 4.4 Estimates of parameters of multinomial logit model of adoption of climate change adaptation strategies

Explanatory variables	Contract farming		Agronomic practices		Soil and water conservation		Shift in livelihood		Livelihood combinations	
	Coefficients	*P* level	Coefficients	*P* level	Coefficients	*P* level	Coefficients	*P* level	Coefficients	*P* level
Peasant Associations										
2	0.0129955	0.517	**1.183671*** **	0.033	2.939551***	0.000	0.357544***	0.016	0.1750311***	0.003
3	0.7546546**	0.068	21.34745	0.933	18.66115	0.990	1.047849***	0.000	-5.966589***	0.000
Age of HHs	-0.0198401	0.298	-.031494***	0.042	-0.0297911**	0.079	0.0151361	0.517	-0.0000768	0.997
Gender of HHs	-0.2538523***	0.028	-0.0216117	0.961	0.0858937	0.861	-0.4658927	0.489	0.5004286	0.299
Education of HHs	1.317647***	0.000	0.6993155***	0.001	0.496814**	0.065	0.4231221	0.286	0.1850158***	0.001
Family size of HHs	0.3561363***	0.013	0.0611546	0.601	0.1166779**	0.078	-0.1713208	0.421	0.1187263	0.406
Livestock in TLU	0.2549433***	0.000	0.0009287	0.981	-0.0189754	0.663	0.0086845	0.879	0.0551417	0.226
Size of farmland	2.016815***	0.000	-0.01825	0.957	-0.9286473***	0.012	0.0425807	0.941	0.9664089***	0.012
Access to agricultural technologies	1.629544***	0.008	3.792444***	0.000	-1.725638***	0.012	1.610364***	0.014	0.8237067**	0.091
Access to credits	0.781943	0.262	-15.77094**	0.087	-15.88145**	0.091	0.7792333**	0.052	0.1067912	0.883
Distance to market	-0.1207115	0.495	0.2121142	0.131	-0.1943557	0.246	-.1799953***	0.007	-0.3122482	0.101
Access to metrological information	-1.344071	0.263	0.0178087**	0.086	1.192355	0.247	-14.24949	0.994	-14.73547	0.993
_cons	-7.638643***	0.002	22.61266**	0.082	19.11217***	0.009	9.888764	0.996	11.25555***	0.000

Number of obs. = 368

LR χ^2 (60) = 451.57

Prob > χ2 = 0.0000

Log likelihood = -389.39436

Pseudo R^2 = 0.3670

Base category: No adoption of any strategy

*****, **,* Significant at 1%, 5% and 10% probability level, respectively.** **Source: Authors estimation, 2018**

Table 4.5 Marginal effects computed from multinomial logit model of adoption of climate change adaptation strategies

Adoption Options	**Contract farming**		**Agronomic practices**		**Soil and water conservation**		**Shift in livelihood**		**Livelihood combinations**	
	Coefficients	***P* level**	**Coefficients**	***P* level**	**Coefficients**	***P* level**	**Coefficients**	***P* level**	**Coefficients**	***P* level**
Peasant Associations										
2	0.2339866 ***	0.000	0.0219705**	0.050	.0408789***	0.004	0.0294766***	0.000	0.0770816***	0.003
3	-0.0991232 ***	0.000	-0.0166766	0.103	-0.0067291***	0.005	-0.1230147***	0.001	-0.4242189***	0.065
Age of HHs	0.0018631***	0.015	-0.0006367	0.561	-0.0023742	0.151	-0.0012374	0.410	0.0008333	0.345
Gender of HHs	-0.0131142	0.670	-0.0095046	0.843	-0.0198876	0.647	-0.0272532	0.296	0.0717557**	0.033
Education of HHs	0.0970296 ***	0.000	0.0991232 ***	0.000	-0.0159345	0.471	0.0197157	0.183	-0.0209477	0.279
Family size of HHs	0.0202086***	0.010	0.0064406	0.586	-0.0219705**	0.050	-0.0095419	0.235	0.0098154	0.319
Livestock in TLU	0.0149579***	0.000	-0.0047581	0.241	-0.0067291***	0.074	-0.0012334	0.540	0.0022964	0.467
Size of farmland	0.1089628***	0.000	0.1230147***	0.000	0.0691458***	0.022	-0.0196029	0.342	0.0313224	0.237
Access to agricultural technologies	-0.0581702	0.109	0.4242189***	0.003	0.0305625	0.735	0.0719962***	0.001	0.2339866 ***	0.000
Access to credits	0.4847181***	0.006	-1.204738	0.991	-0.8406071	0.994	0.1231191	0.971	0.5739343	0.979
Distance to the market	-0.0166766	0.103	0.0439761***	0.001	-0.0081059	0.545	-0.002526	0.807	-0.0204021	0.121
Access to metrological information	-0.128173***	0.000	0.0333671	0.155	0.0408789***	0.037	-0.0358224	0.224	0.0770816 ***	0.000

*****, **,* Significant at 1%, 5% and 10% probability level, respectively.**

(Source: Authors computation, 2018)

Access to credits

Regardless of the expectations of SHFs', households with better access to credits affected negatively and significantly by the decisions to adopt CCASs such as agronomic practices and shift in livelihood as CCASs. Even though access to credits did not have any significant effect on CF, livelihood diversification has negatively associated with agronomic practice and shift in livelihood as an adoption of CCASs in the study areas. This clearly revealed that the sampled households were access to credits not due to adaptation to climate change, rather because of introduction of CF and previous extension services in place. To this end, this empirical study was consistent with the study done by Tessema *et al.* (2013), where access to credits affected SHFs' engaged in CF before adopting climate change adaptation in their locality because of their prior investment. Thus, the policy implications should promote access to credits as one of the important ingredients of CCASs and if available. It could facilitate CCASs through filling the financial gap created because of financial problems in the study locations.

Distance to Market

Empirical evidences such as Tessema *et al.* (2013); Amare and Simane (2017) clearly portrayed that distance to market increases the chance of adaptation as it may create opportunities to get access to new technologies and other agricultural inputs. However, distance to market was negatively related to shift in livelihood in the study areas. This may imply that the sampled households are expected to travel longer distance to get the market. This reduces the time to spent on farmland or other agriculture related activities in the study areas. However, it probably creates an opportunity for SHFs' to share and gain experiences from other farmers related to agricultural technology, agronomic practices and improve ways of agricultural production techniques.

Access to metrological information

Access to metrological information such as access to rainfall, temperature, humidity, flood and drought is positively and significantly associated with adoption of agronomic practices as CCASs. Having access to metrological information related with CF and agronomic practices that could help in pre-harvest and post-harvest crop management, where SHFs' respond to any change in the metrological discrepancies or challenges such as heavy rainfall, drought, flood and pest infestation. Consequently, the policy implications here is that there should be institution that continuously make available metrological information through various meanses

including media out let (radio, television, cell phones), where SHFs' can easily access time specific metrological information.

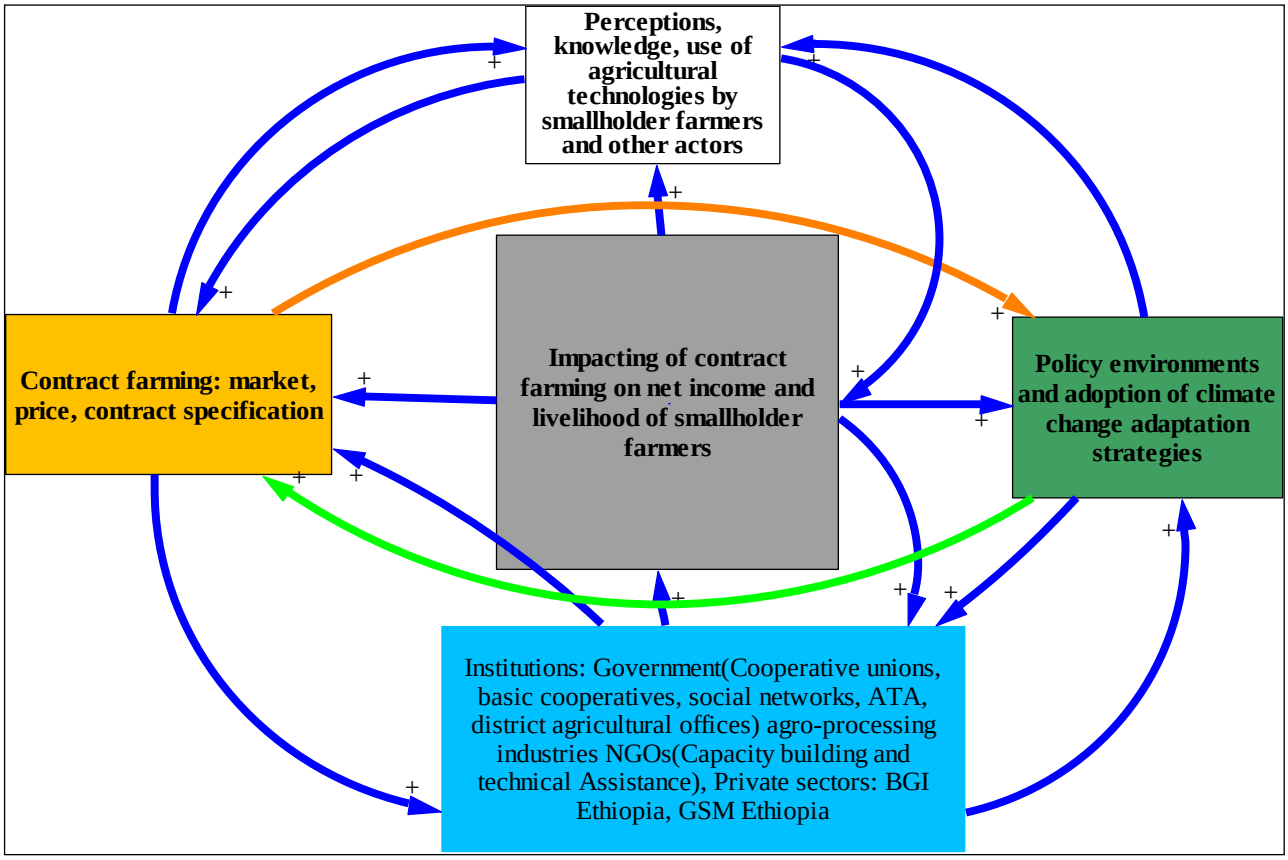


Figure 4.5 A diagrams of contract farming, agronomic practice, agricultural technologies and climate change adaptation nexus

Source: Authors construction, 2018

The current agricultural commercialization is the result of the interplay between perceptions of SHFs' and private sectors, NGOs, contract farming situations, institutions and climate change adaptations employed in the in the changing climatic condition, which ultimately are governed through the use of CF: agronomic practices and agricultural technologies in the whole agricultural production. The arrows with orange color and green arrow shows that CF has a direct link with CCASs, where agricultural input such as fertilizers, agro-chemicals, improved seeds, extension service packages including technical advice and supports from development agents and agricultural experts affected the success of CF and climate change adaptations SHFs

employed in the study areas. These have a strong bearing on the nexus between the factors, which facilitates agronomic practice and technology transfer.

Moreover, the plus signs (+) at the head of the blue arrow revealed that the relationships among the factors in figure 4.2 are very strong and positive in affecting one another. For example as indicated above, the presence of strong, committed and informed institutions work towards successful CF practices (i.e. in search of markets and fair contract design) that could serve as an input in adoption of CCASs, a mechanism to ease agronomic practices and transfer of agricultural technologies.

4.4 Conclusions and policy recommendations

CF as responses to CCASs is paying more attention to environmental sustainability (FAO, 2018). Hence, understanding adoption of CCASs requires understanding the livelihood contexts of SHFs and the overall socioeconomic, institutional and environmental conditions. The CCASs SHFs' employed to address climate change in the study areas are not *a one shoe for all approach*. It tried to employ a locations specific CCASs that have the capacity to curb climate change and climate variabilities in the study locations. The study revealed that the local climate is changing and manifesting itself in rainfall and temperature irregularities, recurrent drought and flash floods. These are affecting the livelihood of sampled SHFs' engaged in Malt Barley and Sugarcane CF. Consequently, all these changes and variabilities in climate stimuli necessitated respondent SHFs to adopt various CCASs such as CF, agronomic practices, SWC, shift in livelihood and livelihood diversifications in their locality. From the adoption choice made, adoption of agronomic practices, contract farming, SWC and livelihood diversification are the most and widely employed CCASs in the study areas.

Therefore, in line with the findings, it is very crucial to inculcate the following into policy recommendations.

- It is paramount important for policy makers to find a way and promote young farmers to employ CCASs so as to reduce the adoption gaps created as a result of age difference in adoption of CCASs focusing on those energetic, abled youth farmers to employ various climate change adaptation strategies.

- Broadening the income base of SHFs help to build the adaptive capacities of farmers and immensely facilitates adoptions of various climate change strategies in the study locations;

- In order to help those non-adopters because of not accessing resources, there is a need to design and redesign adaptation mechanisms to curb climate change and climate variabilities and creates access to financial resources;

- The policy makers should work on strengthening provisions of extension service packages, good CF management, proper implementation of agronomic practices that have the capacity to engaged SHFs' in CCASs and promote the use of various agricultural inputs that have the capacity to enhance their production and productivity;

- The policy makers should promote a fair and well-designed CF as an instrumental business model and as one of the important ingredients of CCASs; Creating access to metrological information through various means including media out let (radio, television, cell phones) that could have the capacity to improve SHFs' planning, crop management and paves the way for better climate change adaptations, where SHFs' can easily access time specific metrological information); and

- Above all, understanding adoption option in CCASs' in the light of agricultural commercialization is paramount important. Moreover, creating link between adoption of CCASs, commercial agriculture, agronomic practices that serve as a decisions making tool or ground for policy makers and agricultural experts working in the field of agriculture, climate change and livelihood improvements.

Chapter 5 _____

5. Contract farming and smallholder farmers in Ethiopia: empirical evidences on challenges and opportunities in Malt Barley and Sugarcane contract farming

Abstract

The major purpose of this study is to identify and analyze the CF and smallholder farmers in Ethiopia: empirical evidences on challenges and opportunities of Malt Barley and Sugarcane CF in Kofele and Adama Districts of Oromia Regional State, respectively. Multi-stage sampling techniques were used to select the region, Zone, District, PAs and the study households through purposive and proportionate sampling techniques. This study was conducted based on household level primary data collected data from 368 respondents. It employed Principal Component Analysis in identifying and analyzing the major challenging factors and opportunities of CF in the study areas using SHFs' household heads as a unit of analysis. The results revealed that among all the variables in the five dimensions, lack of storage facilities for agricultural produce, poor market linkages, shortage of trainings and other technical assistance, delay in financial services, poor pricing strategies and delay in payments had registered the factor loadings of 0.97, 0.92, 0.83, 0.82 and 0.72, respectively. Thus, the total extracted factor explained approximately 61.4% of the total variance in 14 observed constructs considered in the PCA. Consequently, the findings implied that addressing the major factors challenging CF in the study areas are very essential to design policy, legal frameworks and guidelines that would have the capacity to improve the major challenging factors affecting CF in the study areas.

Keywords: Contract farming, Dimensions, Major challenges, Opportunities, Principal Component Analysis, Small scale farming

This paper is under review as:

Megersa, G. & Assefa, E. (2020). "Contract farming in enhancing livelihood of smallholder farmers' in Ethiopia: an empirical evidences on challenges and opportunities from Malt Barley and Sugarcane contract farming practices.", *Journal of Sustainable Development in Africa*: *http://www.jsd-africa.com/: Under review*

5.1 Introduction: Background of the study

Contract farming as a business and commercialization arrangement plays an essential role in improving agricultural production, income and livelihood of SHFs'. According to Nijhoff and Trienekesen (2012) in developing countries like Ethiopia, well-designed and managed CF could benefit the country at large and SHFs' by creating international markets for agricultural produces and the resultant products. It may also help to secure access to agricultural inputs, serve as a knowledge transfer mechanisms and a mechanism for agro-business firms to access agricultural lands on the SHFs' own farmland. According to MoFED (2007), the Ethiopian government expressed its deepest concern and took CF as a key in improving export values. SHFs' Adoption of CF as a strategy is another greater opportunity for SHFs' to access both domestic and international markets through network formation with private and NGOs and public private partnership (Ayelech, 2010 and 2012).

Even though CF may be viewed as a mechanism to increase agricultural production, income and livelihood of SHFs, there are limited successes because of the challenges that hinder the SHFs' and the agro-business firms to obtain the maximum benefits out of such business arrangements (Singh, 2002; Da Silva, 2005; Nijhoff and Trienekesen, 2012; Prowse, 2012). Accordingly, the various challenges of CF in Ethiopia require hard evidences that aimed to expose the challenges and address them. Thus, it is paramount important to see the historical development of CF in Ethiopia. Gebreselassie (2006) underscored that there are little experiences and benchmarks in CF implementation in Ethiopia that clearly indicate the way forward in CF business arrangements to guide the whole processes.

In Ethiopian, the history of CF dated back to the establishment of Ethiopian Seed Enterprise (ESE) in 1980s that were primarily engaged in production of Teff and Wheat. As indicated in ESE Report (2006-2010) and USAID (2012), ESE has its own farm. It entered in to large-scale commercial farming with SHFs' for more than three decades. According to Yonas *et al.* (2008), the use of contract seed production during the planned economic system by Derg Government. The contract was with seed-producing scheme with farmers' group approach (i.e. producers' cooperatives). The contract agreement was between cooperatives and the ESE, where quality of the seed produced was the key aspect in the agreement. USAID (2012) documented that the cooperatives were fully responsible for honoring the contractual agreement for seed production by its members. However, this was failed because of the downfall of Derge regime in 1991 G.C.

After 1997, CF arrangements with SHFs' were mainly related with the implementation of five-year Seed Systems Development Project in Ethiopia, focusing on Farmer Based Seed Production and Marketing Scheme (FBSPS) financially supported by IDA, IFAD and the Government of Ethiopia during 1997-2001 (USAID, 2012). The major aim of the project was to engage SHFs' and support them in sustainable seed production and income generation by providing farmers with the necessary materials and inputs required including credits, training of farmers, extension workers and small-scale seed cleaning facilities implemented as a pilot project by the previous Ethiopian Seed Industry Agency.

The CF arrangement in West Arsi, Kofele District of Oromia Regional State started its operation in 2014 G.C on Malt Barley CF arrangement. On the other hand, CF arrangement at Eastern Shewa, Adama District started its Sugarcane CF or outgrower scheme at Kuriftu Hida and Adulala Hake Haroreti villages in 1975 G.C and 2008 G.C. As emphasized in USAID (2012) and Yonas *et al.* (2008), most of the contractual schemes like in ESE was sustainable and ended up with certification of seed production. The arrangement it-self involves the formal agreement (i.e. written contract agreement) between the ESE and the individual farmers stipulating the obligations of all parties. The contractual agreement stipulated was so strong and geared towards provision of technical support, basic seed or certified seed multiplication and raw seed packaging materials. More importantly, the technical support includes supervision, training on crop management and quality control, flexible pricing strategy with 15% premium price as incentive as well as field inspection and laboratory tests (USAID, 2012).

Another study by Nijhoff (2010) clearly put CF schemes in the inventory of the investigation. Most of the CF schemes including this study (i.e. Malt Barley and Sugarcane CF) were at their infant stages. However based on the inventory, Nijhoff (2010) made on CF in Ethiopia, the CF schemes such as EHPEA Vegetable Company, Beza Mar Agro-Industry PLC, Solagrow Seed Potato Company, AfricaJuice, Passion Fruit Juice, Tradin (Selet), Organic Sesame, Tiret Barley, EthioFlora, Horticulture and Asella Malt Factory were some of the successful agribusinesses arrangements in Ethiopia. Despite their maturity, these agri-business firms were building a strong base for the successful functioning of the firms. They were executing their tasks as per the contractual agreement they made with the SHFs'. However, transparencies and accountability situations of these companies still require further investigation, strong government and other development partners' commitment and follow-ups. There were also agri-

business firms that failed in their contractual schemes. First, Soreti International Trading Company, Oil Seed and Pulses producing company engaged in the production of Oil Seeds and Pulses Trading failed in their to continue their arrangement. Second, Acos Trading Company, Pulse, was a joint venture between Ethiopia and the Italian investors. Their main objective was to penetrate the EU markets with high quality produce of haricot beans, chickpeas, lentils and other pulses. Both these companies failed to function because of poor management schemes. However, because of presence of side selling and information gaps created between the agri-business firms and the farmers, both the schemes were not successful (Nijhoff and Trienenksen 2012).

The history of CF in Ethiopia clearly revealed that there were limited investigations conducted on the situation, status and future prospects of CF in Ethiopia in general and study areas in particular. These areas in any CF arrangement need strong and basic interventions for the mutual interest or benefits of the firms and the SHFs'. These indicates that there are research gaps especially with regard to what sort of challenging factors hinders the successes of CF and its opportunities in the context of current study. The study by Nijhoff and Trenenkesen (2012) tried to identify the pitfalls of CF in Ethiopia through simple exploratory method and failed to identify the major CF challenges and opportunities. Thus, the major aim of this study is to identify and analyze the opportunities and major challenging factors that are affecting the successes of Malt Barley and Sugarcane CF arrangement in the study areas. To do this, Principal Component Analysis (PCA) as a multivariate tool was employed to investigate the problem under study.

5.2 Research methodology: Methods of data analysis and interpretations

The field survey data collected on the major challenges and opportunities of CF was organized and analyzed through SPSS version 20 softwares and Stata 14 version software. Before conducting PCA, the data was tested for suitability or measure of sampling adequacy using Kaiser-Mayer-Olkin (KMO) and Bartlett Test of Sphericity (BTS). Finally, the extracted components were rotated using orthogonal varimax method to achieve significant components. According to Kalantari (2008), if the KMO value is greater than 0.5 and the BTS value is less than 0.05, the data is situable for PCA. In this study, the KMO coefficient revealed the sampling adequacy of 0.7173, which is greater than 0.50. The BTS is significant at 95% ($p<0.000$) as indicated in the following table 5.1. Finally, the quantitative data collected through

household survey was analyzed via PCA. The author substantiated the results with the qualitative data collected through FGDs and KIIs on challenges and opportunities of Malt Barley and Sugarcane CF to confirm the consistencies of the results in the study.

5.3 Results and Discussions

5.3.1 Analysis of challenging factors in Contract farming (PCA)

As explained in the methodology part, one of the major aims of PCA is to explain the major challenging affecting CF in the study areas. This application enables for the summarization of the total variance to few uncorrelated variables by visualizing them into multi-dimensional space (Champika *et al.*, 2014). As clearly indicated in table 5.1 below, the Bartlett Test of Sphericity (BST) was carried out by comparing the correlation matrix with the matrix of Zero correlation, which is termed technically as the identity matrix Williams *et al.* (2012). The PCA tries to bring or bundle up the variables together based on their correlation. As Robin (2012) suggested by looking into the correlation matrices with values more than 0.3 and less than 0.8, ultimately it is possible to conduct a meaningful factor analysis in identifying and examining the major challenges of CF in the study areas.

Table 6.1 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.7173**
Bartlett's Test of Sphericity	Approximate Chi-Square	1079.37
	df	35
	Sig.	0.000

Source: Own calculation, 2019

In the analysis of the major challenges of CF in the study areas, the varimax rotation techniques were relied on to identify and examine the major challenges in CF in the study locations. There were about 14 (Fourteen) variables included in the analysis of this study using PCA. According to table 5.2, the result revealed that the factor loadings in the analysis come up with five dimensions extracted and considered in the interpretations of the result. The variances as expressed in percentage of the variation decreased as one goes from the first dimension to the last dimension, which varied from 26 to 7.2 factor loadings.

From the 14 variables, in the first dimension three (3) variables namely transportation problems, poor market linkages and lack of storage of agricultural produce revealed 0.83, 0.92 and 0.97,

respectively. This means that the transportation problem, poor market linkages and lack of storage of agricultural produce explained approximately about 83%, 92% and 97% in ascending order. Moreover, in the second dimension shortage of trainings and other technical assistance (0.82) and delay in providing financial services registered higher factor loadings. Regarding the third dimension and fourth dimension, contract breaching revealed the variation by 68% and problems of risk sharing exhibited a high factor loading of 0.65, which was about 65%. In the last dimension, substandard agricultural produce, poor pricing strategies and delay in payments portrayed higher factor loadings or explained the challenges by 60% and 71%, respectively. However, not all the variables in all the dimensions were associated with one another in the PCA because of the results are independent of each other. This means that each of the factors independently affected the overall successes of CF in the study areas.

Table 5.2 Major challenges in contract farming

S.N	Codes	Major challenging factors	Dimensions				
			I	II	III	IV	V
1	SStAP	Substandard agricultural produce (grain and ratoon quality)	0.11	0.20	0.18	-0.51	0.60
2	LT	Lack of transparencies (Agro-firms, Coops and smallholder farmers	0.00	0.15	0.14	0.09	-0.05
3	PKCT	Problems of keeping contract terms or contract breaching	0.14	-0.18	0.68	0.31	-0.01
4	STOTA	Shortage of trainings and other technical assistance	-0.14	0.82	0.22	0.05	-0.04
5	DAI	Delay in Agricultural inputs	-0.11	0.28	-0.72	-0.14	0.00
6	DAProd	Delay in supply of agricultural produces	0.25	0.26	-0.13	0.29	-0.20
7	DPFS	Delay in providing financial services	0.26	0.72	0.11	0.01	0.03
8	TP	Transportation problems	0.83	0.17	0.10	0.09	-0.02
9	PPS & DP	Poor pricing strategies and delay in payments	-0.02	-0.13	-0.12	0.41	0.71
10	PRS	Problems of risk sharing	0.27	0.06	-0.27	0.65	0.00
11	LPLFW	Lack of policy strategies and legal frameworks that guides CF	0.02	-0.13	0.04	-0.25	-0.33
12	PML	Poor market linkages	0.92	-0.18	-0.13	-0.05	-0.03
13	FLUfCF	Forceful land utilization (Sugarcane CF)	-0.97	0.10	0.05	0.14	-0.02
14	LStAP	Lack of Storage facilities for agricultural produce	0.97	-0.10	-0.05	-0.14	0.02
		Eigen values	**3.67**	**1.55**	**1.22**	**1.17**	**1.01**
		Variations (%)	**26**	**11.1**	**8.7**	**8.4**	**7.2**
		Cumulative variation (%)	**26**	**37.1**	**45.8**	**54.2**	**61.4**

Source: Computed from survey data, 2019

Extraction Methods: Principal Component Analysis, Methods Varimax with Kaiser Normalization

5.3.2 Analysis of dimensions through principal component analysis (PCA)

i. First dimension

The factor loadings in the first dimension varied from 0.83 to 0.97. From all the 14 variables, three variables: transportation problems (0.83), poor market linkages (0.92) and lack of storage facilities for agricultural produce (0.97) showed high factor loadings in the PCA. This dimension explained the variation by 26%. Among the three factor loadings, lack of storage facilities for agricultural produce revealed 0.97 in the first dimension.

ii. Second dimension

Shortage of trainings and other technical assistance and delay in providing financial services explained the variation and revealed factor loadings of 0.82 and 0.72, respectively. In this second dimension, the variables: shortage of trainings and other technical assistance registered the highest factor loading with 0.82, which shows the variation by 82%. This dimension explained the variation by 11.1% of the total factor loadings.

iii. Third dimension

This dimension explained the variation by 8.7%. In this dimension, only one variable that was identified as one of the challenging factors in CF in the study locations: problems of keeping contract terms or contract breaching revealed a factor loading of 0.68.

iv. Fourth dimension

Similar to the third dimension, only one variable (i.e. problems of risk sharing) had a factor loading of 0.65. This dimension explained the variation by 8.4%.

v. Fifth dimension

This the last dimension that explained the variation by 7.2%. It constituted substandard agricultural produces and poor pricing strategies (i.e. agricultural produces below the expected or set standards), delay in payments, having factor loadings of 0.60 and 0.71, respectively.

This study identified and analyzed the major challenges of CF in the study areas. In contrast to this study, the study by Nighoff and Trienkseken (2012) employed simple exploratory method and only listed the challenges in CF arrangement in Ethiopia. They did not put the factors in the order of their challenges and failed to analyze and put the major factors in ascending or

descending order of challenge (i.e. it failed to answer: which major challenges affect CF arrangement more than others do). As one can understand from the dimensions, the values of the variances decreases as one goes from the first dimension through five. Thus, this study paves a way and put the challenges from high to low, which is expressed in percentages (i.e. 26% - 7.2%). Consequently, these results may serve as a corner stone for policy makers and those engaged in CF researches to design the strategies and conduct researches to address CF challenges that have the capacity to guide policy makers to act up on the major challenges by looking into the each of the components.

Apart from the results revealed in table 5.2, the discussions made with FGDs and the KIIs clearly explained the various challenges that are affecting Malt Barley and Sugarcane CF arrangements. Lack of transparencies in the over all process of CF arrangements, low level of income generated from the scheme, very low price (i.e. 1000-1115 ETB per Quintal for Malt Barley and only 60 ETB per Quintal for Sugarcane) were among the challenging factors in CF practices in the study locations. Moreover, delay in payments, land grabbing, which means, as the income obtained from the agricultural produce become less and less, one can say that the agro-processing firms have got a ground to exploit the farmers and their families labour that ultimately result in power imbalances. The agri-processing firms might use o follow a delay mechanism in input provisions and side selling in part of SHFs were among the challenges of CF in the study areas. The FGDs and the KIIs further underscored that once the farmland is included in the Factory as outgrower scheme (i.e. delineated in Factory's Sugarcane plantation). There are no exit strategy put in place or designed in the contractual agreement and if the SSFs are to do so, the SHFs are obliged to leave their farmland (i.e. "land grabbing")

In general, among all the variables in the five dimensions, lack of storage facilities for agricultural produce, poor market linkages, shortage of trainings and other technical assistance, delay in financial services, poor pricing strategies and delay in payments had registered the factor loadings of 0.97, 0.92, 0.83, 0.82 and 0.72, respectively. The influence of the variables or constructs on the dimensions did not show associations because of their independent major challenges on CF in the study areas. In each dimension, the eigenvalues explained depicted the amounts of variance out of the total variance, explained each of the factors. Thus, five factors were retained after running the default cut-off points, which is greater or equal to 1 in the extraction of eigenvalues. Thus, the total extracted factor explained approximately 61.4% of the

total variance in 14 observed constructs considered in the PCA of major challenging factors affecting CF in the study areas.

5.3.3. The Scree plot analysis

Relying on the scree plot is a mechanism to identify comparatively high loading values (more than 0.50) for the constructs: substandard agricultural produce (SStAP), problems of keeping contract terms or contract breaching (PKCT), shortage of trainings and other technical assistance (STOTA). Moreover, delay in financial services (DPFS), transportation problems (TP), poor pricing strategies and delay in payments (PPS&DP) problems of risk sharing (PRS), poor market linkages (PML) and shortage of agricultural produce (StAP) revealed high factor loading above 0.50. Based on this, there are about five comparatively high eigenvalues with values greater than or equal to 1, which are indicated in the scree plots of eigenvalues after conducting principal component analysis.

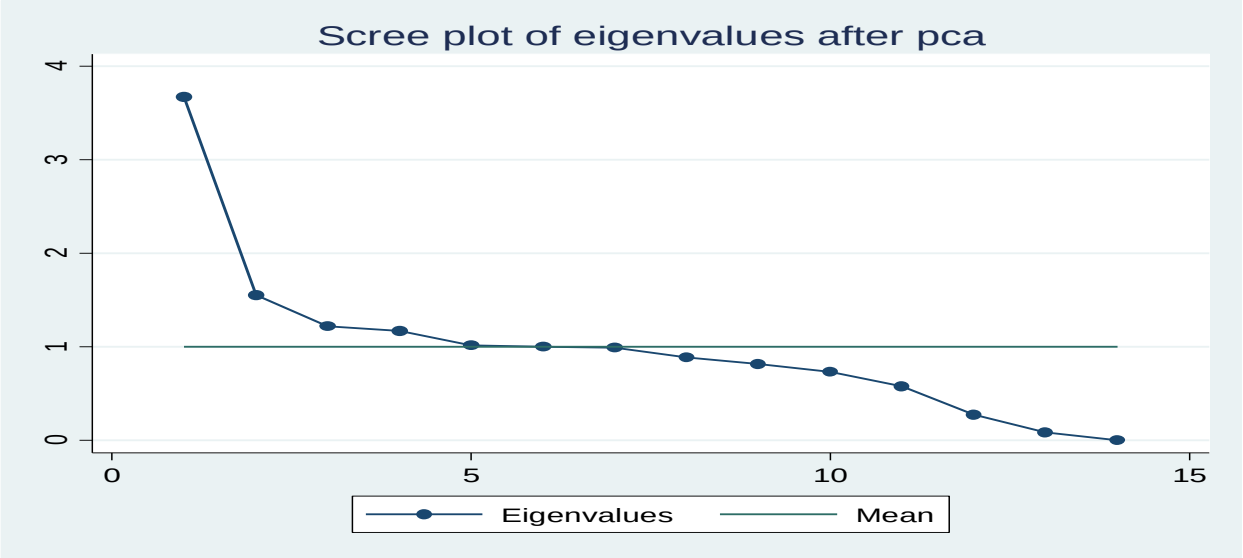


Figure 5.1 Scree plot of eigenvalues after principal component analysis

Source: Authors, 2018

As indicated in figure 5.1, it is depicted that the eigenvalues greater than or equal to 1 are clearly seen in the scree plot of this figure and one can easily look into the figure and retain the components in the analysis. Moreover, the boundaries between the upper and lower eigenvalues were clearly observed between component 5 and component 6. According to Cattell (1966), this helps to decide on the number of components included in the analysis of PCA.

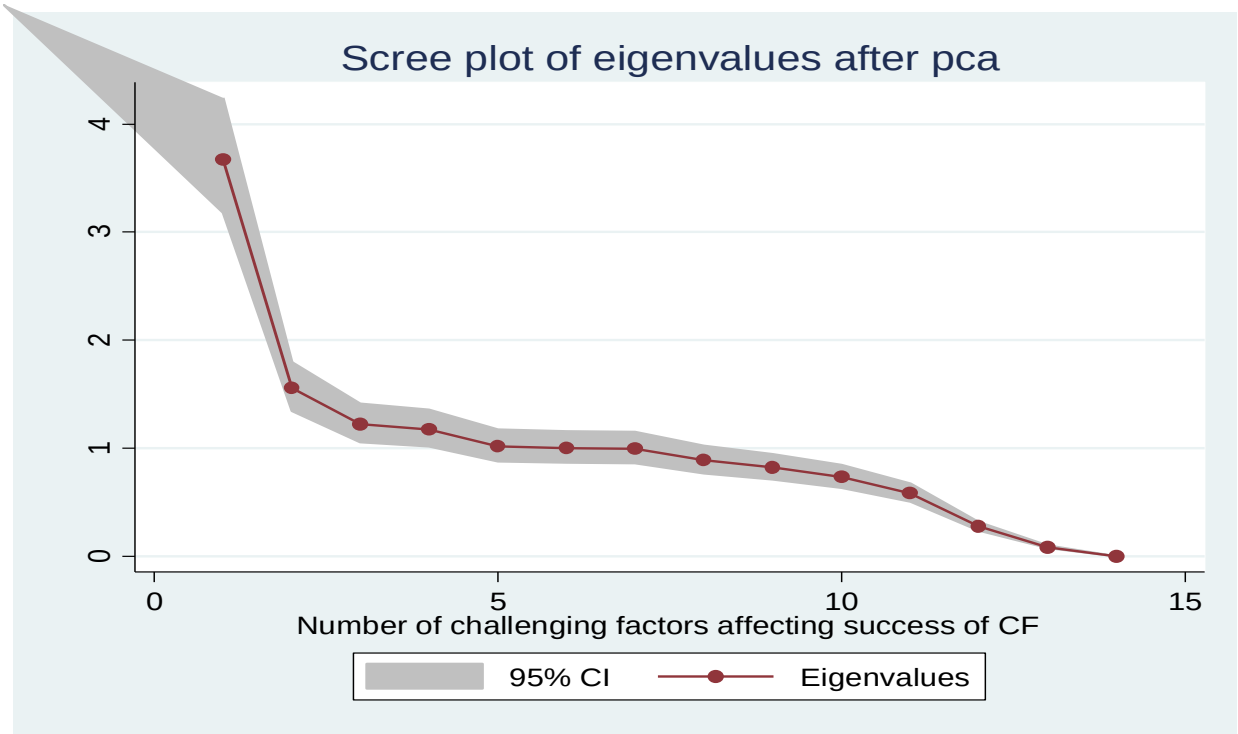


Figure 5.2 Scree plot of eigenvalues of pca with confidence interval

Source: Authors construction, 2019

According to figure 5.2, the results in the scree plot of eigenvalues after PCA revealed the components with eigenvalues greater or equal to 1 (StataCorp, 2015) guiding the overall selection. Thus, about five (5) components had a chance to be included in the analysis of the major components under consideration.

5.4 Qualitative analysis of challenges and opportunities of contract farming

5.4.1 Challenges of Malt Barley contract farming

This part of the analysis focused on the qualitative data collected through FGDs, KIIs, field observations and case histories. The agricultural experts and extension workers pinpointed the major challenges in the study areas. They continued explaining that not all the SHFs engaged in CF used the full-packages of agricultural production. Their farmlands were small in size (0.25-2 hectares). As discussed during FGDs and KIIs, the major reasons for the challenges to persist emanates from lack of awareness in the side of SHFs' and lack of finance as underscored during FGDs and KIIs. Moreover, the greatest problems were lack of improved and selected seed varieties, the provision of the selected seeds, other technologies, and the provided amount

mismatches the time that the SHFs' need them, increase in the price of agricultural inputs (For example: - a price of 100 Kg of Fertilizer is about 1800 ETB, which is costly). Thus, the SHFs' were compelled to plough small parcel of land. Furthermore, delay in input provision and collection of Malt Barley production, presence of various crop diseases such as Scald and Net Blotch, strong and resistant weed varieties (highly resistant to Agro-24D and Pallas 45 OD), fall in the price of agricultural production after harvest, less competition between the firms (for instance: between Assela Malt Factory and BGI Ethiopia. Moreover, there were poor horizontal relationships between Heineken and GSM, between GSM and BGI Ethiopia and so on. There were also delay in setting price for agricultural produce and establishing market linkages, the local traders give high amount of loan for SSFs even before harvest and easily access farmers produce and high probability of side selling. The FGDs and KIIs continued in explain about the challenges that affected CF such as situation of adopting technologies were very slow, weak support provided to SHFs from the sectors responsible to work and improve the livelihood of SSFs (i.e. District Agricultural, Rural Development and Natural Resource Management Office, Cooperative Unions, Agricultural Development Agents).

Regarding climate change and climate variabilities in the study areas, irregularity in RF, heavy flood due to intensive RF and removal of top soil and washed away of seed from farmlands, increased in cold periods by flood water and increased in wind erosion in dry seasons in the District. Apart from the challenges discussed by FGDs and KIIs, two of the case informant (i.e. one from Germama PA, Malt Barley CF scheme explained the challenges in CF as follows (Box-1).

Box-1: Malt Barley CF challenges

He is 55 years old. He is engaged in Malt Barley CF at Kofele District. He has six children and four grand children. He earns a living from agriculture and sometimes he sells cabbages and other vegetable at Shashemene Town. He explained that he makes a very small margin of profit from Malt Barley and selling of vegetables. As he explained, the income he earned did not enough to cover the families' domestic meal. This crippled his capacity and hindered him to invest on agricultural inputs such as fertilizers, agrochemicals and other relevant agricultural technologies. These were beyond his capacity and he was unable to increase the Malt Barley production and earn much more income and support his family.

Therefore, all these challenge limited the production and the productivity of the farmlands, which ultimately reduced the annual income obtained from Malt Barley production.

5.4.2 Opportunities of Malt Barley contract farming in the study area

Malt Barley CF is one of the crops under CF arrangement in the study area. Presence of various organizations that supports the SHFs in the area (Such as: - GMS Ethiopia, Self Help Africa, Heineken, BGI Ethiopia, Asella Malt Factory) facilitated the organization of basic cooperatives and Cooperative Union in the study areas. The qualitative analysis of the data clearly revealed that there were opportunities because of the introduction of Malt Barley in the study areas. CF served the SHFs as a source of finance and gets access to credits either from Assela Malt Factory, BGI Ethiopia, Heineken or GSM Ethiopia or Cooperative Union. Moreover, it linked SHFs to market and get access to full agricultural extension packages. The FGDs and the KIIs underscored that SHFs' adopted new production technologies such as Threshers, BBM Ayber, Malt Barley Seed Varieties (Traveller, Sabin). Moreover, they have got access to consumption goods such as Sugar, Oil and others facilities. Above all, the SHFs increased use of inputs for Malt Barley production (For instance: before CF, the SHFs use 50 Kg per hectare and now the SSFs are using more than100Kg of fertilizer per hectare and almost the ratio is 1:1 now.

As the agricultural experts at Kofele and Adama Districts explained the SHFs', buy fertilizers, improved seed varieties and agro-chemicals. Above all, the agro-processing firms have opportunities in accessing Malt Barley production; the produce is up to the standards set by the firms. They get the amount they need and provide incentives for SHFs', which motivate other farmers to enter into CF practices. Accordingly, the incentives given for the SHFs' for 1st Grade, 2nd grade and 3rd grade is 7%, 5.7% and 4.5%, respectively.

5.4.3 Challenges in Sugarcane contract farming

The qualitative data gathered on major challenges of CF from FGDs and KIIs on Malt Barley and Sugarcane CF underscored the following points. These substantiated the field survey data collected from agricultural experts, FGDs, KIIs and consistent with the quantitative findings.

According to the interviewees, many of the challenges emanated from the factory itself. On average, some farmers own 0.25-8 hectares and subjected to give their farmland to the Factory. This is unconditional for each of the farmers whose farmland is located in the factory's territory. The SHFs' are all obliged to give all their farmland to the Factory without their consent and interest. That is why whenever there is a conflict or instability in the area, the SHFs' set fire on the Sugarcane plantation and destroyed so many hectares of the production. This is still an

ongoing situation and the farmers are interested to replace the Sugarcane production by crop production such as Teff, maize, tomatoes, onions, garlic and others.

Many of the interviewees such as the Adama District Cooperative Office experts, District Agricultural experts, extension heads and Wonji-Shewa Sugarcane Cooperative Manager replied that since that farmland was take away or snatched from the SHFs'. SHFs' were not considering the sugarcane production as their own. This is becoming the source of conflict or cause of disagreement between the Wonji Sugar Factory and the SHFs' in Sugarcane production areas. Many of the SHFs' families earning become less and subjected to various economic, social and political problems in the area. Moreover, there are delays in different payments and in input provisions that become the fashion of the day. Furthermore, over flooding of many hectors of Sugarcane production in last year summer. In the aftermath of the flooding last winter, the farmers set the Sugarcane plantation in fire and affected by subsequent drought, which lead many of the families for starvation due to drought.

There are also other challenges that affected the overall production processes in Sugarcane outgrower schemes. The discussions and interviews made with FGDs and KIIs indicated that the committee working as a mediator between the factory and the SHFs were not transparent enough in facilitating access to credits, forcing the farmers to plant Sugarcane and supply it to the Factory. Moreover, delay in providing inputs, delay in remuneration payments or salary, delay in payment of what is supplied by farmers and poor or absence of communication between farmers and the factory officials posed challenges on the scheme. They further continued explaining that fallowing of SHFs' farmland for many years (i.e. more than 3 Years for instance) that may reduce income of SHFs. Furthermore, Wonji Shewa was not keeping agreements made between the SHFs' and the Factory. They failed to discharge its roles and responsibilities as per their agreement. So that, the SHFs' were not willing to work with the Factory. They are not feeling as if the factory belongs to them and this situation is putting the sustainability of Sugarcane production at risk.

Consequently, there were no positive relationships between the Factory and the SHFs', which in turn affected the overall situation of the Factory and the SHFs'. According to Adama District Cooperative expert, agricultural extension and rural development experts, there were proximate causes for such relationship: poor income gained from the production of Sugar cane. Because of

this, the SSFs were forced to destroy the plantation, cutting of the plastic pipeline and taking away the sugarcane to somewhere else and local markets other than the factory.

5.4.4 Opportunities of Sugarcane contract farming

SHFs' have access to irrigation water that may immensely contribute to increase in agricultural production. The SHFs' have also an opportunity in getting trainings on agronomic practices, new ways and techniques of production in the light of acquiring new technologies. On the other hand, the Factory has access to farmland and labor that may enhance the Factory's production capacity and for further expansion of the Sugarcane plantation that further necessitate the expansion of the Factory or opening of new branches. To this end, the use of Sprinkler irrigation on the farmers land is now increasing economic use of water without wastage, which we may consider it as water use efficiency.

Despite the challenges in Sugarcane CF or out grower scheme, Wonji Shewa Sugarcane our grower schemes created employment opportunities for more than 300 people, improved infrastructures: water facilities, irrigation lines, water canals, schools, health , electricity, feeder roads etc for the local communities and workers engaged in the scheme. Moreover, because of the scheme, more than 200 SHFs' built their houses from iron sheets, adopted new agricultural technologies, relied on and use of improved varieties of Sugarcane plant (i.e. better Sugarcane ratoon. The FGDs strongly underscored that the SHFs' could easily get access to market for their Sugarcane plantation and obtained a continuous supply of Cane to the Factory (63% of the cane supply is from the Outgrower shemes).

In addition to such challenges, one of the KIIs participant expressed his feelings towards the challenges in Sugarcane outgrower scheme in the below Box-2.

Box-2: Challenges in Sugarcane outgrower scheme

The second case informant who is 36 years old young man at Wonji Shewa Sugarcane out grower scheme articulated that his farmland was naturally located in the land delineated in the factory's sugarcane plantation site. He strongly explained that because of the lesser income obtained from the outgrower schemes, his families livelihood situation is at risk. He has five children and another two children adopted from the surrounding community. He underscored that because of such income, he is planning to get out of the outgrower scheme. However, he has no an opportunity to earn a living from his farmland, since the farmland is fully located at the middle of the factory's sugarcane plantation. As he said, his chance is only to leave the farmland and free himself without any compensation and there is no exit mechanism in place.

5.5 Conclusions and policy recommendations

The Principal component analysis was conducted to identify the major challenges of CF in the study locations. The results revealed that lack of storage facilities for agricultural produce, poor market linkages, shortage of trainings and other technical assistance, delay in financial services, and poor pricing strategies and delay in payments were identified as the major challenging factors affecting CF in the study areas. However, this does not mean that contract breaching, problems of risk sharing, poor pricing strategies and delay in payments hindered the successes of CF in the study areas. From the result, there are pitfalls in storage facility, problem of markets, which can be explained in terms of poor market connection, side selling, lack of trainings and other technical assistance provided to the farmers, financial access problems, poor pricing strategies (i.e. pricing through committee), delay in payment after supplying agricultural produce to the agro-processing firms.

Based on the results obtained and analyzed through principal component analysis, the result revealed the major challenging factors that affected CF in the study areas. Thus, one can conclude that any intervention or policy recommendation regarding the effective implementation of CF in the study areas require addressing the following challenges and reverting the challenges as opportunities of CF. These are:

- Working on storage facilities that could help to keep the agricultural produce from post harvest loss and the qualities of the produce;
- Establishing appropriate sustainable market linkage for the agricultural producers of smallholder farmers which in turn help to address side selling and defaulting problems;
- Designing appropriate training schemes both for the smallholder farmers and other partners working on CF in the areas strengthening the relationship among them to get the desired results from CF arrangements;
- Designing workable pricing strategies that benefit smallholder farmers, scheduling of the payment system and automation of payment and remuneration systems;
- Ensuring and putting in place appropriate financial mechanisms that facilitate access to financial services for smallholder farmers;

- There should be strong market regulation mechanisms that specifically geared towards agricultural produce in Malt Barley and Sugarcane CF arrangement;
- It is also very essential to design risk-sharing mechanism that could benefit both smallholder farmers and the agri-business firms engaged in CF arrangements in the study areas;
- Improving adoption of technologies and market linkages on sustainable basis; and
- Establishing monitoring and evaluation mechanisms that helps the government bodies, agribusiness firms and SSFs to track the courses of CF impacts in the study areas and act appropriately based on the impact result.

Even though, there were no policy and legal frameworks that guides the overall CF processes, it is very essential to design policy strategies, legal frameworks, guidelines and enforcing contracts that minimize the challenges and maximize opportunities out of CF arrangement to help farmers and agro-processing firms get benefits out of such business arrangements.

Chapter 6

6. Synthesis of the findings, key findings, policy implications and recommendations for future researches

6.1 Introduction

Contract farming as a tool of agricultural transformation played a tremendous role in increasing agricultural production and expected to benefit SHFs' engaged in CF. The major purpose of this paper was to conduct an investigation on CF as a response to climate change and climate variabilities in Ethiopia: empirical analysis from Oromia Regional State. The study offers new perspectives on how CF paves a way for addressing climate change and climate variabilities taking into account as a central discussion point: Malt Barley CF and Sugarcane outgrower schemes. It seeks to shade some lights and provide answer for questions like - how do SHFs perceive CF as CCASs in the area? How CF practices in the area do affects the net-income of SHFs? What are the determinants of adoption of CF as CCASs in the study locations?; and, then, what sort of challenges and opportunities are introduced with respect to Malt Barley and Sugarcane CF in the study areas? Consequently, this synthesis tried to provide an impression from the four research findings: perception of SHFs on CF, impacts of CF on net-income and livelihood improvement, factors affecting adoption of CF as CCASs and the challenges and opportunities induced because of CF schemes. Finally, the policy implications of this piece of research work is presented based on the four papers, followed by indicating future research areas that ultimately accompanied by highlights of the contributions of the research in terms of empirical, methodological and theoretical points of view.

6.2 Key findings of the study

Contract farming as a response to CCASs can be investigated from different angles. It first attempted to see how the SHFs engaged in Malt Barley and Sugarcane outgrowers perceives CF as CCASs in Kofele and Adama Districts, respectively. Along with the perception studies, the author investigated and incorporated into the study: the climate change and climate variability situations by looking into the trend analysis of rainfall and temperature variables of 15-30 years of climatic data (i.e. 1987-2017 E.C).

Thus, the study results depicted that for the last 15-30 years, the rainfall and temperature situation greatly revealed changes and fluctuations across years affecting the agricultural production and productivities in the study areas. Regarding rainfall and the temperature, the trends in mean annual rainfall and mean annual temperature at Adama and Kofele Districts obtained from NMAE suggested that the rainfall was irregular and revealed differences in distribution across years from 1987-2017 G.C (NMAE, 2018). The regression result for minimum and mean annual temperature for Kofele revealed a decrease by 0.717^0C and 0.756^0C, respectively. However, the regression result for maximum annual temperature in one-year period for Kofele District indicated an increase of temperature by 0.5693^0C. The trends in maximum and mean annual temperature in and around Adama District exhibited a decrease of maximum and mean annual temperature by 0.084^0C and 0.043^0C, respectively. Conversely, the trends in minimum annual temperature from 1987-2017 G.C revealed an increase of temperature in and around Adama District by 0.4309^0C,where the minimum annual temperature decreased for Adama and its environs because of Sugarcane CF microclimate reduced the temperature in the area **(Chapter 3; Megersa and Assefa, 2019)**

From the general literature, CF practices in the study locations positively contribute in improving the net-income and the SHFs' livelihood. The farmers' perceived that the pricing situation was not enough and the income earned from Sugarcane was limited to 60 ETB Birr per Quintal and unable to support the SHFs' livelihood at Wonji-Shewa areas. Despite the use of agricultural inputs and agronomic practices, the production of the Sugarcane lasts from Twelve up to Fourteen Months and its production decreased from time to time affecting the net-income obtained from it. Both the participant and non-participant farmers' perceived that the Sugarcane CF scheme as a business model was not profitable and they were interested to end and breach their agreement with the agri-business firms. They are rather very fond of covering their farmland with other crops such as Teff, Maize and Chickpeas, onions and obtain better income **(Chapter 2; Megersa and Assefa, 2019).** With respect to the impact of CF on the net-income and enhancing livelihood of SHFs', it reduces the net-income of participant SHFs because of its contract specification or design. Those SHFs' at Wonji Shewa were forcefully included in CF scheme. Here, there are no exit strategies put in place whenever the farmers pursue to leave the contract. Consequently, the SHFs' consider the CF arrangement as systematic "land grabbing" mechanism in the study area **(Chapter 2; Megersa and Assefa, 2019).** Even though SHFs' have access to agricultural inputs, agricultural technologies, irrigation water (i.e. Wonji Shewa

Sugarcane out grower schemes), good agronomic practices, they considered CF as a mechanism of accessing cheap farm and family labour in the study areas. The SHFs' also see CF as a mechanism of using farmers plots of land for private companies (Heineken, Meta Abo Breweries and government Factories (Assela Malt Factory and Wonji Shewa Sugar factory (**Chapter 2, 3 and 5; Megersa and Assefa, 2019).** The SHFs consider that the benefits go to the private companies, government Factories and individuals engaged in running the cooperative unions **(Chapter 3; Megersa and Assefa, 2019).**

The other key finding that clearly revealed in **(Chapter 2; Megersa and Assefa, 2019 and Chapter 3; Megersa and Assefa, 2019),** there is no policy and legal frameworks specifically designed to strategically guide, manage and address the overall processes in CF in Ethiopia in general and study areas in particular. Based on the two chapters **(Chapter 2; Megersa and Assefa, 2019 and Chapter 3; Megersa and Assefa, 2019)**, the author argue that SHFs have better access to agricultural inputs and technologies because of introduction of CF. Furthermore, they adopted the best agronomic practices and better adapted to the existing climate change and climate variabilities in the study locations.

Generally, we learned that SHFs perceived CF better than they do before. Adoption of CF as CCASs created access to market, access to credits, access to agricultural inputs and agricultural technologies and helps SHFs to get opportunities to employ best agronomic practices. However, delay in provision of agricultural inputs; side selling, systematic land grabbing was the major challenges in the study locations. Moreover, absence of specific CF policy and legal frameworks become the major hurdles of implementations of CF in the study areas.

6.3 Contributions of the study, policy implications and future research areas

6.3.1 Contributions of the study

In this part, the author discussed about the contributions of this study to the existing scientific body of knowledge and methodological aspects. Regarding its contribution to the knowledge base and methodological aspects, CF as a response to CCAS contributes in the following ways: empirical, methodological and theoretical. It empirically documents the knowledge of the intricacies and complex realities in Malt Barley and Sugarcane outgrower schemes by exposing the level of perception of SHFs towards CF, CF impacts on net-income and improving SHFs livelihood, adoption of CF as CCASs and the prevailing CF challenges and opportunities. Thus,

it attempts to fill such knowledge gap in understanding the overall aspects of Malt Barley CF and Sugarcane outgrower schemes. Therefore, the author argue that this study shades some lights on the problem under investigation and helpful in laying ground for further knowledge on CF and adoption of CF as CCASs.

Methodologically, this research employed various methodological approaches in addressing Malt Barley CF and Sugarcane CF as a response to CCASs. It explored the grass root level CF situations, CF challenges and opportunities and employed impact evaluation techniques to answer research questions posed. To the best of my current knowledge and understanding, no previous researches tried to conduct such studies in Ethiopia in general and in the study areas in particular. Consequently, this research puts an effort to assess and review the existing theories and concepts that lays ground for the current study. It contributes to frame future researches and understands better the theories and observations pertinent to the problem under investigation.

6.3.2 Policy implications

The systematic, planned and structured CF arrangement could yield a better result in terms of its implementation, providing the desired result for the agribusiness firms, SHFs and the spillover effect for non-participant SHFs' in the area. A better CF arrangement: better CF design or specification, clear and transparent, well written and well articulated one helps to build trust among stakeholders engaged in CF. Moreover, better and sustainable market linkages, good pricing strategies, welcoming incentive strategies could bring about trustworthiness by reducing side selling, defaulting and reduces instances of conflicts between SHFs' and agribusiness firms. Furthermore, it also invites the non-participant SHFs' to engage in CF arrangement and get the opportunities induced because of CF practices such as access to agricultural resources, inputs, trainings on technical activities and modern agronomic practices in the areas.

Thus, the experiences, understandings, performances, the commitments of agribusiness firms and the broad based policies and frameworks designed to address over all CF processes play a fundamental role in CF practices and CCASs. To this end, the concerned institutions should work and engage in discussions that boldly affecting the overall aspects of CF and climate change adaptations in the study areas. All the concerned parties should work in conjunction with each other to raise the understandings of all the stakeholders and strive to design policy, legal frameworks and strategies that geared towards Malt Barley and Sugarcane CF and establish supervisions. There is also a need to monitor and evaluate the overall CF processes to

maximize the benefits of all actors engaged in CF processes (i.e. including the agricultural practices pertinent to CF). This study, however, argues that policy recommendations should - create favorable conditions to improve the existing CF management practices and CCASs; facilitate the institutional cooperations and commitments specifically in improving the net-income and livelihood of SHFs. These in turn, facilitate the transformation of subsistence farming to modern and mechanized agriculture, which paves the ways for agro-industrialization that ultimately improves agricultural production, raise net-income and improves livelihood of SHFs engaged in CF.

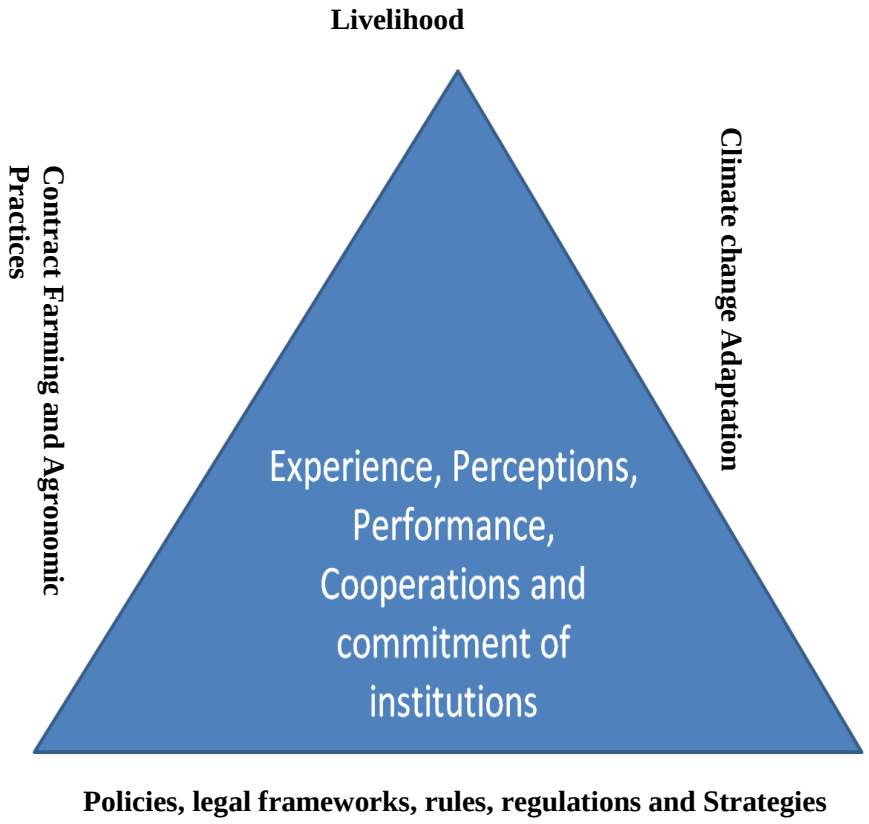


Figure 6.1 A Pyramid of contract farming, livelihood and climate change adaptation strategies nexus

Source: Authors construction, 2019

6.3.3 Recommendations for future researches

This study tried to provide some insights on the perception, impacts of CF on enhancing net-income and improving livelihood of SHFs, adoption of CF as CCASs and the challenges and opportunities in CF in the study areas. Conducting research on a specific area such as CF and

climate change adaptation in various areas is not the one time investigation. The author truly believes that this study did not adequately address all aspects of CF in Ethiopia and other parts of the world. Consequently, it is imperative that conducting future researches on: Malt Barley and Sugarcane contract farming, CF and value chain analysis in Ethiopia, the role of institutions in contract farming in Ethiopia, CF and agricultural transformation in Ethiopia are very important. Further, conducting future investigation on CF and sustainable land management in Ethiopia and other parts of the globe, CF and irrigation efficiency nexus, the linkages between CF and "Land grabbing" in Ethiopia: an empirical analysis and so on would enrich the existing body of knowledge and theoretical aspects.

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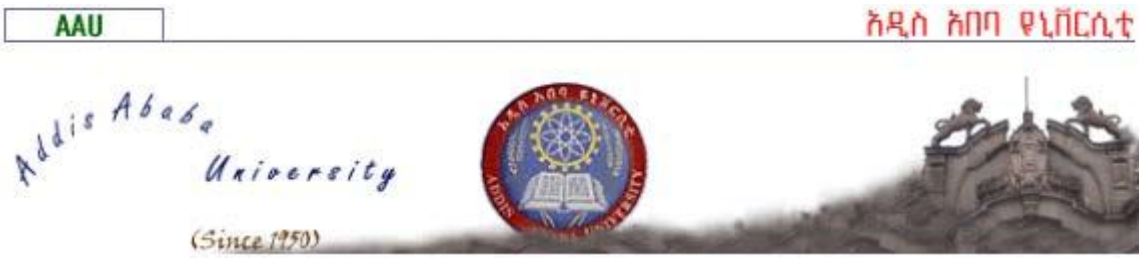

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Appendices

Appendix 1: Household survey questionnaire

Title of the Study: Smallholder farmers' contract farming as a response to climate change adaptation and variability in Ethiopia: empirical analysis from Kofele District and adama District of Oromia Regional State

Introduction and consent statement

Getachew Megersa, a PhD candidate of Addis Ababa University, is carrying out this research. The objective of this questionnaire is to collect primary data on contract farming practices, **"Smallholder farmers' contract farming as a response to climate change and variability in Ethiopia: empirical analysis from Kofele District and adama District of Oromia Regional State"** and development related information that are required to assess the contract framing practices in curbing climate change adaptation undertaken in the study areas. Therefore, researcher kindly requests you to give your response freely and accurately to the success of this study.

Dear respondents: You should feel confident that this information is used only for the purpose of this study.

Lastly, I thank you for your kind cooperation and honest response.

Name of respondent _____Code _____Date _____
Zone:_____Woreda:_____Kebele _____
Name of Enumerator _____Code_____Date _____
Name of Supervisor_____Code_____ Date_____

General directions

- Try to follow the instructions for each part very attentively.

- Circle the number or letter of your choice as given in the question.
- Some of the questions may have multiple answers and please circle all of them as per the question.
- You can proceed to the later question if the former question has no an answer.
- For those questions that needs written answers, please write your answers on the space provided at the end the question.

Household survey

General information

A. Socioeconomic and demographic characteristics

1. Household Code:_____
2. Sex of the household head: 1= Male 2= Female
3. Age of the household head:_____
4. Religion: 1=Orthodox 2=Muslim 3=Protestant 4=Other, Specify_____
5. Marital Status: 1=Married 2=Not Married 3=Divorced 4=Separated 5=Widowed
6. Educational Status: 1=Capable of Reading and writing 2=Illiterate 3=Highest grade Attended (1,2,3,4,5,6,7,8,9,10,11,12, Above 12, Specify_____)
7. Responsibility in the Family/community and/or cooperative: 1=Household Head 2=Member of the community 3=Religious Leader 4=Coordinator of Development Tasks 5=Member of Cooperative 6=Others, Specify_____

B. General livelihood situations

1. What was your Farming practice before your engagement in contract farming practices?
   1. Subsistence Farming 2. Trade 3. Both 4. Others Specify_____
2. If your engagement was on subsistence farming, what types of productions are there? Fill the following table based on your production type.

S.N	Farming activity	No. of family participated		Income Earned Per Year
		Male	Female	
1	Crop production			
2	Vegetables and fruits			
3	Livestock Production			
4	Others, Specify_____			
	Total			

3. **Input utilization based on crop/plant types**

Types of Crop Production	Size of Farm Land in Hectare	Production (in Qun) 100kg)	Input utilization						Protection chemicals in Litter	Ash/Lime (Kg)	Total Production in Quintals	Price of a Quintal
			Chemical Fertilizer(kg)		Natural Fertilizer(kg)		Improved Seed	Local Seed				
			DAP	Urea	Manure	Compost						

4. Income earned from off-farm activities and employment situations

S.N	Activities	Persons Participated		Income Per Year
		Male	Female	
1	Working for other farmers			
2	Sale of natural products (wood, firewood, charcoal)			
3	Rent of farm land			
4	Sale of animal feeds			
5	Renting agricultural/farm implements			
6	Others, specify_____			
7	Total			

5. Income from non-farm activities and employment situations

S.N	Non-farm activities	Number of persons participated		Total income
		Male	Female	
1	Trade of Livestock (Shoats or Sheep and Goats, Crops, Milk and Milk Products)			
2	Pottery			
3	Tanning			
4	Weaving			
5	Selling fuel wood			
6	Daily labor			
7	Jewelry and welding			
8	Remittance			
9	Others, Specify_____			
10	Total Income			

6. **Consumption expenditure for the family before their participation in contract farming**

Types of food items	Consumed from purchased	
	Amount (kg)	Price in Birr
Cereals and Pulses		
Wheat		
Teff		
Maize		
Barley		
Bean		
Pea		
Chicken pea		
Others, specify_____		
Fruits and Vegetables		
Cabbage		
Potato		
Tomato		
Garlic		
Onion		
Banana		
Orange		
Mango		
Papaya		

Others, specify_____		
Animal products		
Milk		
Butter		
Yogurt		
Meat		
Egg		
Others, specify_____		
Others		
Salt		
Sugar		
Oil		
Others, specify_____		

7. Non-Food expenditures

Description of items	Expense in Birr
Dress and foot wear	
House rent	
Buying of water	
Transport and communications	
Visit of relatives	
Education	
Health	
Religious and cultural issues	
Veterinary Service	
Gas	
For beverages and cigarettes	
Government tax	
For social purposes (For example: *"Idir", "Ekub")*	

8. Where did you get the financial support for your farm activities?

1. From Saving 4. From Relatives 5. Loan 6. Remittance
2. From Government 7. Others, Specify_____
3. From Non-Government Organizations

9. How much did you get in a year? _____
10. For what purposes did you allocate the money that you get from different sources?
    1. To buy agricultural inputs_____Birr
    2. For Hired labour_____Birr
    3. To Buy seeds_____Birr
    4. For transportation_____Birr
    5. Others, specify_____Birr

C. Participation of smallholder farmers in contract farming (cf) and non-participants

1. For how long you have been engaged in contract farming?_____Years
2. What are the reasons for your participation in Contract farming arrangements? Please put them in your Priority and Rank them

S.N	Reasons for your participation in contract farming	Rank
1	Good provision of agricultural inputs	

2	Good market linkages	
3	Credit service	
4	Provision of irrigation water	
5	Use of harvested or stored water	
6	Good access to hire labour	
7	Good price for agricultural product/s	
8	Good risk sharing mechanisms are in place	
9	Good provision of extension service	
10	Source for agricultural technology transfer	

3. Human resources/labour engaged in contract farming activities/practices

S.N	Source of human labour	Number of individuals participated			Human labour per day per person in birr	Estimated human labour per year
		Male	Female	Total		
1	Family Labour					
2	Hired Labour					
3	Daily Laborer					
4	Others, Specify_____					
	Total					

4. How do you see your agricultural production since you started contract farming practices?
   1. Increasing 2. Decreasing 3. No Change
5. If your answer to **Q-4 is "Increasing"** what are the reasons for the increase in your agricultural production? ***(Multiple Answers are Possible)***
   1. Effective and efficient use of agricultural inputs
   2. Sowing Seeds/ Planting at its right time
   3. Harvesting production at their right time
   4. Storing Production at save place
   5. Taking production to market when prices are right
   6. Taking into consideration the advice of extension workers and applying it to production processes 7. Others, Specify_____
6. Did your income from agricultural production increased since you started contract farming?
   1. Yes 2. No
7. If your answer to the above **Q-6 is "Yes",** _____Per cent increase in production increased.
8. For what purposes did you use **the income obtained from contract farming/Subsistence Farming**? Please fill the following table.

Types of food items	Consumed from purchased for both groups				
	Contract farmers		Non-participant farmers		Remark
	Amount(kg)	Price in Birr	Amount(kg)	Price in Birr	
Cereals and Pulses					
Wheat					
Teff					
Maize					
Barley					
Bean					
Pea					
Chicken pea					

Others, specify_____					
Fruits and Vegetables					
Cabbage					
Potato					
Tomato					
Garlic					
Onion					
Banana					
Orange					
Mango					
Papaya					
Others, specify_____					
Animal products					
Milk					
Butter					
Yogurt					
Meat					
Egg					
Others, Specify_____					
Others					
Salt					
Sugar					
Oil					
Others, specify_____					

9. Non-Food expenditures

Description of items	Expense in birr	
	Contract farmers	Non-Participant farmers
Dress and foot wear		
House rent		
Buying of water		
Transport and communications		
Visit of relatives		
Education		
Health		
Religious and cultural issues		
Veterinary Service		
Gas		
For beverages and cigarettes		
Government tax		
For social purposes (for example: ***"Idir", "Ekub"***		

10. Expenses to improve contract farming practices/spill over effects of contract farming and subsistence farming

S.N	Farm activity	Expenditure/Year in Birr	
		Contract Farmers	Non-Participant Farmers
1	To improve crop production and productivity		
2	To expand fruits and Vegetable Farms		
3	Livestock production		
4	Others, Specify_____		

11. Expenses to improve off-farm activities

S.N	Off-farm activities	Expenses per year in birr	
		Contract farmers	Non-Participant farmers
1	To hire other farmers who work on their farm		
2	To but wood, firewood and charcoal		
3	Rent expense		
4	To rent farm implements		
5	Others, Specify_____		

12. Expenses for non-farm activities

S.N	Non-farm activities	Contract Farmers	Non-Participant Farmers
1	Trade of Livestock (Shoats or Sheep and Goats, Crops, Milk and Milk Products)		
2	Pottery		
3	Tanning		
4	Weaving		
5	Selling fuel wood		
6	Daily labor		
7	Jewelry and Welding		
8	Remittance		
9	Others, Specify_____		
10	Total		

13. Use of full agricultural packages before and after contract farming/ out grower scheme: please put "✓" if you employed the agronomic practices or "x" if not mark in the space provided in the table:

S.N	Description	Agronomic practices		Remark
		Before CF (Code 1)	During CF (Code 2)	
1	Extension services (trainings, technical assistance, field demonstration etc)			
2	Employing full agronomic packages			
2.1	Farmland preparation (farmland size in hectare)			
2.2	Selection and use of local seed/improved variety seeds			
2.3	Planting in conventional ways/planting in rows			
2.4	Fertilizer application and use			
a	DAP in Kg			
b	UREA in Kg			
c	Compost/Manure in Kg			
2.5	Water application or irrigation water use			
2.6	Use of agro chemicals(diseases control, insecticides, weed killer)			
2.7	Weeding			
2.8	Harvesting/Cutting			
2.9	Collecting harvests			
2.10	Transporting/Storing in storage facilities			
3	Use of farm technologies			
3.1	Mechanization/Threshers, BBM etc			
3.2	Use of improved variety seeds			

D. benefits of contract farming and subsistence farming

1. fill the following table

s.n	contract farming	subsistence farming	their contribution in supporting climate change adaptation practices

2. benefits and challenges of contract farming please put **"✓"** for its benefits and **"x"** for its challenges

1. access to market for its production and it creates market linkages
2. creates employment opportunities
3. no displacement from farm lands
4. it easily paves ways to transfer skills, knowledge and technologies
5. it facilitates provisions of agricultural inputs
6. creates credit access
7. it induce pollution
8. contract farming agreements often not written in transparent languages
9. indirectly controls the farm lands of smallholder farmers
10. it hinders food security problems
11. it encourages investments
12. others, specify_____

3. Family size, educational level, occupation and labor situations

S.N	Name of the household members	Relationship to the household (see code A)	Sex (See Code B)	Age	Education (see code C)	Average working hours per day (See Code D)			Types of Occupation (see code E)	Labor capacity (See Code F)
						On-farm activities	Off-farm activities	Non-Farm activities		
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
		Code A	**Code B**		**Code C**	**Code D**			**Code E**	**Code F**
		1=Wife 2=Husband 3=Daughter 4=Son 5=Close Relative 6=Dependent 7=Hired Labor 8=Other, Specify____	1=Male 2=Female		*1=Illiterate Read and write* *2=Grade 1-4* *3=Grade 5-6* *4=Grade 7-8* *5=Grade 9-10* *6=Grade 11-12* *7=12+1* *8=12+2* *9=College diploma/certificate* *10=Others, Specify_____*				1=Farming 2=Petty Trade 3=Handy Craft 4=Blacksmith 5=Causal labor 6=Government Employee 7=Broker 8=Others, Specify	1=Child (Too young to work) 2=Working Child(Keeping Livestock, doing Domestic Chores) 3=Adult 4=Elderly 5=Partially Disabled 6=Fully disabled and unable to work at all 7=Other, Specify_____

4. Is there any other source of labor for your farm? 1=Yes 2=No

5. In 2015-2017 family members participated in **contract farming activity/Agricultural activity**, please fill the following

S.N	Contract farming activity or agricultural activity	Contract farmers		Non-participant famers		Remark
		Male	Female	Male	Female	
1	Crop/plant production					
2	Animal Production					
3	Total income from sales of agricultural products					

E. <u>Assessment of perception of smallholder farmers contract farming practices, its benefits, challenges and opportunities, its relations with climate change adaptation strategies</u>

Dear respondent, please try to respond for the following questions based on the level of agreement and disagreement that you have on the respective questions as coded below and put the **"✓"**sign in the measurement level of your choice: **(1= Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree)**

S.N	Questions	Measurement levels				
		1	2	3	4	5
I	**General aspects of contract farming practices**					
1	Contract farming improves agricultural practices					
2	Contract farming increases labour efficiency					
3	Contract farming helps to use family labour efficiently					
4	Contract farming creates market outlets					
5	Contract farming increases household and family income					
6	Contract farming increase food security and reduce poverty situations of smallholder farmers					
7	Contract farming creates employment opportunities for family members					
8	Participation of Smallholder farmers in Contract farming created other livelihood choices (i.e. off-farm and non-farm activities:- Shop, Petty trade, etc)					
9	Contract farming helps promotes use of various agricultural inputs that increases crop production and productivity					
10	Contract farming limits diversification of crops					
11	Overspecialization in certain crops to the detriment of building resilience against climate change/variability and contributing to local food security					
12	Promote sustainable farming practices and not promote reliance on chemicals or expensive seeds, or lead to excessive debts					
13	Substantially include women farmers and promote their rights					
14	Promote the land rights of smallholder farmers					
15	Promote the land rights of smallholder farmers					
16	Agri-business firms apply free, prior and informed consent of those affected in terms of project design and implementation					
17	Contract farming practices increases efficiency of irrigation water use					
18	Contract farming avoids displacement of farmers from their agricultural land					
19	In contract farming, the price of the agricultural produce is decided by the agribusiness firm					
II	**Contract farming specifications**					
20	Contract farming specifications or agreements safeguards the interest of the agri-business					

	firms					
21	Only safeguards the interest of smallholder farmers					
22	It safeguards the interest of the two parties					
23	Contractual agreements be negotiated transparently and fairly among the parties, providing adequate information at all times on the financial aspects of the project and the risks and likely impacts					
24	Contractual agreements consider alternative contract farming models					
25	Contracts be regulated by a written contract spelling out the details and obligations of both the company and the out-growers, and which must be written in a clear and understandable way with out-growers given sufficient time to review it					
26	Contractual agreements be transparent about how the price is determined, the duration of the project and how production inputs and other services are to be supplied and used by farmers					
27	In contractual agreement, build in a clause for the renegotiation of the contract at agreed intervals, and specify the sharing of production and market risks among the parties					
28	Track and communicate performance to affected stakeholders to build accountability at the operational level					
29	Contractual agreement prevent unfair practices in buyer-farmer relations, and not prohibit or discourage farmers from associating with other farmers to compare contractual clauses or to address concerns or problems					
30	Contract Specifications have clear mechanisms for settling disputes					
III	**Role of the Government in the contract systems**					
31	The government is acting as a third party, or mediator, between the parties and not be a mouthpiece for the agri-business firms					
32	The Government have appropriate contract farming laws and legal framework to ensure that farmers' rights can be enforced					
33	There is appropriate policy instrument that guides contract farming practices					
34	There is strong market regulation strategies to guide marketing processes in as a result of contract farming					
35	Organizing Cooperatives and/or Cooperative Unions and let them to participate in CF					
IV	**Role of Private sector or other development partners**					
36	Capacity Building Trainings on Agronomic Practices					
37	Provisions of Technical Assistance					
38	Provision of Quality Inputs such as agro-chemicals for farmers					
39	Controls standards of agricultural produce/Quality Check					
40	Introduction of new variety seeds					
41	Dissemination of new Technologies and trainings on new technologies					
42	Provision of Financial Services					
43	Provision of Logistic services (Transportation)					
44	Setting up Payment systems for the produce of farmers					
V	**Contract farming practices and climate change adaptations nexus**					
45	Contract farming and climate change adaptation are strongly related to each other					
46	Contract farming eases climate change adaptations through provision of agricultural inputs					
47	Households that participated in Contract Farming practices better adapt to climate change					
48	Contract farming opens up an opportunity to share risks					
49	Contract farming serve as a source of income during crop loss as a result of weather or climate change risks					
50	Contract farming practices helps to reduce effects of drought					
VI	**Participation in contract farming as livelihood improving strategy**					
51	Contract farming practice improves livelihood of smallholder farmers and reduce transaction cost for agribusiness firms/Usual agricultural practice improves livelihood as compared to					

	CF (for non-participant farmers in Contract Farming)					
52	The agro-processing firm provides inputs to smallholder farmers at the right time and in the right amount/Cooperatives or other organizations provide inputs for farmers					
53	The agro-processing firm provides capacity building training on agricultural practices for smallholder farmers/ Agricultural office workers provide capacity building trainings					
54	The extension workers assigned by the agro-processing firms works and cooperates in friendly manner with farmers/Agricultural Development Agents or experts assigned from agricultural offices					
55	The awareness of SHFs on CF is improving their farming practices					
56	Contract farming is a source of livelihood diversification (on-farm, off-farm and non-farm activities)/ Both agricultural, off-farm and non-farm activities are source for livelihood diversification					
57	Contract farming activities strengthen the relationship between family members/Crop production and animal husbandry are the source of family relationships					
58	Contract farming serves s a base for livelihood choices (e.g. Farming, off-farming and non farming)					

F. <u>Motivating factors to participate or not to participate in contract farming practices</u>

1. What **<u>motivates or demotivates</u>** you **<u>to/not to engage</u>** in contract farming practices in your area? ***(Multiple Answers are possible)***
   1. It creates access to water (Irrigation and harvested water)
   2. It allows conservation agriculture
   3. It creates access to multiple agricultural inputs 4. It facilitates access to credit services
   5. Contract Specification and contract Terms
2.. How do you evaluate the contribution of contract farming/crop and livestock production in climate change adaptations to in your area?
   1. Poor 2. Fair 3. Good 4. Very Good 5. Excellent
3. Which one of the following contract farming specifications is included in the contract agreement? Please Put "✓" if it is included "X" if not included in the Specifications.
   - Duration of contract _____
   - Contract quota_____
   - Quality specifications and grading system_____
   - Quality control (when, how, who is responsible, who pays)_____
   - Cultivation / raising practices required by the contractor _____
   - Time of delivery_____
   - Conditions of delivery_____
   - Logistic support_____
   - Technical assistance (by Extension Workers (DA's), Agricultural Experts)_____
   - Repayment term of input loan and timing of input credit supply_____
   - Credit facilities to farmers_____
   - Pricing formula (such as fixed prices, flexible prices based on particular (spot) markets, consignment prices, or split prices) _____
   - Methods and time of payment_____
   - Risk sharing system/insurance_____

G. <u>Household land ownership situations</u>

1. Dou you have your own farm land? 1. Yes 2. No
2. If your answer to the above **Q-1 is "Yes",** how did you own farmland?
   1. Family inheritance 2. Provided by Peasant Association 3. Sharecropping 4. Land Renting 5. Others, Specify_____

3. If your answer to **Q-2 is "No",** how do you access land?

1. Sharecropping 2. Land Renting or Contracting Land from others 3. Others, Specify_____

4. Would you please tell land holding and farm characteristics of your farmland?

S.N	Types of land use	Area (ha)	Distance from home in Kms(Minutes)
1	Cultivated (farm) land		
2	Grazing land		
3	Homestead land		
4	Forest land		
5	Unused land(fallowing)		
6	Irrigated land		
7	Total land holding Size		

5. Current number of plots of farmland of your households? _____

6. Do you think that your piece of land is enough to support your family? 1. Yes 2. No

7. If your answer to **Q-6 is "No",** how do you fill shortage of land? ***(Multiple responses are possible)***

1. Sharecropping 2. Farmland Renting or Contracting farmland 3. Others, Specify_____

8. If the piece of farmland is not enough to support the family, what are the reasons for being small?

1. Large family size 2. Small size of farmland 3. Farmland is not fertile

4. Lack of agricultural inputs 5. Others, Specify_____

9. Has the size of your farmland increased or decreased since you start contract farming

1. Increased 2. Decreased 3. No change at all

10. What sort of production you engaged in other than contract farming for the last five years?

S.N	Crop type	Production per year per *Timad* in *Quintal*										
		2009 E.C		2008 E.C		2007 E.C		2006 E.C		2005 E.C		Total Qty Sold
		Timad	Qty	Timad	Qty	Timad	Qty	Timad	Qty	Timad	Qty	
1	Wheat											
2	Teff											
3	Maize											
4	Sorghum											
5	Barely											
6	Bean											
7	Pea											
8	Chick pea											
9	Others, Specify											

11. Is there any change in the productivity of the cultivated land or plantation for the last five years?

1. Increased 2. Decreased 3. No Change at all

12. If your answer to **Q-11 is "increased",** what are the reason(s) for the increase in the productivity of land? ***(Multiple Answers are Possible)***

1. Improved agronomic practices (Soil Fertility Management, Land Preparation, Use of Organic Fertilizer, Mulching, Use of Agro-chemicals, Sowing/Planting, Harvesting, Storage etc)
2. Continuous provision of agricultural inputs 3. Soil and water conservation practices
4. Climate change adaptation strategies put in place (Water Harvesting, Use of irrigation Water)

13. If your answer to **Q-11 is "decreased",** what are the reason(s) for the decrease of the productivity of cultivated land under contract farming? ***(Multiple answers are Possible)***

1. Delay in input supply 2. Land Degradation 3. Drought 4. Pests or Plant /Crop Diseases 5. Lack of Rainfall 6. Rainfall variability 7. Lack of Oxen 8. Others, Specify_____

14. Which of the following **agronomic practices** you depend on to increase your agricultural productivity***? (Multiple answers are Possible)***
    1. Planting Date 2. Fertilizer Application 3. Harvesting Date 4. Weeding
    5. Use of Agro-chemicals 6. Others, Specify_____

15. Do you have access to **extension services** in your locality? 1. Yes 2. No
16. If your answer to **Q-15 is "Yes",** who can provide you the extension workers and extension services?
    1. Government/Woreda Agricultural Office 2. Agri-business firms 4. NGOs
    3. Others, Specify_____
17. What Sort of Support did you get from extension workers?
    1. Different Trainings regarding agricultural practices including contract farming practices
    2. Provision of agro-metrological information 3. Others, Specify_____
18. Do you have land ownership certificate or land use right? 1. Yes 2. No
19. If your answer to **Q-18** is **"Yes",** do you apply better land management technologies (SWC, Agro-forestry) 1. Yes 2. No
20. How is the status of your farmland under contract farming?
    1. Highly Fertile 2. Very fertile 3. Somehow Fertile 4. Not fertile

H. <u>Access to water facilities and infrastructure</u>

1. Is the land under contract farming/crop production is accessible to irrigation water from River?
    1.Yes 2. No
2. If your answer to **Q-1 is "Yes",** how do you use the water?
    1. Once in a week 2. Twice in a week 3. Trice in a week 4. Once in a Month
3. If your answer to **Q-1 is "No"** what other sources of water in your farmland area?
    1. River 2. Cistern 3. Lake 4. Small Ponds 5. Spring
    6. Shallow Well 7. Deep Well 8. Others, Specify_____
4. How long does it take to get to your water source?_____
5. Is this water available every day? 1. Yes 2. No
6. What containers do you usually store water in? _____How many? _____How many liters are they?_____
7. Is there any suitable road infrastructure in your farm location? 1. Yes 2. No
8. If your answer to **Q-7 is, "Yes",** what sort of road is it?
    1. Gravel Road/All weather Road 2. Dry Weather Road 3. Asphalt Road
    4. Feeder Road 5. Others, Specify_____
9. Have you ever get conflict with other farmers, while using irrigation water on farm field?
    1. Yes 2. No
10. If your answer to Question 9 is "Yes", how did you solve the conflict?
    1. Mediation 2. Arbitration 3. Discussing and solving by selfies 4. Others, Specify

I. <u>Access to credit facilities/financial services</u>

1. Do have access to financial services in your locality? 1. Yes 2. No
2. If your response to **Question 1 is "Yes"** which organization is providing you finance?
    1. Co-operatives 2. Agri-business firm 3. NGOs 4. Local Persons 5. Others, Specify_____
3. Is the financial support from the Organization is enough to conduct successfully your agricultural activities? 1. Yes 2. No
4. If your answer to **Question 3 is "No",** how do you fill the financial gaps in your areas?
    1. Use of own Savings 2. Loan 3. Sell of Assets
    4. Taking Collateral agreements with local Banks 5. Others, Specify_____

J. <u>Market and price situations</u>

1. Where do you sell your agricultural produces?
   1. To Local Market 2. Agri-business firm 3. Others, Specify_____
2. How far is the distance of the firm or market from your place of residence?
   1. One Kilometer 2. Two Kilometers 3. Three Kilometers 4. Four Kilometers
   5. Five Kilometers 6. More than Six Kilometers
3. What sort of transportation services do you rely on to take your produce to agri-business or market?
   1. Pack animals 2. Use of tractors /Cars 3. Through human power 4. Others, Specify_____
4. Is there any suitable road infrastructure in your farm location? 1. Yes 2. No
5. If your answer to **Question 4 is**, **"Yes",** what sort of **road** is it?
   1. Gravel Road/All weather Road 2. Dry Weather Road 3. Asphalt Road
   4. Feeder Road 5. Others, Specify_____
6. The price of the agricultural product is 1. Fixed Price 2. Variable Price
7. The price of A Quintal of your agricultural produce is _____Birr.
8. The price of your agricultural product is 1. Enough 2. Not Enough
9. What do you do if the price given to your produce is not enough?_____
10. How do you manage the agricultural product that you produced in your farm?

K. <u>Climate change adaptation practices</u>

1. Is the current climatic condition the same with that before 30 years ago in your locality?
   1. Yes 2. No
2. How is the condition of temperature of the day in the **Past 30 Years**?
   1. Increasing 2. Decreasing 3. No change/constant
   4. I do not know 5. Other, Specify_____
3. What are the local indicators that show the variability/change in temperature through time in your surrounding? (***Multiple answers are possible).***
   1. Frequency of occurrence of drought and floods
   2. Human and animals diseases that has not been seen before
   3. The emergence of new species of animals and plant in your local area
   4. Changes of clothing style of the communities
   5. Degradation/deterioration of rivers through time
   6. Change of animal and plants/crop type (for instance cultivation of Barley and other crop types)
   7. Other, please specify_____
4. Frequency of extreme drought/Flood
   1. Lower than the year before 2. Same as the year before
   3. Higher than the year before
5. Intensity of extreme drought/extreme flood;
   1. Normal (stay for short period) 2. Sever (stay for long Period)
   3. Extremely sever (stay for very long period) 4. Other, Specify_____.
6. How is the condition of rainfall for the **Last 30 Years?**
   1. Increasing 2. Decreasing 3. No change
   4. Change in the seasons of rainfall 5. Increase the frequency of drought
   6. I don't know 7. Other, please specify_____
7. What are the local indicators that show the variability/change in rainfall through time in your surrounding?
   1. Changes in cropping season, 2. Changes in crop types,

3. Changes in productivity/ declining trend, 4. Other, please specify_____

8.Frequency of extreme rainfall;

1. Lower than the year before 2. Same as the year before
3.Higher than the year before 4. It Shows Very erratic nature

9.How about the intensity of extreme rainfall;

1. Normal (stay for short period)
2. Sever (stay for long period)
3. Extremely sever (stay for very long period of time) 4. Others, Specify_____

10.Having perceived changes in temperature and rainfall did you under take adaptive measures?

1. Yes 2. No

11.If your response for **Question 9 is "Yes",** which specific climate change adaptation strategies are employed by your household? Circle "1" if your answer is "Yes" and "2" if your answer is "NO". **Please, Rank your choice in the Column provided in the right corner of the table!**

S.N	Description of adaptation types	Yes	No	Rank
I	**Livestock Related**			
1	Increasing livestock mix	1	2	
2	Increasing number of Livestock (Stocking)	1	2	
3	Number of Livestock (Destocking)	1	2	
4	Selling Livestock to buy food and water/pasture	1	2	
5	Cattle Entrustment	1	2	
6	Rent out animals(Donkey, Horse, Mule/Camel)	1	2	
7	Cattle Fattening	1	2	
8	Sale old/weak animals before the drought break out	1	2	
9	Store butter to sale during the dry season when the price increases	1	2	
10	Others, Specify_____	1	2	
II	**Crop, vegetable and fruit production related**			
1	Expand cultivation of food crops	1	2	
2	Early Planting and Late Harvesting	1	2	
3	Early Planting and Early Harvesting	1	2	
4	Intercropping	1	2	
5	Using new variety or improved seed crops	1	2	
6	Adoption of Contract Farming Practices	1	2	
7	Storage of food crops	1	2	
8	Borrow food or cash to purchase food and water/pasture	1	2	
9	Vegetable and fruit production by using stored or well water	1	2	
10	Agroforestry	1	2	
11	Others, Specify_____	1	2	
III	**Farm land management related**			
1	Improved tillage Practices	1	2	
2	Mulching	1	2	
3	Fallowing	1	2	
4	Crop Rotation	1	2	
5	Application of Compost	1	2	
6	Application of Manure	1	2	
7	Use of Chemical Fertilizers	1	2	
8	Intercropping	1	2	
9	Soil and water conservation practices on farm lands	1	2	
10	Others, Specify_____	1	2	
IV	**Water related**			
1	Digging of hand dug shallow wells	1	2	
2	Digging of Deep wells	1	2	

3	Digging of ponds and allowing flood water to enter into the system	1	2	
4	Irrigation	1	2	
5	Reducing consumption of water during rainy season both for livestock and human beings	1	2	
6	Sale of Water	1	2	
7	Water harvesting in small ponds, Cistern	1	2	
8	Preparing water infiltration Canals	1	2	
9	Draining of Vertisols	1	2	
10	Others, Specify_____	1	2	
V	**Mobility related**			
1	Moving with livestock from place to place	1	2	
2	Migrate to urban Areas	1	2	
3	Flee to Neighboring Countries	1	2	
4	Work at urban areas and return back at home	1	2	
5	Others, Specify_____	1	2	
VI	**Other meanses**			
1	Reduce spending on non food items	1	2	
2	Rent out pasture/Farm lands (if private)	1	2	
3	Sale other assets	1	2	
4	Sale fodder	1	2	
5	Sale fire wood/charcoal	1	2	
6	Carrying cross border trades items, for example contraband materials	1	2	
7	Send children to work	1	2	
8	Send children to relatives of other places	1	2	
9	Dependent on Relief for Some time	1	2	
10	Use traditional safety net system	1	2	
11	Use of Early Warning Systems	1	2	
12	Soil and water conservation practices such as soil or Stone Bunds, Terracing, Tree Plantation, Hedging, etc, Please, Specify_____	1	2	
13	Shift in livelihood: from production of subsistence farming to Commercial Farming, from Agriculture to Merchant, Carpenter etc	1	2	
14	Others, Specify_____	1	2	

12.Do you have access to metrological information in your locality? 1. Yes 2. No

13. . If your answer to **Question 12 is "Yes",** how do you get the metrological information?

1. Through Extension workers 2. From Metrological stations in the nearby sites 3. Others, Specify_____

14. Did you participate in the identification of sustainable adaptation strategies by communities?
    1.Yes 2. No

15. Do you participate actively in the implementation of the adaptation options identified by your community? 1. Yes 2. No

16. Do you contribute money or in kind to sustain the adaptation options implemented? 1. Yes 2. No

17. How do you rate the tradition of working together in the sustainable watershed management in your locality?
    1. Very weak, 2. Weak, 3. Fair, 4. Good, 5. Very Good

18. Explain the problems that hinder the implementation of the above listed adaptation strategies and give you suggestion to solve the problems. (***Multiple answer is Possible)***
    1. Lack of information about climate change and appropriate adaptation responses
    2. Lack of money/credit
    3. Shortage of land

4. Shortage of labor
5. Lack of access to water for irrigation,
6. Shortage of farm inputs 7. Lack of market access

19. Do you think that contract farming serves as one of climate change adaptation mechanism in your locality?

1. Yes 2. No

20. If your response to Question 19 is "Yes", list down the factors on how it supports climate change adaptation processes.

1._____

2._____

3._____

4.

21. If your response to **Question 19 is "No",** write down the reasons why it is not supporting climate change adaptation practices in your area.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

22. How do **you evaluate the contribution of contract farming and traditional agriculture** in curbing climate change impacts in your locality?

1. Contract farming paves ground to provides and employ new technologies that help to address climate change induced impacts,
2. Contract farming processes facilitate skill development faster as compared to traditional or usual agriculture
3. Contract farming facilitates market linkages and reduce transaction costs as compared to traditional one
4. Contract farming facilitates access to credits
5. Others, Please Specify_____

23. Do you think that contract farming is **a good business model** for smallholder farmers like you?
1.Yes 2. No

24. If your answer to **Questions 23 is "Yes",** why it is important for you?
Reasons:

1._____
2._____
3._____
4._____

25. What are the opportunities that you are getting from contract farming practices?

a. _____
b. _____
c. _____
d. _____
e. _____

f. _____

26. What are the overall challenges that hinder the success of contract farming in your area? Put **"✓"** mark on those critical factors in Contract Farming and reason out why it is a challenge to you?

    1. Meeting quality criteria_____
    2. Open communication with well-organized groups_____
    3. Contract terms (complying with contractual terms)_____
    4. Provision of extension Services, training and knowledge sharing on technological issues
    5. Collection of produce (logistics)_____
    6. Side selling_____
    7. Access to credit_____
    8. Access to input_____
    9. Pricing and method of payment_____
    10. Sharing risk_____

27. Is there any conflicts induced between you and the agri-business firms?1. Yes 2. No

28. If your response to **Question 27 is "Yes"** how do you resolve it" Explain the conflict resolving mechanisms in your area?

29. For how many Years did you participate in contract farming practices and/or agricultural in area?

30. Are there significant difference in facilitating climate change adaptation practices because of your participation in contract farming practices or traditional agriculture?

_____
_____

31. What do you suggest to improve contract farming practices and climate change adaptation strategies in way that improves the livelihoods of smallholder farmers like you?

    _____
    _____.

Thank You!

Appendix 2. Focus Group Discussion (FGDs) Checklists

1. What are the **criteria** or **mechanism to select the smallholder farmers to engage/not to in contract farming** practices in your area?
2. In your opinion, is **contract farming creating opportunities** for your family? If not, why?
3. How do you assess the **overall impacts of contract faming for your family and community**?
4. How do you describe the **overall impacts of contract farming** on **your livelihood**? Is contract farming practices helped you to engage in **off-farm and non-farm activities** in your area?
5. Does contract farming **broaden you income** base and helps to create asset for family?
6. How do you **access water for your agricultural practices** or activities?

7. How do you **access land for over agriculture and contract farming**?
8. How do you **evaluate your relationships with the agri-business firm for effectively conduct of your agricultural activities**? What are the **platforms for your agreement** to work with the firm?
9. How do you explain the **pricing situation** for your agricultural produce?
10. How do you get **agricultural inputs** such as fertilizers, pesticides weed killer and the support of extension workers? Is the **extension workers assigned from the firm or the government sector**? Do you think that the supports provided by extension workers are **adequate**?
11. What are the **major impacts of climate change** in your areas? How do you describe the **impacts of climate change** in your areas? What sort of **adaptation strategies** you are employing to curb the impacts?
12. How do you evaluate the **contributions of contract farming in the process of climate change adaptation strategies**? What **achievements made so far in climate change adaptation strategies** in your area?
13. Are the current **climatic conditions similar with that of 30 years**? In this regard, how do you explain the trends f climatic situations? How do **you relate it with Contract farming**?
14. How do you explain the **challenges, barriers and driving forces in relation to contract farming practices**? In your opinion, what do you expect from the agri-business firm, smallholder farmers, **NGOs and other development partners?**
15. **What are the Sustainable land management activities that you employed as a result of contract farming system?**
16. Are there any **conflicts between you and the agri-business** firms so far? How did you **approach whenever conflict arises** in contract farming?
17. How do you evaluate the **impact of contract farming in improving your livelihood in general and food security situation of your family in particular**?
18. How do you compare **subsistence farming and contract farming in terms of generating income for smallholder farmers in your district?**
19. What do you **suggest to improve the performance of contract farming practices and climate change adaptation** strategies in your area?

Thank You!

Appendix 3. Key Informant Interview Checklist (KIIs)

The main purpose of this study is to generate relevant information for a PhD research on "Climate change adaptation and Agriculture: The Case of Contract Farming in Kofale and Adama Districts of Ethiopia". The information obtained from this key informant interview will help the researcher to draw how your organization view contract farming in the process of climate change adaptation and in improving the

livelihood of smallholder farmers in the area. Therefore, your kind cooperation and active participation with genuine response during the interview will be vital for the overall success of this study. Results of this study and any other details will not be used for un-intended purpose other than input for this study. To this end, anonymity and confidentiality of your response is highly guaranteed unless and otherwise under mutual consent between the respondent and the researcher.

Section I. Background of the Key Informant

Name: _____Age: Marital Status_____
Name of Institution: _____
Education: _____Field of Study_____
Position: _____Length of Service in the current Institution: _____
Pace of Residence: Wereda: _____Zone:_____Town:_____
Date of Interview: _____

Section II. <u>Interview Checklist</u>

1. How do you explain **subsistence farming and contract farming** in **generating income** for a family?
2. How do you see **contract farming and its applications** in terms of goals of your organization?
3. How do you describe contract farming in **improving the livelihood of smallholder farmers**?
4. How do you describe contract farming practices in kofale (Malt Barley) and Adama (Sugarcane out-grower) districts of Ethiopia?
5. How do you explain the **contribution of contract farming in overall climate change adaptation** processes?
6. Are there any specific **agreements that you entered with smallholder farmers for the successful implementations of contract farming**? What sort of specifications set by your organizations?
7. Do you think that **contract farming improves the way peoples react to climate change** in the areas?
8. How did the smallholder farmers attempt to **adapt to climate change through contract farming practices**?
9. What are the **major achievements of smallholder farmers in contract farming** in terms **of climate change adaptations**?
10. What are the **overall challenges and opportunities of contract farming practices** in terms of achieving your target?
11. How contract farming is **benefitting smallholder farmers** in these study areas?
12. How do you describe the relationship between smallholder farmers and Agri-business firms?
13. How do you describe the **power relationship between smallholder farmers and the agri-business** firms?
14. How do you explain the **foreign agro-firms and domestic agro-processing firms in respecting the rights of smallholder farmers** engaged in contract farming practices?
15. What are the advantages of smallholder farmers for their participation in contract farming practices as compared to non-participant smallholder farmers?
16. Is there any **difference in adaptation to climate change for those participant and non-participant smallholder** farmers?
17. Which one of farming **system Subsistence farming or Contract Farming practice** that **support climate change adaptations in your district? Why?**
18. What sort **of support do you provide for smallholder farmers and agri-business firms**?
19. What are **the roles of your office in contact farming practices** as a business model?

20. Do you think that **contract farming is the appropriate business model** for farmers engaged in Sugarcane and Malt Barley production? Why?
21. What are the **Sustainable Land management** (SLM) practices related to Contract farming and Climate Change Adaptations in your locality?

22. Is there **any policy instrument, laws, legal framework and legislation that specifically address the issue of contract farming** in Ethiopia/Oromia Regional State?
23. What do you **suggest to improve contract-farming practices and climate change adaptation practices**? Who should do what?

Thank You!

Appendix 4. Wealth ranking checklist (wr) for participant and non-participant shfs

Wealth raking is one of the qualitative tools that help to identify the level of well-being of smallholder farmers in the study areas and it will help to categorize farmers who are participant in contract farming and not into four: very rich, rich, poor and very poor. The well-being differentiating categories and the subsequent household characteristics that are developed with the focus group discussants during the discussions. It considers those farmers who participated and not participated in contract farming practices; ultimately, the groups will compared the asset categories based on their asset level and the researcher will discuss the results thoroughly and analyze the outcomes in the findings of the study.

- What are the factors that helped you to categorize farmers of this area into different asset groups?

Appendix 5. Case history checklists (CH)

This section will deal with particular cases picked up with the focus group discussants and deeply studied to understand the specific situations of smallholder participation in contract farming practices.

1. <u>General information</u>

Name: _____Marriage:_____
Sex: _____Age:_____
Number of Family: Male_____Female_____Total_____
Place of Residence: Zone: _____Wereda:_____Kebele_____
Date of Interview: _____
2. Size of Land in Hectares: a. For Crop Production_____
b. For Contract Farming_____
c. For Grazing_____
d. For Rent:_____
e. For Vegetable Production_____
f. For Vegetation_____

3. Household Labour Situation:
a. Family Work Force (Those able to work at Family farm Level)
Male_____Female_____Total_____
b. Hired Labour: Male_____Female_____Total_____
c. Other Sources of Labour*:("Debo", "Wenfel", "Jigi"* etc)_____

_____
_____
_____.

4. **Types of Agricultural Production:**

a. Major Crops: For Commercial Purposes:_____
_____
_____
_____.

b. Major Crops: For household Consumption Purposes
_____
_____
_____
_____.

5. **Livestock:**

a**.** For commercial purposes: _____
_____
_____.

b. For household consumption_____
_____
_____.

6. **Off-farm activities:_____**
_____
_____.

7. **.Non-farm Activities**_____
8. **Source of Livelihood Before your engagement into outgrower/ contract farming:___**
    a. _____
    b. _____
    c. _____
9. Yearly income (birr) in subsistence farming:_____
10. Yearly expenditure from subsistence farming:_____
11. Household consumption patterns during subsistence farming:
    a. For Food_____Birr
    b. For Clothing_____Birr
    c. For Social Purposes*("Equib", "Idir", lending, Schooling, Health etc)*_____Birr
    d. Other expenditures, specify_____Birr
12. The Year that you started outgrower scheme /contract farming_____
13. **Number of years in outgrower scheme/contract farming:_____**
14. **Type of crop/plant in CF**:_____
15. **Pricing situation:**
    _____
    _____
    _____
    _____.
16. **Annual income obtained from outgrower scheme/ contract farming**
    a. Annual income from contract farming:_____
    b. Annual income from other agricultural activities:_____
    c. Annual income from off-farm activities:_____

d. Annual income from non-farm activities:_____
e. Income from other Sources(Remittance, Gift, etc)_____

17. Access to market, transportation services, financial services and provision of agricultural inputs:

a. Market linkages_____
b. Transportation Services by:_____
c. Financial Services: From Whom?_____How Much??_____Birr
d. Provisions of agricultural inputs_____
e. Technology transfer_____

18. Expenditure Situation After your Participation in Contract Farming (In terms of Birr)

a. For crop production (to buy agricultural inputs such as fertilizers, pesticides etc)_____
b. For household consumption:_____
c. For contract farming:_____
d. For hired labour_____
e. Others, specify_____

19. **How do you explain the relationship between contract farming practices and climate change adaptations in your locality?**

_____

20. Climate adaptation strategies employed by the households

a. _____
b. _____
c. _____
d. _____

21. Major challenges in contract farming practices and adaptations to climate change

i. Major challenges in contract farming practices

a. _____
b. _____
c. _____

ii. Major challenges in climate change adaptation strategies

a. _____
b. _____
c. _____

22. What are the **Sustainable Land management** (SLM) practices related to Contract farming and Climate Change Adaptations in your locality?

_____
_____
_____

23. What do you suggest to address the challenges in contract farming practices and climate change adaptation in your locality?

i. Suggestions to address challenges related to contract farming

1. _____

2. _____
3. _____

ii. Suggestions to address challenges related to climate change adaptation strategies

1. _____
2. _____
3. _____

Thank You!

Endnotes

iAyber BBM is a broad bed furrow maker and refers to a ploughing agricultural technology used to drain water from the farm field (i.e. from black solanchak soil).

[ii] This paper employed "contract farming" as "CF".

[iii] This paper uses the term "smallholder farmers" and "farmers" interchangeably and used to represent the sampled households that are termed as "participant farmers in contract farming and non-participant that are not participant in CF".

[iv] The term small-scale farmers are used quite loose, to denote two characteristics, having limited farming areas and not having the resources to invest in expanding the farming practice on their own. These households are typically average to poor households in a community. According to this study, they have farmlands less than five hectares.

[v] EATA this refers to the Ethiopian Agricultural Transformation Agency established to support the agricultural transformation of the country. It takes into account the comparative advantages of the areas preferably regions based on their resource endowment.

[vi] "GMS" refers to a Global Malting Service engaged in consultancy service in Malt Barley production at Kofele District.

[vii] Climate change refers to a change in one or more climatic elements or stimuli such as rainfall, temperature, relative humidity manifested through drought, floods, snowfall, and change in planting of sowing date and so on.

[viii] Climate change adaptation strategies termed as "CCASs" are strategies that the farmers' employed to curb the impacts of climate change by building local specific adaptation strategies in the study areas. For example: Soil and water conservation, use of local landraces, improved varieties of seeds, use of Ayber BBM and so on.

[ix] "P" denotes "Participant farmers in CF arrangements

[x] "NP" refers to those "Non-participant farmers in CF

[xi] on CF based on five point scales: "Strongly agree', 'Agree', 'I don't know', 'Disagree' and 'Strongly disagree' by assigning 5, 4, 3, 2 and 1, respectively"

[xii] Total Livestock Units (TLU) is measurement unit that helps to measure live heads of cattle with animal category and its conversion factor. Thus, according to Strock, et al. (1991): Calf=0.25 TLU, Heifer=0.75 TLU, Cow/Ox=1.00 TLU , Horse=1.10 TLU, Donkey =0.70 TLU, Sheep/Goat=0.13 TLU, Chicken=0.013 TLU, Bull=1.00 TLU and Mule=0.70 TLU.

[xiii] "GP"="Participants farmers at Germama "; "GNP"="Non participants farmers at Germama";" PK"="Participants at Kuriftu Hida"; "NPK"=Non-participants at Kuriftu Hida"; "AP"=Participants at Adulala Hake" and "ANP"="Non-participant farmers at Adulala Hake"

[xiv] Contract Farming designated as CF refers to the Malt Barley and Sugarcane contract farming or outgrower schemes at Kofele and Adama districts, respectively. CF and Outgrower schemes are here convey the same meaning where a business arrangement made between the agribusiness firms and farmers through Cooperative Unions and agreed up on pre-determined price of agricultural products, supply of agricultural inputs, technical assistance and agronomic practices followed in the process of production. The sampled smallholder farmers in these two districts are engaged in CF schemes.

[xv] "Land grabbing" is a land appropriation methods where investors systematically control the farmland of SHFs and even control it for a long period. Moreover, they again systematically rely on the household labour for agricultural production both in pre-harvest and post-harvest periods.

[xvi] Net income here refers to the overall income earned before contract farming and during contract farming and it is the aggregate income from on-farm, off-farm and non-farm activities that contributed in the livelihood of smallholder farmers.

[xvii] The natural log of income difference denoted as "Income diff" is the difference between the income earned before the smallholder farmers' participated in contract farming and the income earned during contract farming. Thus, the impact analysis or evaluation of income situation depends on this "Income diff".

[xviii] NNM is one of the average treatment effect techniques employed in Propensity Score Matching Methods (PSM) and denoted as Nearest Neighbour Matching; RM for radius matching; KM for Kernel Matching and STM for stratification matching

[xix] PNP refers to Participant and Non-Participant smallholder farmers' in Contract Farming arrangement and it signifies the treatment variable employed in the Propensity Score Matching through Probit regression model.

[xx] This paper uses the term "smallholder farmers" and "farmers" interchangeably and it uses it for the sampled households and it represents the "participant and non-participant" farmers in contract farming.

[xxi] The term smallholder farmers are used quite loose, to denote two characteristics, having limited farming area and not having the resources to invest in expanding the farming practice on their own. These households are typically average to poor households in a community. According to this study, they have farmlands less than five hectares.

[xxii] Adoption here refers to a mechanism to employ and use various climate change adaptation strategies in the context of location where the adoption options based on local or own resources and making the adoption practices their own.'

[xxiii] The soil and water conservation practices designated as SWC in the study areas refers to stone bundling, terrace, farm top drainage canals, hedges, fallowing, in farmland canals to drain water from farm fields and so on, which helps to conserve soil and water on farm fields and the surrounding farmland environments.

[xxiv] Agronomic practices as a typical CCAS incorporates those farming practices such as farmland preparation, sowing or planting in rows or conventional ways, weeding, natural or modern fertilizer application, use of pesticides, harvesting, storing agricultural produce and watering of crops from irrigation sources and rainfed. In general, it deals with pre-harvest and post-harvest crop management that aimed to boost agricultural production.

[xxv] Livelihood diversification in this context describes the use of various livelihood choices or combinations such as agriculture based, off-farm activities, non-farm activities employed by a smallholder farmer. It is expected that livelihood diversifications broaden the income bases of farmers' and immensely help as CCASs.