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# Determinants of Women Farmers' Participation in Seed System: The Case of Local Seed Business in Sinana, Agarfa and Dodola Districts of Southeastern Oromia, Ethiopia

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## Abstract

*The study analyzed women farmers' participation in seed producers and marketing cooperatives in Sinana, Agarfa and Dodola districts of Bale and West Arsi zones of Oromia National Regional State, Ethiopia. The purpose of this study was to identify determining factors that influence women farmers' participation in local seed business in the study area. A multi-stage purposive sampling technique was employed to select local seed business project intervention kebeles for the analysis. Dureti Tullu, Elabidu, Wirtu Kachama and Barisa seed producers and marketing cooperatives were selected for the study because of their good experience in farmer based seed multiplication. Based on female-headed households sampling frame, samples were allocated across the four kebeles using probability proportional to size sampling technique. Finally, a total of 160 sample respondents (68 participants and 92 non-participants) were selected by using stratified and simple random sampling method. Cross-sectional data were collected using pre-tested structured interview schedule, focus group discussions and key informants interview. Descriptive statistics and econometric model were employed to analyze the collected contextual data to meet the objectives. Among 12 explanatory variables included in to the logistic regression model, education level, family size, farm size, total annual income, and access to and use of credit had shown positive and statistically significant influence while age and women's reproductive role had shown negative and statistically significant influence on women farmers' participation in local seed business. The findings indicate that the more the women farmers are educated and the better the asset holdings, the more tendency to participate in local seed business. Thus, enhancing efficient delivery of services and building the capacity of women farmers in terms of education and asset holdings would improve women farmers' participation in seed producers and marketing cooperatives.*

**Key words**: Participation; Local Seed Business; Socio-Economic Factors; Reproductive Role; Institutional Factors; Seed Producers and Marketing Cooperatives, logistic regression model

## Introduction

The agriculture sector is a core driver of Ethiopia's growth, eradicating poverty, improving rural livelihood, long-term food security and economy (MoFED, 2010). It supports 85% of the population's livelihoods/employs labor force, accounts for 41.6% of gross domestic product (GDP), generates over 70% of the country's export (foreign currency) earnings and 80% of raw materials supply for agro-industries (UNDP Ethiopia, 2012). These imply that agriculture has vital role in sustainable development, and its importance in achieving the Millennium Development Goal of halving by 2015 the share of people suffering from extreme poverty and hunger is paramount. It is also a cornerstone of Ethiopia's medium term strategy-the Growth and Transformation Plan (GTP) (MoFED, 2010).

The agricultural development led industrialization (ADLI) policy, development strategies and plans of Ethiopia emphasizes the need to bring about rapid agricultural development through the use of improved agricultural technologies (variety/seed, knowledge, information, management practices, farm equipment, tools, and machine) in a sustainable way as the main means of reducing poverty in the country (ATA,

2012). This would, however, bring the required impact if it properly addresses the needs of agriculture dependent resource rich, medium and poor men, women and young farmers in the rural Ethiopia. Given the significant current and future role of the agricultural sector, a vibrant seed system that provides quality seed to meet the demands of farmers (men, women and young) is an essential enabler to continued economic and social development of Ethiopia's agricultural system. Progress in developing the seed system has already been made and can be built upon, including further development of improved varieties, increased farmer knowledge about input potential, and a clear policy direction that involves all stakeholders (Dawit et al., 2010). According to Dawit, farmers that are involved in seed system are not only men, but also women form a very large integral part of the agricultural activity.

Women play important roles in household livelihood security and food security especially in rural areas. Gender analysis indicates that about 88% of the Ethiopian women live in rural areas; nearly 85% of their labour is spent on farming as major sources of livelihood, which includes crop production and animal husbandry (Kaba, 2009). This study added that greater than 50% of the labor-force of Ethiopia is women and they are contributing a lot to the agricultural production. They have indigenous technical knowledge (ITK) and play a great role in seed selection, seed production, processing and marketing, and seed supply system has traditionally been associated with women in the informal farmer seed system (Bawa et al., 2010). Women are increasingly assuming leadership roles and decision-making in the absence of men in many households. As a matter of fact, Vuyiseka (2012) reported that female-headed households (FHHs) account for more than 30% of all rural smallholder households in Africa countries. In Ethiopia, FHHs constitutes more than 22% of the family (FAO, 2013).

The women in the area of study see agriculture as the major means of livelihood and therefore put high expectation of returns on the occupation. Their roles remain largely unrecognized. Their development needs were not addressed. What is more, their indigenous knowledge and expertise, which is a base in technology generation and transfer, were not properly identified and utilized. The lack of visibility of women's participation and contribution in agriculture stems from the patriarchal norms that make women's contribution in the household or in subsistence sector–"non-economic or non-market activity" and secondly, the decision makers continue to regard women as home producers or assistants in farms and not as farmers and economic agents (Mehra and Rojas, 2008). Women are aggressively fighting for the liberalization of their role as opposed to restricting them to the home and home-based activities (Lawanson, 2008). So, any economic strategy for agriculture and rural employment linked to poverty alleviation and food security must, therefore, consider gender equity and women's contributions as central issues in productivity and access to resources (Cheryl, 2013). Cheryl particularly pointing towards women farmers' access to inputs and women being targeted by policies for agricultural and economic reforms, otherwise, a turnaround is not possible in Africa without helping women farmers.

While access to and availability of seed has the potential to greatly improve smallholder productivity, there is currently a substantial gap between the country's production of commercial seeds and farmers' demand for, knowledge of, access to, and usage of these seeds. The annual supply of improved seed through the formal seed system is only 10% to 20% (Dawit et al., 2010). Informal seed production (farmer-based seed multiplication and farmer-to-farmer seed dissemination mechanisms) started before 10 years after political, economic and social reforms in Ethiopia in 1991 (Minilek et al., 2012). It accounts for 90% of the seed and the share of improved seed is less than 10% (Zawdie et al., 2008). As a result, how to increase the supply in terms of kind, quantity, quality and access (at right time, place and reasonable price) is the urgent issue to be addressed. Intermediaries - cooperative based seed system, is known as Community-Based Seed System (CBSS), is a relatively good low-cost system that can maintain quality of the seed to a level satisfactory to neighboring farmers locally (Dawit, 2011). Cognizant of this, since 2009, ISSD Ethiopia programme is identifying where commercial opportunities may arise and how these can be captured to improve the commercial potential of FBSMs (Dawit et al., 2010). With this support, then, a project entitled Local Seed Business (LSB model) has been promoting a transition of

farmers' group seed production schemes that was only to fulfill their seed demand into commercial seed businesses to boost the development of an integrated seed sector. This intervention is an agricultural innovation that typically arises through dynamic interaction among the multitude of actors involved in growing, processing, packaging, distributing, and consuming or otherwise using agricultural products (The World Bank, 2011).

However, in most developing countries the national average of women membership in cooperatives is only 7% (Assefa, 2007). In many of the Asian countries, women's membership is low and ranging from 2 to 10.5% in agricultural cooperatives. In countries like India, Nepal, Bangladesh, Sri Lanka and Pakistan, women comprise just 7.5% as compared with men (92.5%) of the total membership. In Africa, there is an under-representation of women in cooperatives (ILO, 2012). In terms of participation trends, women's participation still lags behind men's in mixed-sex cooperatives in Ethiopia. Both urban and rural cooperatives organized for different purpose was 16% in 2007 and women constitute only 18% of cooperative members (ILO, 2012). About 23% of women found in primary cooperatives in Ethiopia (Bezabih, 2012). The level of women farmers' participation in the already established groups of farmers is very minimal and is below 10% (Thomas and Fanaye, 2012). Women's participation in agricultural cooperatives was only 8% in 2004 (USAID, 2005 as cited in Thomas and Fanaye, 2012). They added that the share of women members in the cooperatives is about 20% on average. The participation of women accounts 20-25% in various cooperative types in Tigray region (Gebru, 2006; as cited in Daniel, 2013).

In the study area, the under-representation of women farmers still exists and also there is no women-only group or women's seed producer cooperatives. As resource endowment, agro-ecological settings, institutional arrangement, socio-economic and cultural characteristics of the farming community vary from one place to another, a farmer's decisions to participate in a given innovation or enterprise are also very variable (Firew, 2010). However, despite its presumed importance, it is not well understood which factors are associated with women's participation in cooperatives. Finding out the reasons for the low participation of women is the first step in improving women's participation in cooperatives. Thus, in order to have women responsive SPMCs, increase business opportunities for women, actively involve them in LSB project, strengthen women seed entrepreneurship and demonstrate benefits to both men and women smallholder farmers, we need to understand the differences and constraints in relation to the needs, interests, roles, access, control and benefits of women in seed production, processing and marketing.

Given that gender matters in agriculture, different studies documented evidence based findings on gender issues in agricultural production (Kaba, 2009). However, very little is understood about women farmers' participation in community-based seed system/SPMCs and there is paucity of information with regard to such a scenario of low level of participation (Mohammad and Amsalu, 2013). They added that there are few empirical researches that have been done to underpin the socio-economic, psychological, socio-cultural, communication and institutional factors that contribute to the low representation of women in SPMCs/LSBs. Furthermore, up-to-date, reliable and comprehensive data on women's participation in SPMCs/LSBs in the area of study is scant. Therefore, the objective of this study is to identify determining factors that influence women farmers' participation in LSBs in the study area.

## Methodology

### Description of the Study Area

The research was carried out in Sinana and Agarfa districts of Bale Zone and Dodola district of West Arsi zone of Oromia National Regional State (ONRS), Ethiopia. The three districts have well experienced seed producers' cooperatives and are LSB project intervention area.

### An overview of the study zones

Bale and West Arsi zones are among the 18 administrative zones of the ONRS located in southeastern Ethiopia. This part of the country is known for its extensive wheat production and is sometimes called "the wheat belt area of Ethiopia" (Bekele, 2011). Farmers in the two zones have access to different improved agricultural technologies mainly because of their proximity to Sinana Agricultiral Research Center (SARC) and the former state farms under Bale Agricultural Development Enterprise (now, Oromia Seed Enterprise-Bale Branch).

### An overview of the study districts

Sinana and Agarfa districts are among the 18 districts of Bale zone located at 430 and 460 kms southeast of Addis Ababa, respectively. Farming system of the districts is characterized by crop-livestock mixed farming. The major crops grown by farmers in the districts are wheat (bread, durum and emmer), barley (food and malt), field pea, faba bean, linseed, maize, hot pepper, potato, cabbage, banana, sugar cane, orange and papaya. Cattle, equines, sheep, goats and chickens are important livestock species reared by farmers in the district (BZADO, 2013).

Dodola district is among the 12 districts of West Arsi zone, which is 75km far away from Shashamanne and located at 326km southeast of Addis Ababa. Farming system of the districts is characterized by crop-livestock mixed farming. The major crops grown by farmers in the district are wheat (bread, durum and emmer), barley (food and malt), tef, maize, sorghum, field pea, faba bean, chickpea, linseed, lentil, enset, potato and cabbage. Cattle, equines, sheep, goats and chickens are important livestock species reared by farmers in the district (WAZADO, 2013).

### Sinana district

Sinana district is one of the largest and potential district of Bale zones with an area of 1168km$^2$ (116,800 hectars). It is divided into twenty (20) kebeles and 4 small rural towns. According to Central statistics Authority (population census, 2007), the population of Sinana district has been 119,208 of which the share of male and female are 62,280 and 56,928, respectively. There are about 17,651 male-headed households and 1633 female-headed households in the district (Bekele, 2011). It is estimated that 5960 (5%) are urban dwellers and 113,248 (95%) are rural dwellers. About 99% of the population is engaged in agriculture. The land use of the district classified as the following, land covered with crop is about 63%, 11.78% covered with grazing land , 7.5% of land covered with forest ,0.07% of land covered with barren/degraded land and 17.65% of land occupied with others (for construction, rivers, gorges and others).

The agro-ecological zones of the district are highland (90%) and midland (10%). The altitude ranges from 1650m to 3650 m.a.s.l. The annual average temperature of the district is found between 10$^o$c-23$^o$c. The annual average rainfall is 1105mm where as the minimum and maximum rainfall is 1060mm and 1150mm, respectively. The dominant soil type is loamy clay and pellic vertisols. Sinana district is bounded by Agarfa district in the North, Dinsho district in the West, Barbare and Goba districts in the South, Gasara district in North-east and Goro in the East and the administrative center of the district is Robe town (Sinana District ADO, 2013).

### Agarfa district

Agarfa district is divided into twenty (20) kebeles and 2 towns with a total land area of 1343 km$^2$ (134,300 hectars) and out of this land 45% is arable land, 30% is under grazing land, 12% is covered by forest, 5% is covered by barren/degraded area, and 8% is occupied by others (such as rivers, mountains, different constructions, etc.). According to Central statistics Authority (population census, 2007), the population of Agarfa district has been 104,412 out of which 53,276 is male and 51,136 is female. It is estimated that 13,760 (13.2%) are urban dwellers and 90,852 (86.8%) are rural dwellers. More than 95% of the population is engaged in agriculture.

The agro-ecological zones of the district are highland (83%), midland (11%) and lowland (6%). The altitude ranges from 1250m to 3855 m.a.s.l. The mean annual temperature of the district is found between 10$^o$c-25$^o$c. The mean annual rain fall is 800mm where as 1200mm and 400mm maximum and minimum annual rain fall recorded in the district, respectively. The dominant soil type is loamy clay and vertisols (ranges from well-drained fertile to waterlogged vertisols). Agarfa is bounded by Sinana and Dinsho districts in the South, Arsi zone in the North, Adaba district in the West and by Gassara district in East and the administrative center of the district is Agarfa town (Agarfa district ADO, 2013).

### Dodola district

Dodola district is divided into twenty three (23) kebeles and 4 rural towns with a total land area of 1432.46km2 (143,246 hectars) and out of this land 30.05 is arable land, 26.28% is under grazing land, 38.4% is covered by forest and 5.27% is occupied by others (such as water bodies, mountains, different constructions, etc.). According to Central statistics Authority (population census, 2007), the population of Dodola district has been 153,873 out of which 75,783 is male and 78,090 is female. It is estimated that 12,464 (8.1%) are urban dwellers and out of which 50.2% are female, and 141,409 (91.9%) are rural dwellers and out of which 51% are female. There are about 18,620 male-headed households and 3400 female-headed households in the district. More than 95% of the population is engaged in agriculture.
The agro-ecological zones of the district are Dega (91%), Woynadega (8%) and Kolla (1%). The altitude ranges from 1500m to 3655 m.a.s.l. The annual average temperature of the district is found between 12oc-25oc. The annual average rainfall is 1109.5mm where as the minimum and maximum rainfall is 800mm and 1419mm respectively. The dominant soil type is loamy clay and pellic vertisols. The district shares bounder line with Gadab Hasasa in the north, Kokosa and Kofale in the west, Adaba in the East, and Nensebo in the south and the administrative center of the district is Dodola town (Dodola district ADO, 2013).

**Sampling Techniques and Sample Size**

**Sample size determination**

In principle, accurate information about the given population could be obtained only from a census study. However, due to financial and time constraints, in many cases a complete coverage of a population is not possible. Thus, taking optimum, manageable and representative sample size is recommended to infer about the population. Sampling is one of the methods, which allows the researcher to study a relatively small number of units representing the whole population (Kaba, 2009). Hence, this study applied a simplified formula provided by (Yamane, 1967 as cited in Udayakumara *et al.*, 2010) to determine the required sample size at 95% confidence level, degree of variability=0.05 and level of precision= 7% (0.07); $n = \dfrac{N}{1 + N(e)^2}$ ; where **'N'** is total population/sampling frame for the study kebeles, **'n'** is sample size and 'e' is margin of error at 0.07. $\dfrac{748}{1+748(0.07)^2} = \dfrac{748}{4.67} = \mathbf{160{=}n}$

**Sampling techniques**

A multi-stage purposive sampling technique was employed to select ISSD Ethiopia program- LSB project intervention region, zones, districts, kebeles and female-headed households for the study. Dureti Tullu SPMC from Waltai Barisa kebele of Sinana district, Elabidu LSB from Elabidu kebele of Agarfa district, Wirtu Kachama SPMC from Kachama Chare kebele and Barisa SPMC from Barisa kebele of Dodola district were selected for the study because of their good experience in farmer based seed multiplication. After having fresh list of the study population from the selected four kebeles, FHHs were selected using stratified sampling and samples were allocated across the four kebeles based on probability proportional to size (PPS) sampling technique. Again, stratified sampling was employed to have participants and non-participants FHHs. Probability (simple) random sampling method was employed in order to have a total of 160 sample respondents (68 participants and 92 non-participants in SPMCs/LSBs) for the study purpose. Thus, for this study both purposive and probability sampling were employed.

**Table 1:** Distribution of total population of the selected Kebeles and sample respondents

| No | Selected Kebeles (with SPMCs) | Kebele Households | | | Sample respondents | | |
|---|---|---|---|---|---|---|---|
| | | Male-headed | Female-headed (FHHs) | Total | Participants in SPMCs | Non-participants | Total sample |
| 1 | Waltai Barisa | 428 | 108(20.2%)=N1 | 536 | 5 | 18 | 23=n1 |
| 2 | Elabidu | 538 | 127(19.1%)=N2 | 665 | 15 | 12 | 27=n2 |
| 3 | Kachama Chare | 1288 | 364(22%)=N3 | 1652 | 20 | 58 | 78=n3 |
| 4 | Barisa | 595 | 149(20%)=N4 | 744 | 28 | 4 | 32=n4 |
| | **Total** | | **748=N** | | **68** | **92** | **160=n** |

**Source:** Kebeles Administration Office and own survey result, 2014

As it is shown above in Table 1, women farmers who have land ownership certificate and landholders are 20.2%, 19.1%, 22% and 20% in Waltai Barisa, Elabidu, Kachama Chare and Barisa Kebeles, respectively. This result supports the previous research findings. Only 10 to 20% of all landholders are women (Vuyiseka, 2012) and about 20% of landholders are women (FAO, 2013).

**Key:**

N1 + N2 + N3 + N4= N is total population/sampling frame for the study

N1=Total FHHs in Waltai Barisa kebele,    n1=Total sample from Waltai Barisa kebele,

N2= Total FHHs in Elabidu kebele,      n2=Total sample from Elabidu kebele,

N3= Total FHHs in Kachama Chare kebele, n3=Total sample from Kachama Chare kebele,

N4= Total FHHs in Barisa kebele,        n4=Total sample from Barisa kebele,

P= Participants in SPMCs/LSBs,       TP= Total participant sample respondents

NP= Non-participants in SPMCs/LSBs,   TNP= Total non-participant sample respondents

## Data Types and Sources

To have a complete scene of the topic under investigation, both qualitative and quantitative data were collected from primary and secondary sources through different methods.

### Primary data

The primary data were collected through household survey from the selected 160 sample respondents (68 participants and 92 non-participants in SPMCs/LSBs). The collected data were based on the independent/explanatory variables, which were hypothesized to influence the women farmers' decision to participate in seed producers and marketing cooperatives. These independent variables include demographic, socio-economic, communication, institutional and social-cultural factors. Focus Group Discussion (FGD), Key Informant Interview (KII) and personal observation were used to get relevant information to the topic. During FGD with the selected discussant, multiple choices individual, group and/or group interaction data were generated.

### Secondary data

According to CARE (2002), some of the most common sources of secondary data include official reports (monthly, quarter, annual, progress, etc.), official statistical reports (eg. CSA), technical reports, project reports, baseline studies, project evaluations, professional and academic journals, reference books, bulletins, proceedings, FAO publications, unpublished thesis and documents, IFPRI publications, government officials, computerized data bases and internet web sites. Relevant information were also collected from several secondary sources such as zone and district Cooperative Promotion Offices, zone and district Agriculture and Rural Development Offices, kebele level SPMC office, Women's Affairs office and NGOs.

Secondary data review involves collecting and analyzing a vast array of information. Hence, secondary data such as targeting strategy to select members of cooperatives, history and characteristics of SPMCs, the proportion and participation of women farmers in SPMCs/LSBs, seed sources for women farmers and distribution mechanisms, partners/stakeholders and their roles in SPMCs, institutional arrangement, problems related to seed production and marketing in the area of study, different seed interventions, the support of LSB project to seed producers and marketing cooperatives and their achievements were collected through reviewing the various relevant published and unpublished documents available for use.

## Methods of Data Collection

Interview schedule was designed according to the objectives of the study. All the quantitative data were collected from sample respondents through personal interview by using structured interview schedule. Eight enumerators were selected (four researchers from Sinana Agricultural Research Center and four development agents/DAs from the study area) based on their capacity/knowledge, proficiency in Afan Oromo language, experience and knowing the study area very well. They were trained for one day on how to approach the respondents and how to administer the interview schedule. Kebele leaders and DAs were consulted on identifying the appropriate time to get the sample respondents for data collection. Lists of FHHs in the selected kebeles and SPMCs/LSBs were taken as a sampling frame.

Before effecting the quantitative data gathering by using personal interview technique, the questionnaire was pre-tested intensively with 20 non-sample women farmers through pilot survey at Dodola as a pilot testing to assess whether the target households and enumerators can understand each other, simplicity of the questions for interviewees' understanding the meaning and intention of the question, inclusiveness of all response options (unexpected response) and finally, amendments were made based on the feedback. The edited structured questionnaire was used for formal household survey. The survey was conducted in January and February 2014. Continuous supervision was made by principal researcher to correct possible error on the spot during actual survey. Completed interview schedule was reviewed and checked every day to make sure that there is no fault and ambiguity.

FGD and KII were used to collect qualitative data. Checklist questions were prepared to capture the divergent idea on a common purpose. For FGD, a team having 6 to 7 members (representatives of the groups) was purposively selected from homogenous group to discuss on a common purpose. A total of eight FGD were conducted; two times at each Kebeles with two different homogenous groups (6 discussant/women farmers from participants and 7 discussant from non-participants), separately. The discussants selected based on variation of age, literacy and economic status, and as perceived locally to come with different views. In the case of FGD, there was no interview during data collection, rather note taking method and it was supported by tape recorder to record their voice to simplify the process of data analysis.

 For KII, in-depth interview was conducted with selected individuals (18 key informants) who have better knowledge, experiences and those who are expected to give important information about the SPMCs/LSBs in the study area. Accordingly, four (4) SPMCs leaders, three (3) district agricultural and cooperative promotion experts, three (3) district Women's Affairs, four (4) Kebele Women's Affairs and four (4) DAs were interviewed for this purpose.

## Methods of Data Analysis

The data analysis method was selected based on the nature of the data and objective of the study. The households' data were analyzed using descriptive statistics and econometric model, so as to draw meaningful inferences about the problem under investigation. Microsoft Office Excel 2007, Statistical Package for Social Science (SPSS) version 20 (for data entry and cleaning) and STATA version 11 (for analysis) were used as tools for data entry and analysis. Likert type scale was used to measure attitude towards SPMCs.

## Descriptive statistics

After the organization of the quantitative data, descriptive statistics such as frequency of occurrence, percentages, mean, range and standard deviations were employed to compare and contrast the two categories (participant and non-participant) of sample respondents with respect to different personal

and demographic, economic, communication, institutional, socio-cultural characteristics and women's empowerment in agriculture. Moreover, the potential explanatory variables hypothesized to affect women farmers' participation in SPMCs/LSBs were tested, whether they are statistically significant or not using t-statistics and chi-square ($\chi 2$) tests. The independent samples t-test was used to test the significance of the mean value of continuous variables of the groups of participant and non-participant women farmers. Similarly, potential dummy explanatory variables were tested using the $\chi 2$ test. The statistical package SPSS version 20 was employed to compute these statistical tests.

## Econometric model

Econometrics is the application of mathematical statistics to economic data to obtain numerical result (Gujarati, 2004). To achieve the second objective of the study, binary logistic regression model was also employed to identify determinant factors that affect the participation of women farmers in SPMCs/LSBs in the study area. In other words, it was used to determine the relative influence of the independent variables on the dependent variable. In this study, "women farmers' participation in SPMCs/LSBs" is treated as dichotomous variable. Participation in SPMCs/LSBs is therefore, a dummy dependent variable that does not satisfy the assumption of the linear regression model. The most widely used approaches to estimate dummy dependent variables regression models are the linear probability model (LPM), the logit, the probit and the tobit models (Gujarati, 1995; Kaba, 2009).

### Model specification - The Logit Model

Following Gujarati (2004) the functional form of logit mode (logistic distribution function for the participation in SPMC/LSB) can be specified as follows:

$$Pi = \frac{1}{1 + e^{-(\beta_0 - \beta_1 X_i)}} \quad \text{…………………………….…..…....……..……. (1)}$$

For ease of expression, we can write equation (1) as follows:

$$Pi = \frac{1}{1 + e^{-zi}} \quad \text{………………….............……………...…………… (2)}$$

**Where,** Pi is the probability of participation in SPMC/LSB for the $i^{th}$ farmer and it ranges from 0 to 1. It is the observed response of the $i^{th}$ farmer (i.e. the binary variable, P=1 for participant, P=0 for non-participant). The probability that a given HH participate in SPMC is expressed by **(2).**

$$Z_i = \beta_0 + \beta_1 X_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_n X_n$$

$\beta_0 =$ is an intercept/constant

$\beta_1, \beta_2, \beta_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, \beta n =$ are slopes of the equation

$X_i =$ n explanatory variables or $X_1 \text{------------} X_n$ are independent/explanatory variables

If Pi, the probability of participating in **S**PMC/LSB, is given by equation **(2)**, then (1-Pi), the probability of not participating in **S**PMC/LSB, is:

$$1 - Pi = \frac{1}{1 + e^{zi}} \quad \text{………………….…….…..……...………… (3)}$$

Therefore, we can write: $\frac{Pi}{1-Pi} = \frac{1 + e^{zi}}{1 + e^{-zi}} = e^{zi}$ … … … … … … … … … … …. … … … … (4)

Then, $\frac{Pi}{(1-Pi)}$ is simply the odds ratio in favour of FHHs participation in LSB/SPMC (i.e. the ratio of the probability a household head will participate in SPMC/LSB to the probability a household head will not participate in SPMC/LSB).

Finally, taking the natural logarithm of the equation **(4),** we obtain:

$$L_i= \text{in } \frac{Pi}{(1-Pi)}= Z_i= \beta_0 + \beta_1 X_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

If the disturbance term (Ui) is introduced, the logit model becomes or for estimation purpose, we write equation **(5)** as follows:

$$L_i= \text{in } \frac{Pi}{(1-Pi)}= Z_i= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n U_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(6)$$

$X_i$= Vector of relevant explanatory variable

$L_i$= is log of the odds ratio, which is not only linear in $X_1$ but also (from the estimation view point) linear in parameters.

L is called the logit, and hence the name logit model for models likes equation (**5**).

**Estimation procedure**

**Testing multicollinearity problem**

Prior to the estimation of the model parameters, it is crucial to look into the problem of multicolinearity among the potential hypothesized independent variables. The reason for this is that if multicollinearity turns out to be present, regression results obtained might not be used to make valid policy recommendations. Before running the binary logit regression all the hypothesized independent/explanatory variables were checked for the existence of mulitcollineality problem among them. It was measured using Variance Inflation Factor (VIF).

According to Gujarati (2004), VIF can be defined as: VIF $(X_i) = \frac{1}{1-R_i^2}$ , Where $R_i^2$ is the coefficient of determination when the variable *Xi* is regressed on the other explanatory variables. A statistical package known as SPSS version 20 was employed to compute these values. Once $R^2$ values were obtained, the VIF values can be computed using the formula. As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if Ri $^2$ exceeds 0.95), the variable is said to be exhibit collinearity (Gujarati, 2004). Thus, it is quite essential to omit the variable with the VIF value exceeds 10. Similarly, there may be also interaction between qualitative variables, which can lead to the problem of mulitcollineality. To detect this problem, coefficients of contingency were computed. The contingency coefficient was computed as follows: C= $\sqrt{\frac{\chi^2}{n+\chi^2}}$

Where, C is coefficient of contingency, $\chi^2$ is chi-square test and n = total sample respondents. As a rule of thumb, variable with contingency coefficient below 0.75 shows weak association with others and is recommended. The value above 0.75 indicates strong association of variables and should be omitted.

### Definition and Hypothesis of Variables

Once the analytical procedures and their requirements are known, it is necessary to identify the potential explanatory/independent variables and describe their measurements. Accordingly, key variables that were expected to have influence on households' (FHH) decision to participate in SPMCs are explained below.

### Dependent/explained variable

**Operational definition:** The following terms were defined according to the meaning they have in this study.

The dependent variable operationalized for this study is whether or not the female-headed household participates in SPMC. In this study, women farmers' participation in SPMC/LSB is treated as a dichotomous dependent variable, i.e., it takes the value 1 if the FHH participate (membership) in SPMC/LSB, and 0 otherwise. Therefore, the information to categorize FHHs into participatory and non- participatory groups is based on household heads' membership in the agricultural cooperatives, particularly, in SPMCs/LSBs.

**Agricultural cooperative membership:** It is expected that women farmer (FHHs) that are into SPMCs have received assistances/support from LSB project that can enable them to increase their level of involvement in seed production, management, post harvest handling, storing, processing (value addition) and marketing, and become seed entrepreneurship.

**Women farmer** operationalized in this study is FHHs who is characterized by divorced or widowed or married in a polygamy situation, but separated (means not officially divorced), living alone with or without their children and without the mediation of husband or father in the routine day to day activities of the household, has land ownership certificate and organized in one to five development group. This study did not include women farmers living with their husband in male-headed household (dual-adult) and have land ownership certificate in common with their husband.

**The seed system** operationalized in this study is the intermediary or community based and cooperative seed system, which is commonly known as Community-Based Seed System (CBSS).

### Description of Independent/Explanatory Variables

**Table 2:** Independent/explanatory variables code, type, definition and measurement

| No | Variables code | Variable Type | Variables and measurement | Sign of the variables | |
|----|----------------|---------------|---------------------------|----------|----------|
|    |                |               |                           | Expected | Observed |
| 1  | HHAGE          | Continuous    | Age of the household head (in years) | - | - |
| 2  | EDUCALE        | Dummy         | Education level of the household head (0=Illiterate, 1=Literate) | + | + |
| 3  | FAMLSIZ        | Continuous    | Family size in number of family member | + | + |
| 4  | UHIRLABO       | Dummy         | Household head use of hired labour (No = 0, Yes =1) | + | + |
| 5  | FARMSIZ        | Continuous    | Farm size of the household head (in hectare) | + | + |
| 6  | USEOFCRE       | Dummy         | Use of credit by the household head (No | + | + |

| 7 | TANINCOM | Continuous | Total annual income (on-farm, off-farm, non-farm) of the household head (in Ethiopian Birr) | + | + |
|---|---|---|---|---|---|
| | | | = 0, Yes =1) | | |
| 8 | DACONTA | Dummy | DA contact of the household head (Weak =0, Strong =1) | + | + |
| 9 | MASMEDEX | Dummy | Mass media exposure of the household head (to radio, TV, printed materials and public meetings) (No = 0, Yes =1) | + | + |
| 10 | EXTSERPA | Dummy | Participation of the household head on extension services such as attending training, demonstration, field days, hosting on-farm trials and extension visits at/outside FTC (No = 0, Yes =1) | + | + |
| 11 | WOREPROL | Dummy | Reproductive role of the household head - whether the household head perceive that this role affect their participation (No = 0, Yes =1) | - | - |
| 12 | ATIONLSB | Categorical | Attitude of the household head towards the profitability of SPMCs (Likert type scale) to (Low=1, Medium=2, High=3) | + | + |
| 13 | LEVEMPOW | Dummy | Women farmers' level of empowerment in agriculture (0=Not-empowered, 1=Empowered) | + | + |

**Source:** Own construct, 2014

## Results and Discussions

### Overview of the selected SPMCs/LSBs

From the total members in four selected SPMCs/LSBs, the proportion of women farmers is only 69(19.6%) and men farmers constitutes the largest number 283(80.4%) in mixed-sex farmers' group (Table 3). This figure showed that women still underrepresented both in membership and leadership position in all SPMCs in the study area.

**Table 3:** Description/profile of the selected seed producers and marketing cooperatives

| No | Zone | District | Number of selected SPMCs/LSBs | Name of the SPMC/LSB | Year of establishment | Members | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Male | Female | Total |
| **1** | Bale | Sinana | 1 | Dureti Tullu | 2007 | 70 | 6(7.9%) | 76 |
| **2** | Bale | Agarfa | 1 | Elabidu | 2010 | 73 | 15(17.1%) | 88 |
| **3** | West Arsi | Dodola | 2 | Wirtu-Kachama | 2007 | 80 | 20 (20%) | 100 |
| | | | | Barisa | 2011 | 60 | 28(31.8%) | 88 |
| | | **Total** | **4** | | | **283** | **69** | **352** |

**Source:** Bale and West Arsi Zones Cooperative Promotion Office, 2014

**Descriptive Statistics**

T-test (for continuous variables) and $\chi 2$- test (for dummy/categorized variables) were also employed to test the significant level of the explanatory variables.

**Table 4:** Relationship between continuous independent/explanatory variables and women farmers' participation in SPMCs/LSBs (n=160)

| Variable | Respondent category | n | Mean | S.D. | Maxi. | Mini. | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| Age of the sampled respondents | Participant | 68 | 42.76 | 6.20 | 58 | 35 | | |
| | Non-participant | 92 | 48.64 | 5.33 | 58 | 39 | | |
| | **Total** | 160 | 46.14 | 6.40 | 58 | 35 | -6.433*** | 0.000 |
| Family size | Participant | 68 | 6.54 | 0.74 | 8 | 5 | | |
| | Non-participant | 92 | 5.74 | 0.85 | 7 | 4 | | |
| | **Total** | 160 | 6.08 | 0.90 | 8 | 4 | 6.246*** | 0.000 |
| Farm size of the sampled respondents | Participant | 68 | 3.88 | 0.59 | 5.00 | 2.80 | | |
| | Non-participant | 92 | 3.17 | 0.45 | 4.25 | 1.50 | | |
| | **Total** | 160 | 3.47 | 0.62 | 5.00 | 1.50 | 8.663*** | 0.000 |
| Total annual income the respondents | Participant | 68 | 41187 | 4443 | 52830 | 25060 | | |
| | Non-participant | 92 | 32025 | 4418 | 43800 | 20750 | | |
| | **Total** | 160 | 35919 | 6335 | 52830 | 20750 | 12.937*** | 0.000 |

**Source:** Own survey result, 2014

**Note: ***= Significant at 1% probability level, n= number of sample respondents,
S.D. = Standard Deviation, Maxi. = Maximum, Mini. = Minimum

**Table 5.** Association between dummy/categorized independent/explanatory variables and women farmers' participation in SPMCs/LSBs (n=160)

| Variable | Response category | Respondent category | | | | | | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Participant | | Non-participant | | Total | | | |
| | | F | % | F | % | F | % | | |
| Educational level | Illiterate | 24 | 35.3 | 58 | 63.0 | 82 | 51.2 | | |
| | Literate | 44 | 64.7 | 34 | 37.0 | 78 | 48.8 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 12.051*** | 0.001 |
| Use of hired labour | No | 31 | 45.6 | 53 | 57.6 | 84 | 52.5 | | |
| | Yes | 37 | 54.4 | 39 | 42.4 | 76 | 47.5 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 2.266[NS] | 0.151 |
| DA contact of the sampled respondents | Weak | 27 | 39.7 | 48 | 52.2 | 75 | 46.9 | | |
| | Strong | 41 | 60.3 | 44 | 47.8 | 85 | 53.1 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 2.441[NS] | 0.149 |
| Mass media exposure | No | 23 | 33.8 | 54 | 58.7 | 77 | 48.1 | | |
| | Yes | 45 | 66.2 | 38 | 41.3 | 83 | 51.9 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 9.689*** | 0.002 |
| Use of credit in 2012/13 | No | 32 | 47.1 | 78 | 84.8 | 110 | 68.8 | | |
| | Yes | 36 | 52.9 | 14 | 15.2 | 50 | 31.2 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 25.899*** | 0.000 |
| Participation on extension | No | 17 | 25 | 29 | 31.5 | 46 | 28.7 | | |
| | Yes | 51 | 75 | 63 | 68.5 | 114 | 71.3 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| services | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 0.812$^{NS}$ | 0.384 |
| Women's | No | 23 | 33.8 | 19 | 20.7 | 42 | 26.2 | | |
| reproductive | Yes | 45 | 66.2 | 73 | 79.3 | 118 | 73.8 | | |
| role | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 3.504* | 0.071 |
| Attitude | Low | 0 | 0 | 27 | 29.3 | 27 | 16.9 | | |
| towards | Medium | 15 | 22.1 | 65 | 70.7 | 80 | 50.0 | | |
| SPMC/LSB | High | 53 | 77.9 | 0 | 0 | 53 | 33.1 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 110.128*** | 0.000 |
| Women farmers' level of empowerment | Not-empowered | 22 | 32.4 | 62 | 67.4 | 84 | 52.5 | | |
| | empowered | 46 | 67.6 | 30 | 32.6 | 76 | 47.5 | | |
| | **Total** | 68 | 100 | 92 | 100 | 160 | 100 | 19.249*** | 0.000 |

**Source:** Own survey result, 2014

**Note: ***, \*= Significant at 1% and 10% probability level, respectively
        F=Frequency, NS=Non-significant

## Empirical Results of the Econometric (Binary Logistic Regression) Model

### Factors determining participation of women farmers in SPMCs/LSBs

Not only identification of the variables but also the relative influence of each variable should be known for priority based intervention. Thus, in order to identify variables determining participation of women farmers in SPMCs, the binary logistic regression econometric model was estimated using maximum likelihood estimation procedure. Prior to the analysis of the data, it was found important to look into the problem of multicollinearity or linear association among the hypothesized explanatory variables. Based on the standard given, there was no problem of multicollinarity among continuous as well as dummy/categorized explanatory variables.

Attitude of women farmers towards the profitability of SPMCs/LSBs excluded from the model, because the model didn`t run perfectly and disturbed other variables. Then, a total of twelve (12) independent variables out of which four (4) potential continuous and eight (8) dummy variables were entered all together into the binary logistic regression model analysis to determine the best subset of independent variables that are good predictors of the dependent variable. Of these, the coefficient and marginal effect (Table 6) showed that education level, farm size, women's reproductive role and use of credit services of the household head were important variables and should be considered for priority intervention.

**Table 6:** Results of the maximum likelihood estimates of the binary logit model (n=160)

| Explanatory Variables | Coefficient | Standard error | Marginal effect dy/dx | P-value |
|---|---|---|---|---|
| HHAGE | **- 0.41705*** | 0.02731 | **- 0.07763** | **0.004** |
| EDUCALE | **3.98312*** | 0.16468 | **0.67170** | **0.000** |
| FAMLSIZ | **1.48865*** | 0.16758 | **0.27709** | **0.098** |
| UHIRLABO | 0.38707$^{NS}$ | 0.22099 | 0.07164 | 0.746 |
| FARMSIZ | **3.34633*** | 0.33366 | **0.62286** | **0.062** |
| TANINCOM | **0.03247**** | 0.03421 | **0.06513** | **0.023** |
| DACONTA | 0.24480$^{NS}$ | 0.23064 | 0.04573 | 0.843 |
| MASMEDEX | 1.25995$^{NS}$ | 0.18395 | 0.22999 | 0.211 |
| USEOFCRE | **2.38043*** | 0.26458 | **0.49289** | **0.062** |
| EXTSERPA | 1.60999$^{NS}$ | 0.17574 | 0.24846 | 0.157 |
| WOREPROL | **- 2.59206**** | 0.27744 | **- 0.54702** | **0.049** |
| LEVEMPOW | 1.78897$^{NS}$ | 0.21461 | 0.33347 | 0.120 |
| **Constant** | -18.09698** | 7.89387 | 0.24728 | **0.022** |

**Source:** Survey data and model output, 2014          Number of observation=160
Log likelihood function = -16.00448          LR Pearson Chi-Square (12) = 186.18
Pseudo $R^2$ = 0.8533 (correctly predicted overall sample = 85.33%), Prob. > $\chi2$ = 0.0000
**Note: ***, ** and *** = Significant at 1%, 5% and 10% probability levels, respectively.

### Elaboration of significant independent/explanatory variables

**Age of the sampled respondents (HHAGE):** The model analysis result (Table 6) showed that age of the household head has negatively and significantly affected participation of women farmers in SPMCs/LSBs at 1% significance level. The possible explanation is that as age of the household head increases, the tendency to participate in SPMC decreases. The marginal effect for this variable indicates that a one year increase in age would decrease the probability of women farmers' participation in SPMCs/LSBs by 0.078(7.8%) assuming all other factors keep constant. This result agrees with the findings of Jemal (2008), Damisa et al., (2007), Ahmed (2010), Firew (2010) and Daniel (2013), who reported that young and middle aged farmers are agile, dedicated, more active, innovators and participate in and spend much of their time on agricultural production activities. This implies that targeting this group of women farmers in the intervention of farmer based seed multiplication (local seed business model) is probably advisable, as they tend to be risk takers, less resistant, more active in understanding new innovations and flexible in their decisions to participate in new venture.

**Education level of the sampled respondents (EDUCALE):** The model output (Table 6) indicated that formal educational qualification of the household head had positive and highly significant influence on the probability of women farmers' participation in SPMCs/LSBs at 1% significance level. The probable reason is that education can change the outlook of farmers through enhancing understanding of innovations and is thought to create a favorable mental attitude for the willingness and acceptance of new venture. The marginal effect for this variable shows that a one year of schooling (a one grade) increases in educational level increases the probability of participation in SPMCs/LSBs by 0.672(67.2%) keeping all other factors constant. This result is in agreement with the findings of Kaba (2009), Bawa et al., (2010), Mengistu (2012), Thomas and Fanaye (2012) and Daniel (2013), who revealed that educated farmers can get information from a wide range of sources and use their abilities to secure the necessary information as a powerful instrument for attaining the desired objectives. This implies that the more education to women farmers means the more likelihood to enhance their ability to acquire, analyze, interpret and use information relevant to the new innovation. The result suggests the need to educate women farmers who had low education level to be more productive and enhance participation in SPMCs in the study area.

**Total annual income of the sampled respondents (TANINCOM):** The model analysis result (Table 6) revealed that total annual income has affected the participation of women farmers in SPMCs/LSBs positively and significantly at 5% probability level. The probable reason is that income is one of the basic factors for the people to increase their participation in different economic and/or social groups and can perform development activities. Respondents generated their incomes from different income sources. The marginal effect for this variable indicates that a unit increases in total annual income would increases the probability of participation in SPMCs/LSBs by 0.065(6.5%) controlling the influence of all other variables constant. The result supports the findings of Damisa et al. (2007), Mengistu (2012) and Daniel (2013), who concluded that more income earnings of farmers enable them to meet the financial outlay required in agricultural production. This might imply that women farmers who have more income would invest more to meet the technical and logistic needs in seed production, management and marketing (on seed value addition) activities, and ability to bear risk. This suggests the need for institutional arrangements and collaboration of support institutions to diversify income for women farmers and enhance participation in the study area.

**Women's reproductive role (WOREPROL):** The model analysis result (Table 6) showed that women's reproductive role has negatively and significantly affected participation of women farmers in SPMCs/LSBs at 5% significance level. The possible explanation is that women's reproductive and

domestic responsibilities constitute their main role, and limit/restrict women participation in economic and/or social groups and public leadership activities outside the household sphere and places. Thus, it is the root cause of their heavy work burden/workload, time and mobility constraints. The marginal effect for this variable indicates that a unit increases in reproductive activity would result in the probability of decreasing women farmers' participation in SPMCs/LSBs by 0.547 (54.7%) keeping all other variables constant. This result is in agreement with the findings of Mahlet (2005), Kaba (2009), Bekele (2011), Vuviseka (2012) and Omer (2013), who concluded that reproductive activities are tedious, take more of their time, energy and consume their productive working time to participate in innovations. This suggests the need to suppress and have manageable workload, to relax their time and mobility, and enhance participation in the study area.

**Family size of the sampled respondents (FAMLSIZ):** As the model result (Table 6) depicts the variable family size had positive and significant influence on the likelihood of women farmers' participation in SPMCs/LSBs at 10% significance level. Probably, participation in SPMC increases the seasonal demand of labour since seed production and marketing process need intensive management. Hence, participation is more attractive to households with a large number of family members having economically active labourforce. The marginal effect of family size indicates that a one person increases in family size would result in the probability of increasing women farmers' participation in SPMCs/LSBs by 0.277(27.7%) assuming all other factors keep constant. This result is in agreement with the findings of Gezahegn (2008), Mengistu (2012) and Thomas and Fanaye (2012), who identified as households having productive labourforce have more inclination towards participating in agricultural production activities/innovations. This suggests the need to enable family labour more productive and efficient to enhance participation in the study area.

**Farm size of the sampled respondents (FARMSIZ):** The analysis result (Table 6) indicated that farm size of the household head had positive and significant influence on the likelihood of women farmers' participation in SPMCs/LSBs at 10% significance level. The possible explanation is that many agricultural innovations require substantial productive resources of which land is the key asset. Thus, household with larger cultivated land are more willing to participate in seed production activities and allocate better proportion of land as compared to farmers with small farm size. The marginal effect of farm size shows that a one hectare increases in the size of cultivated land would result in the probability of increasing women farmers' participation in SPMCs/LSBs by 0.623 (62.3%) keeping all other variables constant. This result is goes in line with the findings of Karl *et al.*, (2006), Gezahegn (2008), Kaba (2009), Ahmed (2010), Firew (2010), Mengistu (2012), and Thomas and Fanaye (2012), who identified farm size as the most important variable explaining participation decisions by farm household head in agricultural innovations. This suggests the need to support women farmers who had small farm size to enhance participation in the study area.

**Use of credit services of the sampled respondents (USEOFCRE):** The model output (Table 6) revealed that use of credit had positive and significant influence on the probability of women farmers' participation in SPMCs/LSBs at 10% significance level. Possibly, farmers who have access to and use credit services from formal organizations like micro-finance institutions more probable to participate in SPMC and invest in seed production, management and marketing activities than those who have not. The marginal effect of use of credit services indicates that a unit increases in use of credit services would result in the probability of increasing women farmers' participation in SPMC by 0.493 (49.3%) controlling the influence of all other variables constant. This result matches with similar findings of Jemal (2008), Gezahegn (2008), Asmamawu (2009), Kaba (2009), Firew (2010) and Mesay et al., (2013), who indicated that the lack of access to and use of credit services (in cash/kind) significantly inhibits household head decision to participation in agricultural production/innovations. This suggests the need of support institutions that can access women farmers in credit/financial services to enhance participation in productive and income generating activities in the study area.

**Conclusions and Recommendations**

**Conclusions**

Variation in participation among the sampled respondents was assessed in view of various factors (demographic, socio-economic, communication, institutional, social-cultural factors and women farmers' level of empowerment) theoretically known to influence farmers' participation in new innovation. Result of descriptive statistics using t-test and chi-square tests indicated that out of thirteen (13) explanatory variables, ten (10) such as age, education level, family size, farm size, total annual income, mass media exposure, use of credit services, women's reproductive role, attitude towards the profitability of SPMCs/LSBs and women farmers' level of empowerment had relationship/association with participation of women farmers in SPMCs/LSBs at different significance level. Conversely, there is no association between three (3) variables such as use of hired labour, DA contact and participation on extension services, and participation of women farmers in SPMCs.

A total of twelve (12) explanatory variables were included into the model of which seven (7) of them had shown statistically significant influence on women farmers' participation in SPMC at different significance level. Accordingly, education level, total annual income, family size, farm size and use of credit were found to have positive and significant influence on women farmers' participation in SPMC at 1%, 5%, 10%, 10% and 10% significance level, respectively. Contrary to this, age of the sampled respondents and women's reproductive role had shown negative and significant influence on the participation of women farmers in SPMCs at 1% and 5% significance level, respectively. On the other hand, the remaining five (5) dummy explanatory variables such as use of hired labour, DA contact, mass media exposure, participation on extension services and women farmers' level of empowerment in agriculture were found to have no significant influence on the participation of women farmers in SPMCs. This might imply that there is no statistically significant difference between participants and non-participants categories in these variables.

Younger and middle aged women farmers, educated, those with larger and economically productive family size, had better asset holding (land, livestock), income, access to and use credit services from formal organizations and manageable workload have better tendency to participate in SPMCs/LSBs. The findings indicate that the more the women farmers are educated; have better asset holdings and efficient delivery of services, the more tendencies to participate in SPMCs/LSBs. Furthermore, the coefficient and marginal effect (Table 6) showed that education level, farm size, women's reproductive role and use of credit services of the household head were important variables and should be considered for priority intervention.

**Recommendations**

This study has identified key factors that influenced the participation of women farmers in SPMCs/LSBs, which needs due attention by concerned, potential and collaborative stakeholders. Thus, the following points were recommended for consideration in improving women farmers' participation in SPMCs/LSBs so as to benefit both men and women farmers from this new business enterprise (LSB model) in the intervention area.

☐ Women have found that working together, in groups and networks, is a highly effective way of gaining access to the assets and services they need to expand their opportunities. Thus, continuous awareness creation using different communication methods for aged group and empowerment for young and middle aged women farmers should be done to enhance participation in the cooperatives in the study area.

☐ To solve the problem of illiteracy and to have educated women farmers in rural areas, the concerned partners should design education/training (formal and/or informal) programmes on

agricultural development activities based on training need assessment (TNA) and by considering women's daily calendar. For instance, modular training

☐ Having healthy and productive family members (through family planning) by improving the working habit of the economically active laborforce and labour saving agricultural technologies (farm machineries, agro-chemicals, sprayers, seed cleaning and grading machines) should be promoted in the study area.

☐ Women farmers who had small farm size should be supported through different land acquisition mechanisms, i.e., local land sharing and land renting in the study area.

☐ Having better income source (can be from on-farm, off-farm and non-farm activities) can enhance women farmers' participation in different groups, innovations and perform agricultural development activities. Hence, there should be support institutions that can contribute to the means of income diversification from livelihood strategies for women farmers in the study area.

☐ Availability of support institutions that provide credit services (without barriers) for women smallholder farmers should get attention to enhance their participation in the study area. Therefore, organizing women's group and strengthening credit schemes (rural micro finance services) specific to women farmers' needs and interests are recommended.

☐ Easing women's workloads opens up opportunities for participating in income-generating activities. Thus, gender equity, different simple, cost-effective, environmentally friendly ways of improving conditions and saving time improved technologies in the home should be introduced in the study area. Therefore, actionable policy and improved technologies (such as energy-saving stoves and biogas units that convert animal manure into gas for cooking and heating water) should be designed.

☐ In principle, voluntary and open membership law of cooperatives that allow open membership is common for all cooperative societies. Thus, all SPMCs should have clearly defined members' selection criteria/targeting strategies, open the room and have periodic selection schedule for new members so that women farmers' participation in SPMCs/LSBs will be promoted in the study area.

☐ Gender disparity in the society causes inferiority to women farmers due to norm and culture of the society in the study area. Thus, gender sensitization for cooperative organizers, leaders, DAs, experts, farmers (men, women and young) and other stakeholders is recommended.

☐ Not only women farmers' numeric representation (nominal participation), but also their interactive participation (the extent to which their voice heard and responded to) in social and/or economic groups should be studied in the future.

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# Assessment of Members' Perception on the Performance of Seed Producer and Marketing Cooperatives in Bale and West Arsi Zones

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## Abstract

*This study intended to assess the performance of seed producers' and marketing cooperative in Bale and West Arsi zones based on members' perceived performance of their cooperatives. Survey data was collected from 122 sample respondents using interview schedule and focus group discussion and analyzed using descriptive, econometric and swot analysis. Members' perception was assessed using 14 performance indicators. In general, the majority of respondents gave good evaluative performance with the overall mean score of 3.67, which is described as high extent. The value were high for indicators like provision of input and training services, leadership ability, self reliance, participation, commitment, technical support, financial growth and customer targeting, medium for marketing and credit services and low for patronage service. Among 13 variables used in the ordered logit model, education, family size, land allocated to seed, number of livestock, non-farm income and position in cooperative were positively and significantly related, while age and distance from cooperative were negatively and significantly related to the dependent variable. It indicates that the more the members are educated and the better the asset holdings, the more tendency to perceive the performance of cooperative. Moreover, the better benefit members' obtained from cooperative the more tendency to evaluate the cooperative as performing well. Therefore cooperative leaders, government and nongovernmental organizations should give emphasis for improving members' perception about their cooperative through continuous trainings, coaching, capital mobilization and improving access to different services.*

**Key words:** Seed production; cooperative members; performance; perception

## Introduction

### Background of the Study

Cooperatives are one of the institutional interventions for attaining food security in many countries of the world (Veerakumaran, 2007). In Ethiopia, cooperatives play crucial roles in the country's economic and social development (AEMFI, 2010). Agricultural cooperatives have been used for implementing agricultural development policies directed specifically towards smallholders' to render economic benefits such as economies of scale, market power, risk pooling, coordination of demand and supply and guaranteed access to input and output markets (Daniel, 2006).

Seed producers' and marketing cooperatives have a significant contribution in the country's socio-economic development by addressing the problem of food insecurity through provision of basic seed of high yielding and marketable varieties to the farmers (Amsalu, 2006). They are a new form of business enterprises established with the aim to increase efficiency of the seed production and marketing system and promote agricultural development in the rural sector of the country (Minilek *et al*., 2012).

In Ethiopia, the share of improved seed through formal system is less than 10%, while the informal seed system (either self-saved seed or farmer- to-farmer seed exchange) accounts for over 90% of the seed used by smallholder farmers (Zawdie *et al*., 2008; Ababa, 2010). So far, attempts have been made to improve seed supply by working with farmers' cooperatives through farmer-based seed production

and marketing units. Currently, many government agencies, donors and NGOs have shown great interest in supporting cooperatives in many different ways. For instance, local seed business (LSB) based farmers seed production, supported by ISSD project, were established in different part of the country since 2009, to provide a better quality seed at low cost, which cannot be attained at the level of nationally operating commercial seed companies (ISSD, 2012b).

Although much effort has been made by different organizations, the performance of many cooperatives in the country is still low due to organizational challenges such as poor internal governance, lack of comprehensive cooperative policy and strategies, technical knowledge, inadequate capacity building, poor members participation, low interest of management committee due to low incentive, strong degree of reliance on government support and lack access to loan finance (Minilek *et al*., 2012). Earlier studies have seen performance of cooperatives only from financial point of view. However, members' perception on the performance of cooperatives has impact on the success of cooperatives beyond other factors. The satisfaction level enjoyed by the members is a crucial, but often ignored, parameter for the long term success of a cooperative (Jacob *et al*., 2013). Therefore analyzing the performance of cooperatives in this context is helpful in explaining the problem in more depth and provides more information on possible solutions.

## General objective

The overall objective of the study is to assess organizational performance of SPMC in Bale and west Arsi zones.

### Specific objective

To analyze organizational performance of selected SPMC based on members' perceived performance of their cooperatives

To analyze strength, weakness, opportunities and threats of the selected cooperatives
To Asses factors affecting members perception on performance of coops

### Research Methodology

### Description of the Study Area

### Sinana district
Sinana district is located in the north western part of Bale zone. The total area of the district is about 1168km$^2$. The district has 20 peasant associations. The altitude of the district ranges from 1650m to 2950m a.s.l. The annual average temperature is 16.5$^o$c where as the minimum and maximum temperature is 9$^o$c and 23$^o$c respectively. The annual average rainfall is 1105mm. (BOFED, 2009). The major crops produced in the district are wheat, barley, pulses and oil crops. Rainfall pattern of the district is characterized by bi-modal rain fall distribution. The district has two distinct seasons, i.e. Belg which extends from March to July and Meher which extends from August to January (BZADO, 2012).

### Dodola district

Dodola is located in the West Arsi zone of Oromia Regional State at a distance of 327 km from Addis Ababa. The total area of the district is 1595 km$^2$. The altitude ranges from 2300 to 3500 masl. The

average annual rainfall ranges between 805 to 1260 mm and temperature ranges from 15 to 20.6$^{\circ}$C. The area is suitable for the production of a variety of crops including wheat, barley, field pea, faba bean, teff, lentil and maize (LSB, 2010a).

**Role of cooperatives in the study districts**

In Bale zone there are 389 primary cooperatives and 3 unions, out of which only six of them engaged in seed production and marketing. The first seed producer's cooperative in Bale zone is Dureti Tullu which was founded in 2005/06 with 75 members of which 6 of them are females. The rest five were established after 2011 (BZCPO, 2012). In Dodola district few farmers were engaged in seed multiplication activities. Before 2011, "Wirtu Kechema" was the only seed producer cooperatives, that were established with the support of by LSB project. This cooperative was licensed to produce and market seed of improved wheat varieties (LSB, 2010a). However, currently other SPM cooperatives are emerging since 2011.

**Sampling procedure and methods of data collection**

Two stage sampling were employed to select sample respondents. In the first stage two seed producers' and marketing cooperatives "Dureti-Tullu" from Bale zone and "Wirtu-Kechema" from West Arsi zone were selected based on their better experience in seed production and marketing. In the second stage 122 sample respondents were selected randomly from the two cooperatives based on probability proportional to size (PPS). The sample size for this study was determined using the formula provided by (Yemane, 1967, cited in Udayakumara *et al.*, 2010).

$$n = \frac{N}{1+Ne^2}$$ Where: n=sample size

N=Total population e=Level of Precision/Margin of error 95%

Primary data were collected from cooperative members using structured interview schedule. The instrument pre-test were undertaken on 15 farmers selected from non-sample cooperative before the actual survey and he questionnaires were improved based on the responses obtained. In addition focus group discussion was made with two groups (10 cooperative members) from each cooperative to identify strength, weakness opportunities and constraints of the selected cooperatives. Secondary data such as trends of cooperative in the country, their contribution to the betterment of members' and policy environment etc. were collected from published and unpublished materials which are relevant to the topic.

**Methods of Data Analysis**

In this study, descriptive statistics were computed, along with the econometric models and SWOT analysis and arranged in a way that allows one to quickly comprehend their meanings. Simple descriptive statistics specifically, percentage, frequency, mean and standard deviation. Chi-square test and one way ANOVA were used to test the significance of variables. On the other hand ordered logit

model were used to assess the influence of the member characteristics on the members' perceived performance of their own seed producers and marketing cooperatives.

## Definition of Variables

### Dependent variable

The dependant variable is members' perception about the performance of their cooperative which is supposed to be influenced by a complex set of socio-economic, demographic, technical and institutional factors. A total of 14 most important indicators were identified. Members were asked for each indicator with five response categories ranging from very low to very high. The values given for each response categories were 5= very high, 4=high, 3=medium, 2=low and 1= very low. As a result maximum and minimum potential mean score is 5 and 1 respectively.

### Independent Variables

| Explanatory variables | Expected Sign | Variables description |
|---|---|---|
| Age of HHH(AGEHH) | - | Age in years |
| Education level(EDULEVEL) | + | Number of schooling years |
| Sex of HHH (SEXHHH) | -/+ | Dummy, favorable response=1 |
| Family size(FAMSIZE) | - | Number of family members |
| Total land size(TLANDSIZ) | + | In hectares |
| Land allocated to seed(LANDSEED) | + | In hectares |
| Total No. of livestock (LSTLU) | + | No.(in tropical livestock unit) |
| Non farm income(NONFARMI) | + | Dummy, favorable response =1 |
| Total annual income(INCOME) | + | In birr |
| Year of membership(YMEMSHIP) | + | Year membership in  coopera |
| Distance from the cooperative(DCFH) | - | Distance in Km |
| Distance from district market (DDMKT) | + | Distance in Km |
| Position in cooperative (POSITION) | + | Dummy, favorable response =1 |

## Result and Discussion
### The Study Cooperatives
As indicated in the methodology part Dureti-Tullu and Wirtu-Kechema seed producers' cooperatives were used in this study. The sampled cooperatives were established in 2007. They have well established organizational structure and bylaws. They are legally registered under zone cooperative agency. Number of members and total capital owned by the cooperative is indicated in table 3 below.

**Table 1. Profile of the selected SPMCs**

| S. No | Name of the SPM coop | Zone | Woreda | Year Establi | Members | | | Total Capital |
|---|---|---|---|---|---|---|---|---|
| | | | | | Male | Female | Total | |
| 1 | Dureti-Tullu | Bale | Sinana | 2007 | 69 | 6 | 75 | 509,824.49 |
| 2 | Wirtu-Kechema | W. Arsi | Dodola | 2007 | 80 | 20 | 100 | 870,420.27 |

## Performance of the cooperatives

The performance of cooperative can be influenced by complex set of organizational, institutional and technical factors (Gumataw *et al.,* 2011). In this study it was assessed based on these factors as follows:

## Institutional Factors

## Input, credit and marketing Services

The sample cooperatives are important source of input to their members. About 57.3% of the respondents have obtained basic seed, fertilizer and herbicide from their cooperatives during 2012/13 production year. The sample cooperative does not provide credit service in the form of cash. However, they provide credit in the form of seed or other inputs. Availability of efficient marketing system has considerable importance in improving the productivity of agriculture by providing incentives to farmers and raises farmers' income. However market for improved seed is not well developed in the study area and there is a seasonal price variation. Lack of seed certification system in the country coupled with low initiation from the cooperatives to add value to the members' product made the price of seed produced by the cooperatives not significantly higher than that of the grain. To standardize seed marketing, the cooperatives should undertake value addition activities like seed cleaning, packing and labeling. Almost all the respondent perceived that there is price difference between cooperative and private traders. The sample cooperatives provide 10-15% price advantage over the market price for their members.

## Technical factor

Seed production needs high level of technical skill including pre-harvest crop management practices, post harvest handling and marketing. Pre-harvest seed management techniques include land preparation, variety selection and planting, fertilizer application, weed and disease control, rouging and harvesting. Post harvest seed handling includes cleaning and sorting, seed treatment, labeling, packing and storage. According to the sample respondents support provided by the cooperative and technical skill acquired by members is high in the area of land preparation, planting, fertilizer application, weed control, rouging, cleaning and storage but low in the area of clustering of farms, variety selection, disease control, seed treatment, labeling and packing.

**Members' perception on organizational performance of their cooperative**

Members' perception on the performance of their own cooperative is one of the determinants of the actual performance of cooperatives (Demeke, 2007). What members perceive is the interwoven result of personal, socio-economic, institutional and psychological factors. In this study, respondents' perceived performance of their cooperative was assessed using 14 important performance indicators (Appendix 1, Table 3). Perception level of sample respondents on each indicator were collected using five scales as very high, high, medium, low and very low extents with the values of 5, 4, 3, 2 and 1 respectively. Accordingly, the perception of respondents on the performance of their cooperative were categorized in to five perception categories as 1.00-1.80 for very low, 1.81-2.60 for low, 2.61-3.40 for medium, 3.41-4.20 for high and 4.21-5.00 for very high using potential and actual mean scores. The overall mean scores of respondents' perception on performance indicators were computed for the target seed producers and marketing cooperatives. The analysis result showed that the minimum and maximum mean perception score from sample respondents was 2.60 and 4.16 respectively.

**Table 3. Total mean score computed for each performance indicators.**

| Category | Very low | | Low | | Medium | | High | | Very High | | Total Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Freq | % | freq | % | freq | % | freq | % | freq | % | Score* |
| Input Service | - | - | 7 | 5.7 | 43 | 35.2 | 53 | 43.4 | 19 | 15.6 | 3.69 |
| Credit services | - | - | 13 | 10.7 | 51 | 41.8 | 49 | 40.2 | 9 | 7.4 | 3.40 |
| Training service | - | - | 2 | 1.6 | 35 | 28.7 | 63 | 51.6 | 22 | 18.0 | 3.86 |
| Marketing service | 1 | 0.8 | 7 | 5.7 | 61 | 50.0 | 46 | 37.7 | 7 | 5.7 | 3.40 |
| Price advantage | - | - | 5 | 4.1 | 31 | 25.4 | 71 | 58.2 | 15 | 12.3 | 3.78 |
| Patronage service | 45 | 36.9 | 6 | 4.9 | 31 | 25.4 | 33 | 27.0 | 7 | 5.7 | 2.60 |
| Technical support | - | - | - | - | 56 | 45.9 | 66 | 54.1 | - | - | 3.54 |
| BM accountability | - | - | 2 | 1.6 | 20 | 16.4 | 89 | 73.0 | 11 | 9.0 | 3.89 |
| Self reliance | - | - | 1 | 0.8 | 17 | 13.9 | 88 | 72.1 | 16 | 13.1 | 3.98 |
| Principles& values | - | - | - | - | 1 | 0.8 | 100 | 82.0 | 21 | 17.2 | 4.16 |
| Memb Particpation | - | - | 3 | 2.5 | 50 | 41 | 62 | 50.8 | 7 | 5.7 | 3.60 |
| Commitment | - | - | 1 | 0.8 | 33 | 27.0 | 72 | 59.0 | 16 | 13.1 | 3.84 |
| Financial growth | - | - | 1 | 0.8 | 33 | 27.0 | 73 | 59.8 | 15 | 12.3 | 3.83 |
| Customer satisfacn | - | - | 2 | 1.6 | 25 | 20.5 | 84 | 68.9 | 11 | 9.0 | 3.85 |

* Total mean score is calculated by the formula $((N1 \times 4) + (N2 \times 3) + (N3 \times 2) + (N4 \times 1))/N$

In general, the majority of respondents gave good evaluative performance to their cooperatives. Accordingly the overall mean score of respondents' perception is 3.69, which is described as high extent (Table 4). Respondents liked the competitive environment created by their cooperative in the community and evaluate cooperatives' performance by comparing their current access to better technologies and services to their non members' counterparts.

Although the majority of respondents rated their cooperatives performance as doing well, they also indicated that consideration should be given to dividend sharing, credit and marketing services that obtained medium to low mean perception score. There are also serious issues to be addressed for the 11 members of Dureti-Tullu cooperative who are not willing to buy more shares because they found the experience not rewarding.

**Table 4. Summary of the Respondents' Perception Mean Scores for selected indicators**

| Performance indicator | Perception mean score | Description of perception |
|---|---|---|
| **Service provision** | | |
|   Input service | 3.69 | High Extent |
|   Credit Service | 3.40 | Medium Extent |
|   Training Service | 3.86 | High Extent |
|   Marketing service | 3.40 | Medium Extent |
|   Patronage Service | 2.60 | Low Extent |
| **Financial aspect** | | |
|   Price advantage for members products | 3.78 | High Extent |
|   Financial Growth over time | 3.83 | High Extent |
| **Technical Aspect** | | |
|   Technical support of the coop in seed production, processing and marketing | 3.54 | High Extent |
| **Managerial ability of board managers** | | |
| Board management transparency and accountability | 3.89 | High Extent |
|    Work according to coop principles and values | 4.16 | High Extent |
| **Self reliance** | | |
|   DM ability of BoD independent of external influences | 3.98 | High Extent |
| **Participation of members in different activities** | 3.60 | High Extent |
| **Commitment to achieve coop objectives** | | |
|   BoDs, Other Committee members and Members | 3.84 | High Extent |
| **Targeting customer** | | |
|   Customer satisfaction in seed and quality aspect | 3.85 | High Extent |
| **Grand Mean** | **3.67** | **High Extent** |

Source: Own survey result 2014

## Factors affecting members perception on the performance of cooperative

In this section, ordered logit regression model were used to estimate the effects of hypothesized explanatory variables on members' perceived performance of their cooperatives using five perception categories. Multi-collinearity between hypothesized variables was tested for all variables using Variance Inflation Factor (VIF). It is quite essential to omit the variable with the VIF value exceeds 10 that happens if $Ri^2$ exceeds 0.90 and show high correlation between the variables (Gujarati, 2004). A total of 13 potential explanatory variables were selected on the basis of theoretical explanations, personal observations and association among the variables and entered into ordered logit analysis to determine the best subset of explanatory variables that are good predictors of the dependent variable. As a result, among 13 explanatory variables considered in the model, 8 of them were found significantly influence members' perceived performance of their cooperative as indicated in Table 5.

**Table 5. Determinants of members' perception on the performance of cooperatives**

| Variables | Coefficient | Std. Error | dy/dx | Significance |
|---|---|---|---|---|
| AGEHH | -0.05673** | 0.02762 | -0.01033 | 0.040 |
| SEXHH | -0.99554 | 0.72643 | -0.17468 | 0.171 |
| EDULEVEL | 0.67969** | 0.31424 | 0.11780 | 0.031 |
| FAMSIZE | 0.17039** | 0.08059 | 0.02676 | 0.034 |
| TLANDSIZ | -0.39539 | 0.25717 | -0.06922 | 0.124 |

| LANDSEED | 1.30793* | 0.67364 | 0.24538 | 0.052 |
|----------|----------|---------|---------|-------|
| NLS(TLU) | 0.24906*** | 0.08806 | 0.03978 | 0.005 |
| NONFARMI | 1.3057** | 0.59031 | 0.20750 | 0.027 |
| INCOME | 2.00e-06 | 0.00001 | 7.67e-09 | 0.894 |
| DDMKT | 0.0691 | 0.12866 | 0.01688 | 0.591 |
| YMEMSHIP | -0.0237 | 0.17947 | -0.0081 | 0.895 |
| DCFH | -0.7270*** | 0.25423 | -0.1431 | 0.004 |
| POSITION | 1.6827** | 0.75051 | 0.2112 | 0.025 |

Note: *, ** and *** = Significant at 10%, 5% and 1% probability levels respectively

**Age of the household head (AGEHH)**:  Analysis result of ordered logit model revealed that age has negatively and significantly affect members' perceived performance of their cooperative at less than 5%. This could arise from the need of high level of skill, management and input for seed production and younger members could be more active in understanding and applying technologies needed for seed production than the older ones. This result is in consistence with the findings of Demeke (2007) and Österberg (2007).

**Educational Level of the Household (EDULEVEL**): The model output revealed that education is positively and significantly related with the dependent variable at 5% level. This indicates that education helps to receive, absorb and utilize new ideas to be more productive. The result is in consistence with the finding of Chibanda *et al.* (2009) and Daniel (2013).

**Family Size (FAMSIZE):** Family size has positively and significantly affects the dependent variable at less than 5% significance level. The probable reason could be seed production need intensive management which needs increased family labor.

**Land Size allocated to seed production:** Land allocated to seed has positively and significantly influenced the perception of members on the performance of their cooperative at less than 10% significance level.  This indicates that as land allocated to seed increase the volume input purchased and product sold by farmers to their cooperatives increase. It also increases participation of members to obtain technical support, input and marketing services.

**Total Livestock holding (NLS-TLU):** Total number of livestock owned by the respondent in (TLU) has a positive and significant effect at less than 1% significance level. This indicated that household with larger TLU can have larger number of oxen to plough their land timely and sufficiently which help to produce better quality and larger amount of seed. They can have a better financial position to purchase input and demand other services from their cooperative. It is in line with the finding of Mahmud (2008).

**Non-farm income (NONFARMI**): Ordered logit model result showed that the variable has positive and significant effect at less than 5% significant level. This implies that the presence of additional income improves the farmers' financial position that in turn enables them to invest in purchasing the needed amount of farm inputs especially fertilizer and improved seed.

**Distance of the cooperative offices from the farmer house (DCFH):**  It was negatively and significantly associated with the dependent variable at less than 1% probability level. The proximity of the cooperative to the farmer house reduces the cost of time and labor that the farmer spent in searching for alternative input sources and buyers for his produces.  It also help to have more contact with cooperative management and have better chance of getting technical support. It is inconsistence with finding of Daniel (2006) and Muthyalu (2013).   .

**Position in the cooperative (POSITION**): It has positive and significant effect on the dependant variable at less than 5%.  This means having a position in cooperative increases the attachment of farmer to the cooperative than the ordinary member and help to realize the benefits of the cooperative. Moreover, those members in the cooperative leadership have better participation in all cooperative activities. It is in line with the finding of Daniel (2006).

**Linkage of SPM cooperatives with other institutions**

The linkage includes training, advisory and audit services, feedback and reports.
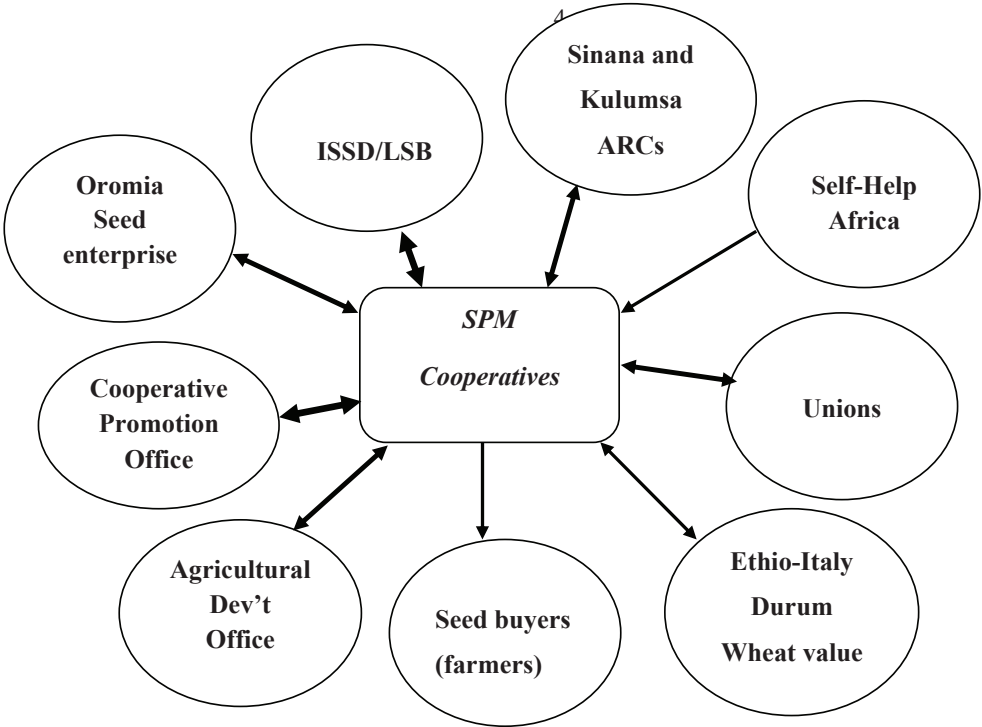


**Figure 1. Actors linkage map using sample seed producers and marketing cooperatives.**
*N.B. The closer and the thicker the arrows the closer the relation ship*

**SWOT Analysis**

| Strengths | Opportunities |
|---|---|
| 1. The Sample cooperatives are able to supply agricultural inputs like improved seed, fertilizer and agrochemicals to their members. | 1. Strong government commitment to support and promote cooperatives. |
| 2. The sample cooperatives are buying seed produced by their members at a higher average price (by 10-15%) than non-member counterparts. | 2. Establishment of good working relationships between the government and development partners |
| 3. They promote members to use improved agricultural practices through improving their access to information services. | 3. Increased demand for seed. |
| 4. Genuine scaling, timely and convenient mode of payment system and competitive price given by the cooperatives attract members. | 4. Proximity of research institutions to the cooperatives. |
| 5. The linkage of cooperatives with different GOs and NGOs improved members' access to input, training and storage facilities. | 5. Availability of GOs and NGOs that support the cooperatives |
| 6. Financial management, record keeping, documentation and information sharing system of the cooperatives were encouraging. Any information about the cooperative and their achievements is prepared in the form of charts, tables and pictures and displayed on the wall in their office. | 6. Availability of conducive environment and technologies for seed production. |
|  | 7. Presence of committed members and board directors. |
|  | 8. Existences of basic communication facilities |
|  | 9. Current owned land allows further expansion to the extent that can accommodate increased production. |
| Weaknesses | Threats |
| 1. Sample cooperatives do not sufficiently help members in providing timely market information, facilitating contractual based marketing and adjusting their products to market through value addition. | 1. Seed production highly depends on nature. |
| 2. Insufficient advertisement and promotional works to attract new members and potential customers | 2. Shortage of basic seed and susceptibility of the existing varieties to disease. |
| 3. Effort to absorb technologies and knowledge at the research center as well as their effort to use unions as marketing opportunity is low. | 3. Grass weed, disease and insect pest are changing themselves with climate change. |
| 4. Lack of professional, full time and paid managers and other staffs. | 4. High fluctuation of wheat price and lower price of wheat imported by government. |
| 5. Proportion of women in the cooperatives as well as their participation in different cooperative activities is low. | 5. Collateral requirement at financial institutions which is beyond the current capacity of the cooperatives. |
| 6. Lack of well structured and clear dividend sharing mechanisms. | 6. Ever increasing price of input. |
| 7. Credit provided by coop is inadequate and only in the form of input. | 7. Poor loan repayment of some cooperative members |
| 8. Lack of post harvest seed technologies including seed cleaner. | 8. Unwillingness of some members to participate in buying share every year. |
| 9. Lack of promoting members to openly communicate with the board members. | 9. Lack of commitment from unions to provided service expected from them due to managerial problems |

## Conclusion and Recommendation

## Conclusion

Seed producer and marketing cooperatives are a new form of business enterprises in Ethiopia. It was established with the aim to increase efficiency of the seed production and marketing system and promote agricultural development in the rural sector of the country. According to the study sample cooperatives are important source of various services like inputs, patronage refund, market information, credit, training, better price and genuine scaling. Members indicated that they are highly benefited from the service rendered by cooperatives. For this reason, the majority of respondents gave good evaluative performance to their cooperatives which emanate from their satisfaction in benefit they obtained from the cooperatives. Although the majority of respondents rated their cooperatives performance as doing well, they also indicated that consideration should be given to dividend sharing, credit and marketing services that obtained medium to low mean perception score. The effort made by cooperative leaders' in enhancing economic returns to members, searching for market alternatives and improving members' income through value addition is also low. Such problems lead to low efficiency of cooperatives which reduce members' satisfaction and perception about the cooperatives. Therefore enhancing efficient delivery of services and members' participation in using service delivered by cooperative would contribute for growth of the cooperatives.

Ordered logit model revealed that age, education, family size, land allocated to seed, number of livestock, non-farm income, proximity to cooperative offices and position in cooperative are among factors that affect members' perceived performance of cooperatives. The result implies that younger and better educated members have better tendency to receive, understand and utilize new ideas to be more productive. Moreover the more the members are educated and the better the asset holdings the more tendency to perceive the performance of cooperative. Therefore building the capacity of members in terms of education and asset building would improve perception of the members towards their cooperatives. On the other hand, strengthening good practice and addressing the weakness of the cooperative through enhancing participatory decision making of members and other stakeholders would help the cooperative improve its performance. GOs and NGOs should give emphasis to continuous trainings, coaching, capital mobilization and access to credit that can boost the performance of the cooperative.

## Recommendation

1. Effort should be made to improve the productivity of cooperatives by enhancing economic return to members through providing timely market information and adjusting their products to market through value addition including seed cleaning, seed treatment, storage, packing, labeling and transporting. On the other hand, contractual based seed production, processing, storage and marketing should be arranged with different organizations including seed enterprises and unions.

2. It is important to recruit professional full time staff including manager and accountant for the cooperatives. Moreover upgrading the management capacity of the cooperatives' management body through education and trainings is crucial.

3. For the cooperatives to be sustainable, they should improve their financial capacity and diversify their income by improving level of investment, enhancing additional share capital, attracting new members, reducing transaction costs and cost of service delivery.

4. Sample cooperatives have less access to credit services due to low capacity of unions and collateral requirement at financial institutions which is beyond the current capacity of the cooperatives. Therefore, the capacity of cooperatives and unions in asset building should be

strengthen. Moreover, government and other concerned bodies should create conducive environment through formulation of sound credit policy that benefits cooperatives.

5. Cooperatives should create well structured and clear surplus allocation mechanisms which motivate members toward achieving their objective. These could be achieved through strengthening financial capacity of the cooperatives and timely auditing of cooperative resource.

6. Relationship with different organizations should be strengthened. For instance Unions and research are the main source of inputs like basic seed, fertilizer, agrochemicals, credit, knowledge and information. However the linkage between cooperatives and union as well as cooperative and research is poor. Therefore in order to improve the efficiency of cooperatives the relationship between cooperative and other stakeholders should be strengthen through creating effective linkage mechanism.

7. Attention should be given by cooperative promotion offices and other supporting organizations for the quality and time of audit. Periodic evaluation on the efficiency of services delivered to the members should be undertaken to guide board of directors and operation groups on the prioritization of programs and activities.

8. Proportion of women in the cooperatives as well as their participation in different cooperative activities is very low. Survey data indicated that females constitute only 14.3% of the total members in the cooperatives and their participation in different committee is only 11%. Emphasis should be given to promote participation of women in the cooperative through awareness creation.

9. Above all, changing the perception of members towards their cooperatives is crucial in improving performances of the cooperatives. This can be achieved through building the capacity of members in terms of education and asset building, efficient service delivery, promoting participation of members in using the services and their participation in decision making, and promoting members to openly communicate and give opinion that could help for the successful growth of their cooperative.

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# Adoption of Transitional Chefeka Bee Hive Package: The Case of Wolmera Woreda, Oromia Special Zone, Ethiopia

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## Abstract

*The study set out to identify factors that affect adoption, assess intensity of adoption and financial benefit of adopting transitional chefeka bee hive package in Wolmera Woreda. Two stage sampling procedure was followed to select rural Kebeles and households for the study. Four Kebeles were randomly selected and stratified sampling technique was employed to stratify respondents in to adopters and none adopters of the technology. A total of 120 respondents were randomly selected using probability proportional to size sampling technique. Pre tested and validated structured interview questionnaire were used to gather data from the 120respondents. Focus group discussion and key informant interview were conducted to generate qualitative data. In addition, secondary data were collected from relevant sources such as Woreda livestock office, research articles and internet. Data were analyzed using descriptive statistics, partial budgeting and tobit model. The Tobit model output reveals that beekeeping experience availability of accessories and knowledge of the technology were found to have significant influence on adoption and intensity of adoption of transitional chefeka bee hive technology whereas age, educational level, livestock holding, honey bee colony holding, frequency of contact with extension agent, apiary visit, beekeeping training, pest problem, market availability and perception of technology attributes were not significantly influencing adoption of transitional chefeka bee hive technology. The partial budgeting result reveals that the beekeepers were profitable due to adopting transitional chefeka bee hive and increased their benefit from chefeka bee hive by more than triple compared to traditional hive. It could be concluded that the conventional variables (such as age, education and frequency of contact) may not necessarily affect technology adoption. The less the experience, the better the availability of technologies coupled with better knowledge on the technology, the better the tendency of adoption. The overall finding of the study underlined the importance of institutional support in the areas of availing beekeeping accessories and improving beekeepers knowledge on the technology to enhance adoption of transitional chefeka bee hive technology package. Therefore, agricultural policy and development interventions should be given emphasis to the improvement of such institutional support*                                51
*Keywords: Adoption, Chefeka hive, packages, improved beekeeping, index*

## Introduction

Beekeeping is an important component of agriculture and rural development programmed in many countries. The role of beekeeping in providing nutritional, economic and ecological security to rural communities at the household level and as an additional income generating activity is high (Food and Agricultural Organization [FAO], 1990)

Beekeeping is a good source of off-farm income to farmers in our country. It plays significant role in supplementing the annual income and has potential to increase incomes of the beekeepers through sell of honey, beeswax, colonies and serving as a healthy food for the consumers. It provides not only direct job opportunities, cash income and food in the rural areas, but also assists the increased agricultural production of various crops through pollination effect of honey bees. As very little space is needed, beekeeping is ideal for people who have no land, little space and

money. They have chance for many landless peasants and small holders to improve their livelihoods since it almost requires no land, capital and does not take much part of the farmer's time, and generates a sizeable income (FAO, 1984). The net return from a well-managed beekeeping is generally thought to be significantly large.

Beekeeping is likely to be at its most profitable if improved beekeeping technologies with its all packages can be used and if pesticides are not used in such a way that the foraging bees are killed. However, traditional production system which result in low production and productivity, poor pre and post harvest processing and handling techniques and practices combined with poor marketing efforts has kept it part of the subsistent sector (Meaza, 2010 ). In most cases in our country, beekeepers are observed to use traditional hive which is very difficult to manage honeybees and to produce honey and honey products in the required quality and quantity. The maximum yield obtained from a traditional bee hive so far is estimated on average to be below 7 kg /hive (Nuru and Eddesa, 2005). This yield can be increased to more than 15 kg/hive and the quality will be improved if transitional chefeka bee hive is used. Besides the yield, this hive and its frames can be constructed by the beekeeper from locally available materials bamboo *(Arundinaria alpina*), shembeko*(Arundinaria donax),* shimel*(Oxytenathera abyssinica*) and eucalyptus (Nuru and Eddesa, 2005).

Research centers, livestock agencies, NGOs have been striving to disseminate and scale up this technology to improve the benefit beekeepers can get from beekeeping. Despite of all efforts, factors that influence adoption and information with regard to intensity of adoption of transitional chefeka bee hive made from locally available materials were not investigated in the country as a whole to the knowledge of the researcher. Regarding adoption studies, subsistence farmers have not been able to benefit fully or partly from the fruits of technological innovations because of different factors hindering the adoption of farm technologies (Biranu, 2002) and it is difficult to develop hypothesis that hold true everywhere because socio-economic and ecological distinctiveness of the different sites and dynamic nature of most of the determinants (Ehui *et al.,* 2004). Due to this fact, the authors recommended repeated study on determinants of adoption under different conditions. Therefore, this research was initiated to address the identified information gap and analyze feedback on the technology and this research would fill the gap.

## Objectives of the Study

- ☞ to identify factors that affect adoption of transitional chefeka bee hive package in the study area,
- ☞ to assess intensity of adoption of transitional chefeka bee hive package in the study area and
- ☞ to analyze economic benefit of adopting transitional chefeka bee hive package at HH level.

## METHODOLOGY

### Description of the Study Area

The study was conducted in Wolmera Woreda, Oromia special zone surrounding Addis Ababa, Oromia national regional state. Wolmera district is about 29 km away in West of Addis Ababa along the Ambo rode at $9^0 02N$ latitude and $38^0 34E$ and altitude ranges from 2000-3380 m.a.s.l. (Bureau of Agriculture [BoA], 2013). The Woreda is bounded in the North by Sululta Woreda, in

the South by Sebeta Awas Woreda, in the West by Burayu city administration and in the East by Ejere Woreda

The Woreda is classified in to two agro climatic zones namely Dega 61%, Woyna dega 39 % (BoA, 2013). The area is characterized by mean annual rainfall of 1067mm and mean temperature of 18 $^0$ c.                                    53

The main rain season is from the months of June to September which accounts for 70% rainfall while the remained 30% is from February to April (BoA, 2013). The Woreda has a total population of 146,227 of which 72,301(49.4%) are males and 73,926(50.6%) are females. In term of area residence 100,857(68%) population has been living in the rural areas while 45,370(31%) has been living in the urban centers (BoA, 2013).

Crop- livestock mixed farming system characterizes agriculture in the Woreda. The major crops in the farming system are wheat, teff, barley, and faba bean.  In the Woreda, about 3,566 hives exist out of which about 1853 was traditional, 870 transitional and 843 box hives (BoA, 2013).

## Sample and Sampling Technique

Identification and definition of the study population is important prerequisite for research sampling design. Accordingly, study population for the study was all beekeepers of the study area. To obtain accurate data about a given population, it is obvious that using census study is better. But due to financial and time constraints, a complete coverage of the population is not an easy task. As consequence, sampling is preferable method that enables the researcher to study relatively small unit in the place of the population, and will obtain data that are representative of the whole population (Sarantakos, 1998).
Wolmera Woreda was selected purposively as representative of beekeeping potential area, where transitional chefeka bee hive was introduced and beekeeping extension program was executed and where adopter and none adopters are found. Two-stage sampling procedure was followed to select Kebeles and farm households. In the first stage of sampling, probability sampling was employed to select Kebele administrations. Accordingly, four Kebele, out of 21 kebele administrations, namely Dohaf lafto, Geresu sida, Nanno suba and Wajitu were selected randomly. In the second stage of sampling,  the beekeepers were stratified into adopters and none-adopters of transitional chefeka bee hive in selected kebeles to see the difference among adopters and none adopters. Sample for the study were taken using simple random sampling technique to give equal chance of being selected for the respondents.

According to Storck *et al*. (1991), the size of the sample depends on the available fund, time and other reasons and not necessarily on the total population. For this study, to decide the size of the sample, different factors were taken into account that include time, human and financial resources, accessibility and other facilities. Hence, the total sample size for the study was 120 beekeepers, out of which 40 were adopters of the technology and 80 were none adopters. For the purpose of the study, adopters are those beekeepers who used transitional chefeka bee hive for two years and none-adopters are beekeepers who did not use chefeka hives during the study period.

## Data Type, Sources and Method of Data Collection

The study used both primary and secondary data sources. Primary data on household personal, economic characteristics, factors affecting adoption, financial benefit from the hive and level of

adoption were collected from sample households using structured interview schedule. Secondary data which support primary data was collected from different sources like journals, research articles, internet and concerned offices.

Quantitative data was gathered using pretested structured interview from the respondents. The interview schedule was pre-tested on 20 beekeepers having the same socio- economic and ecological condition, particularly Ejere Woreda which is 10km in East of Wolmera Woreda before data collection. Depending on the results of the pre-test; the interview schedule was modified accordingly. To collect data three researchers and one technical assistant who are familiar with the culture and local language proficiency were selected. Orientation was given to the enumerators on how to approach the respondents, how to ask questions, how to collect data and on the challenges that they may face in the field. For the case of qualitative data, in order to capture better understanding of factors that affect adoption of transitional hive, intensity of adoption , checklist was prepared to guide focus group discussion,  two focus group discussion and observation of respondents' apiary were conducted.

## Methods of Data Analysis

The qualitative data that was collected through focus groups discussion was analyzed through explanation of idea, opinion, and concept explanation method. Researcher's personal observation of apiary of sampled beekeepers was analyzed through further explanation of the real situation under observation.

However the quantitative data collected using structured interview schedule was analyzed using statistical tools like mean, frequency, percentage and computer software program STATA (version 11.2).

Economic characteristics of sample households and other variables related were analyzed and presented using descriptive statistics such as percentage, frequency, mean and displayed using tables. ANOVA-test and □□□-test were mainly used to evaluate the significance of the relationship between dependent and explanatory variables and test the hypothesis. In addition, Tobit model was used to determine the relative influence of various explanatory variables on the dependent variable.

## Determinants of adoption and intensity of adoption

Estimates of the variables expected to determine the adoption and intensity of adoption of transitional chefeka hive technology package are displayed in Table 13. A total of 15 explanatory variables were included into the econometric model out of which five variables were found to significantly influence adoption and intensity of adoption of transitional chefeka bee hive technology package. These are beekeeping experience, livestock holding, bee forage, availability of accessories and knowledge.

Table 13. Maximum likelihood estimates of Tobit Model

| Variables | Estimated Coefficients | Standard Error | t-ratio | P-value |
|---|---|---|---|---|
| Constant | .2979129 | .531384 | 0.56 | 0.576 |
| EDULHH | 0034465 | .0112569 | 0.31 | 0.760 |
| BKGEXPER | -.0092243 | .0045495 | -2.03 | 0.045** |
| FAMSIZE | .0172781 | .022528 | 0.77 | 0.445 |
| LVSHOLD | .0193125 | .0108694 | 1.78 | 0.079* |
| LANDHOLD | .0228126 | .0394956 | 0.58 | 0.565 |
| BEECOLON | .0082996 | .0085248 | 0.97 | 0.333 |

| | | | | |
|---|---|---|---|---|
| FRQCONTA | .0506748 | .0332126 | 1.53 | 0.130 |
| APIARYVIST | .0310288 | .0911852 | 0.34 | 0.734 |
| BKTRAIN | .1825553 | .1222198 | 1.49 | 0.139 |
| AVACCS | .3448125 | .1038436 | 3.32 | 0.001*** |
| PESTPRBLM | .0090616 | .2258587 | 0.04 | 0.968 |
| BEEFORAGE | .2162477 | .095282 | 2.27 | 0.025** |
| MKTAVAIL | .225217 | .2662358 | 0.85 | 0.400 |
| KNOWLE | .1601252 | .0303275 | 5.28 | 0.000*** |
| PTA | .0035962 | .008057 | 0.45 | 0.656 |

Log    likelihood    = -9.7085847                      pseudo R2=0.8955

Source: Model output

***, ** and * represents 1%, 5% and10% level of significance, respectively.

## Influence of explanatory variables

**Beekeeping experience**: As the Tobit model result indicates, this variable had negative and significant influence on the likelihood of adoption of transitional chefeka hive technology at less than 5% significant level. The negative association suggests that the likelihood of adopting transitional chefeka bee hive technology package declines as beekeeping experience of beekeepers' increases. The possible reason might be more experienced beekeepers will be in a position to experience much with their traditional beekeeping and are expected to be less responsive to newly introduced beekeeping technologies. Small experienced beekeepers are younger beekeepers and they are more knowledgeable and are likely to bear risk due to longer planning horizon. This finding is in agreement with findings of Girmachew (2005) and Almaz (2008).

**Livestock holding:**  As the model output shows, livestock holding had positive and significant influence on the likelihood of adoption of transitional chefeka bee hive technology at less than 10% significant level.  A larger holding of TLU increased beekeepers opportunity to bear the risk that may occur and enabled to invest on adoption of transitional chefeka bee hive technology package. This finding is in agreement with findings of Zelalem (2007).

**Knowledge:** As the model output result shows, this variable had positive and significant influence on the likelihood of adoption of transitional chefeka bee hive technology at less than 1% significant level. Knowledge on improved beekeeping management practices give the beekeepers more confidence and minimize possibilities of failure. Therefore attention must be given to improve the beekeepers knowledge before promoting and disseminating the technology. This finding is in agreement with findings of Degnet and Belay (2001), Workineh (2007) and Almaz (2008).

**Availability of accessories**: As the model output result shows, availability of accessories which the beekeepers use for managing the colony had positive and significant influence on the likelihood of adoption of transitional chefeka bee hive technology at less than 5% significant level. Therefore, availing accessories or training on making these accessories at beekeepers level should get attention. This finding is in agreement with finding of Ehui *et al.* (2004).

**Bee Forage:**  As the model output shows, bee forage had positive and significant influence on the likelihood of adoption of transitional chefeka bee hive technology at less than 5% significant level.  The availability of seed and seedlings of bee forages that flowers in different seasons helped beekeepers to maintain strong honey bee colony. Therefore distribution of multipurpose seed and seedlings should get due attention.This finding is in agreement with finding of Workineh (2007).

## Effects of changes in determinant variables

All variables that were found to influence the adoption and intensity of use of transitional chefeka hive technology technologies might not have similar contribution in influencing the decision of beekeepers. Hence, using a decomposition procedure suggested by McDonald and Moffitt (1980), the results of Tobit model was used to assess the effects of changes in the explanatory variables into adoption and intensity of use and the result is presented on Table 14 below.

**Table 24. Marginal effects of determinant variables**

| Variables | Change in Probability of Adoption* $\dfrac{\partial F(Z)}{\partial Xi}$ | Change in the intensity of Adoption* $\dfrac{\partial E(Y/Yi > 0)}{\partial Xi}$ | Change among the Whole $\dfrac{\partial E\,(AIi)}{\partial Xi}$ |
|---|---|---|---|
| BKGEXPER | -0.002 | -0.0001 | -0.003 |
| LVSHOLD | 0.005 | 0.0001 | 0.005 |
| AVACCS | 0.090 | 0.002 | 0.094 |
| BEEFORAGE | 0.057 | 0.001 | 0.059 |
| KNOWLE | 0.042 | 0.001 | 0.044 |

Source: model output

**Explanatory variables**: A change in experience in beekeeping, livestock holding, availing beekeeping accessories, bee forage and knowledge on the technology package were among the hypothesized explanatory variables found to influence the probability and intensity of use of transitional chefeka bee hive technology package (Table 14).

The results computed indicate that a decrease in a year in experience in beekeeping increases probability of adoption and intensity of use of transitional chefeka bee hive package by about 0.2% and 0.01%, respectively. This implies the need to give emphasis to select beekeepers that have less experience to enhance adoption of transitional chefeka bee hive package.

A unit change in TLU increases probability of adoption and intensity of use of transitional chefeka bee hive package by about 0.5% and 0.01%, respectively. The implication is that emphasis has to be given to build confidence of the beekeepers on the technology while selecting of the beneficiaries to enhance adoption of transitional chefeka bee hive package.

A unit change in bee forage increases probability of adoption and intensity of use of transitional chefeka bee hive package by about 5.7% and 0.01%, respectively. The implication is that emphasis has to be given to distribute multipurpose seed and seedlings for maintaining strong honey bee colony and increase honey yield per hive to enhance adoption of transitional chefeka bee hive package.

Availability of beekeeping accessories accounted higher marginal effect. Availing beekeeping accessories increases probability of adoption and intensity of use of transitional chefeka bee hive package by about 9% and 0.2%, respectively. This implies the need to institutionally support either in availing accessories or giving training how to make these accessories to enhance adoption of transitional chefeka bee hive package.

A unit change in knowledge on transitional chefeka bee hive package increases probability of adoption and intensity of use of transitional chefeka bee hive package by about 4.2% and 0.1 %, respectively. The implication is that emphasis has to be given to improve beekeepers knowledge

on the technology package through practical training, demonstration of the technology and other extension events to enhance adoption of transitional chefeka bee hive package.

## Economic Benefit of Adopting

Yield is an important determinant factor in adopting the technology. The higher the yield obtained from the introduced technology easier it is to convince the farmers to adopt the technology. In order to compare the performances of the transitional chefeka and traditional bee hive yield, the cost and net returns obtained from sampled respondents were recorded and compared. The analysis was done to arrive at per hive net return from both types of hive. As shown on the table 17 below, hive, bee colony, supplementary feed, labor and transport costs were the cost items that needed to run transitional chefeka and traditional bee hive honey production and categorized under column one, category of cost. Based on the data collected from sampled beekeepers, hive cost and service life for the hives were on average 435.00 ETB and 10 years for transitional chefeka and 20 ETB and 5 years for traditional hive. The average price paid to purchase bee colony was 450.00ETB at current market (2013), the commercial life for the honey bee colony was assumed to be 5 years (HBRC, 2004) and this cost was common for both type of hives. Labor cost was calculated based on hours spent in beekeeping for both types of hive per a month, summed for a year and converted to Birr which was 35.00 ETB for daily laborer. Similarly, feed cost and transport cost was calculated based on cost spent for the items divided by number of hives and interest 5% was added on total costs.

On the other hand, honey yield was the benefit for the both types of hives and categorized under column two, return. To get the total revenue from each type of hive, honey yield obtained in the course of the year was multiplied by selling price. In the study area, the average honey yield per annum for traditional and transitional chefeka hive was 9.41kg and 4.81kg, respectively. It is below the national average which is 10-15 kg and 7kg respectively. The price of one kilogram honey from transitional chefeka and traditional hive was 65 and85 birr, respectively. The price difference was due to quality of honey harvested from the hives.

**Table 3. Partial budget for transitional chefeka and traditional bee hive**

| Column 1 | | | Column 2 | | |
|---|---|---|---|---|---|
| Added cost (Birr) | Transitional chefeka | Traditional hive | Additional return (Birr) | Transitional chefeka | Traditional hive |
| Hive cost | 45.0 | 4 | Honey yield | 799.85 | 312.65 |
| Colony cost | 90.0 | 90.0 | Total added return | 799.85 | 312.65 |
| Supplementary feed | 2.76 | 1.91 | | | |
| Labor cost | 27.75 | 46.63 | | | |
| Transport cost to market | 3.87 | 2.74 | | | |
| Interest | 8.47 | 7.49 | | | |
| Total negative | 177.85 | 152.77 | Total positive | 799.85 | 312.65 |

Net income from transitional chefeka hive (799.85-177.85=622.00 ETB)
Net income from traditional hive (312.65 - 152.77=159.88 ETB)
Incremental net benefit of transitional chefeka hive is (622.00 -155.99=462.12 ETB)

The partial budgeting result reveals that the beekeepers are profitable due to adopting transitional chefeka bee hive. Table 16 also summarizes that the incremental net benefit of transitional chefeka hive was 462.12 ETB. This shows that the beekeepers increased their benefit from chefeka bee hive by more than 2.9 fold compared to traditional hive. Melaku (2005) also came with similar conclusion in his study using partial budgeting analysis that timber made Kenyan top bar hive was beneficial and remunerative. It is also in line with the study of Workineh (2007).

As to conclusion, beekeeping is environmentally sustainable activity that can be integrated with agricultural practices like crop production, animal husbandry, horticultural crops and conservation of natural resources. It does not require fertile land and uncultivated area is suitable for beekeeping and would be one of the most important intervention areas for sustainable development of poor farmers since it has immense contribution to the economies of the society and to a national economy as whole. Regardless of its contribution, yield per hive was below national average due to shortage of bee forages that flower at different times of the year and indiscriminate use of agrochemicals that had adverse effect on honey bees. These factors together with several household personal, economic, institutional and psychological factors affected the adoption of transitional chefeka bee hive package.

Based on the research findings of this study, the following possible recommendations are recommended to improve beekeepers' adoption transitional chefeka bee hive package.

Honey bee colony holding is crucial for adoption and use of technology. The price for a single honey bee colony in traditional hive is 600-650ETB and this is costly for resource poor farmers. Therefore, organizing beekeepers and training them with simple honey bee colony multiplication will solve problem of colony shortage and increase adoption.

Beekeeping requires protective equipments. Without these equipments operating the hive was impossible since the bees go upward while opening the outer cover and start to attack the beekeeper. Smoker has play significant role in cooling down the honeybees. Therefore, availing these accessories or training the beekeepers on how to make these accessories should get attention while transferring the technology.

Arranging training, field day and other extension events play a major role in technology popularization and dissemination. They make the beekeeper to have more information and exposure to the technology. Therefore, due attention should be given for practical training on the technology and arrangement of extension events.

None-adoption and deviation from recommended package practices was found partly due to lack of knowledge on the technology. Transitional chefeka bee hive package involves the use of different practices that require knowledge and skill of management. Knowledge on the technology was found to have a strong relation with adoption. Therefore, due emphasis has to be given towards strengthening beekeepers knowledge on transitional chefeka bee hive package through training.

From group discussion held with beekeepers, it was realized that beekeepers sold their honey immediately harvest at low price to meet their demand for cash to pay wage for harvesting, pay taxes and other social obligations and the beekeepers were not in a position to obtain better income as a result of low selling price . Therefore, emphasis has to be given to improvement of market and marketing system particularly through cooperative unions

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# Value chain analysis of cattle fattening in selected districts of western Oromia

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**Abstract**

*Despite the fact that Ethiopia in general and the study area is characterized by a high livestock population, its productivity, marketing system, value chain actors' coordination are characterized as low, less developed and weak respectively. Therefore the objectives of the study were to identify core functions and main actors in the fattened cattle value chain, identify marketing channels of fattened cattle in the study areas, estimate the market cost and margin in the fattened cattle trade and identify major constraints and opportunities in its value chain in the western Oromia. Sample procedures, sources and data collection methods and data analysis methods were undertaken to materialize the objectives of the study. The result of the study indicates that there are six major market channels in the study areas and there were loos and/or lack of vertical and horizontal cooperation and linkage among value chain actors. Demand fluctuations, feed shortage, lack of medicines, weak extension service and lack of improved feeds were among others constraints. As the numbers of value chain actor increases and value addition on fattened cattle increases the share of the small scale farm household from final consumers' price decreases. Therefore, enabling constraints at every stage of the value chain must be prioritized and should be solved according to the need of society- if the profit shares of small scale farm households are to be increased. Again to increase the profit share of the small scale farm households the value adding activities should have to be accomplished by primary producer farm household themselves.*
**Key Words:** Value chain analysis, value addition, cattle fattening, fattened cattle, actors

**Introduction**

Livestock production is an integral part of Ethiopia's agricultural sector and plays a vital role in the national economy. At present, livestock contributes about 20% of the GDP, supporting the livelihoods of 70 % of the population and generating about 11% of annual export earnings. As the country has a large livestock population, which ranks first in Africa and tenth in the world, it has

much to gain from the growing global markets for livestock products (UNESC-ECA, 2012).

Ethiopian livestock production system is characterized based on integration with crops production, level of input and intensity of production, agro-ecology and market orientation is categorized as pastoral, agro-pastoral, mixed crop-livestock farming, urban and peri-urban farming and specialized intensive farming systems (Mohamed *et al*., 2004; Amare *et al.,* 2010).

Despite the fact that Ethiopia is characterized by a high livestock population, its productivity is low, at least in terms of conventional products such as meat and milk and farmers received low benefit for their livestock and livestock products production. This mainly due to poor breeds, inadequate feeds, diseases, poor market systems characterized by lengthy marketing processes, high transaction costs, and etc.

The informal cattle trade, over-exploitation producers by brokers, weak and uncoordinated linkages between the major marketing actors and a lack of both market-oriented cattle production and modern cattle marketing channels were the most reasons why producers were less productive and harvest lesser share of final price paid by end buyer of fattened cattle. In addition, the majority of smallholder cattle producers in Ethiopia specifically in western Oromia only sell their animals in response to short term demands for cash, that, is those smallholder farmers are not market and customers oriented producers.

Therefore this paper is going to highlight the value chain status of fattened cattle of some selected districts of western Oromia by giving due attention on describing the existing fattened cattle marketing system, identifying major value chain actors and assess their performance, identifying main marketing channels, opportunities and challenges of fattened cattle value chain. These research findings provide updated scientific information for fattened cattle sector development and for the development of policies that will serve for both production and productivity of the fattened cattle generally for Ethiopia specifically for the study area with general objective of to analysis value chain of fattened cattle producers in Illu Hara, Illu Galan and Guto Gidda districts of western Oromia. The specific objectives were to;
1.  describe the existing fattened cattle marketing system in the study area
2.  identify major actors involved in the value chain and assess their performance in the study area
3.  identify marketing channels of fattened cattle in the study area
4.  discover major constraints and opportunities in of fattened cattle in the study area

## Research Methodology

### Description of the Study Areas

The study was undertaken in three potential central and west zones of Oromia regional state in fattening of cattle for beef. In each zones one district was selected as representative of their zone in fattening cattle for beef. Accordingly Illu Harar, Guto Gida and Illu Galan were selected from Illu Abora, East Wallaga and West Shawa zones, respectively.

Guto Gida is the district found in East Wollega zone. It is located at about 328 kilometres distance from Finfinne to the western direction possessing a total area of 901.80 km². Guto Gida district is contiguous with Sibu Sire and Wayyu Tuka in the east, Sasiga, Digga and Benshengul Gumuz in the west, Gida Ayana, Abe Dongoro and Gudaya Bila in the north & Wayyu Tuqa and Leka Dulecha to the south. It is divided in to 21 farmers associations and one urban center having the capital town named Nekemte. The district is divided in to three distinct geographical areas with different proportion; namely, highland 0.26 percent, the midland 46.74 percent and the

lowland 53.00 percent. The site of the study in the district is located in lowland area known as Ukke.

Illu Harar is the district found in Illu Ababora zone. It is located about 390 kilometres distance from Finfinne to the west direction and found between Dabana and Dhidhesa drivers' catchment. This area of the study is populated by ''Anniya'' and ''Afran Kalo'' among the others clan of Barentu Oromo's inhabitants. These clan of Oromo societies are kwon for their ''Harar Bull'' in the Eastern part of Oromia regional state and they are practicing what has been experienced by their clan in the eastern part of the state her in the study area. The district is also known for its soya bean and rice production.

 Illu Galan is the district found in west shawa zone of Oromia regional state. It is located on the main road to the west part of the country 200 kilometres away from Finfinne. The district is known for its potential on livestock, maize and horticultural crop production among the others.

**Sampling Procedure**

A combination of purposive and random sampling technique was employed to select sample respondents. In the first stage of sampling procedure, three districts from three zones were Guto Gidda, Illu Harar and Illu Galan districts from East Wollega, Illu Ababora and West Showa zones, respectively were selected purposively based on fattened cattle production existence of small scale household farm producers and proximity to the market centres of the study areas. In the second stage, two Peasants association were purposively selected from each district among fattened cattle producers PAs. Finally, from three studies site about 110 sample respondent farm households were selected based on Probability Proportional to Size (PPS) of random sampling method.

**Source of data and Collection Methods**

Both primary household survey and secondary data were used. The Primary data were collected from small scale farm household producers, traders, trade mister, butchers, restaurants and hotels. The Secondary data were collected from books, journals and other published and unpublished documents from Bako agricultural research center, zonal and bureau of market development offices, livestock development and animal health agency of each district, CSA and other related sources to supplement primary data.

A number of usual data collection methods and instruments were used to generate background information to capture value chain related information on relevant variables from all value chain actors at all level of the value chain. These are: focused group discussions (FGD), key informant interviews and visual observations were undertaken in all selected district to identify actors involved in the fattening cattle production, marketing, marketing outlets and challenges and opportunities in fattened cattle production at farm level. Checklist were employed for different activities in the value chain of fattened cattle to guide group discussions and key informants interviews. After focused group and key informants discussions were undertaken, structured questionnaire were developed for each actor in fattened cattle value chain to quantify the findings at all stages in the fattened value chain.

**Method of Data Analysis**

Quantitative data collected from the study areas were analyzed using thematic approach and used for as bases to prepare structured questionnaire. Quantitative data were analyzed using descriptive statistics analysis techniques using SPSS computer software. Descriptive statistics such as mean, standard deviation, frequencies distribution, and percentages were used to have a clear picture of the characteristics of sample units and costs and margin amylases methods were employed.

## Results and discussion

### Household Characteristics

Table 4: Sample household heads characteristics during the survey period

| Household description | | Guto Gida (=47) | | Ilu-Harar (N=33) | | Ilu-Galan (N=30) | | Total (N=110) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std.D | Mean | Std. D | Mean | Std. D | Mean | Std. D |
| Age of Household | | 40.15 | 8.43 | 38.97 | 14.95 | 44.10 | 13.40 | 40.87 | 12.15 |
| Education level | | 4.28 | 3.27 | 3.36 | 2.60 | 6.30 | 4.36 | 4.55 | 3.58 |
| Family size | | 6.70 | 1.90 | 6.48 | 2.39 | 8.37 | 3.53 | 7.09 | 2.67 |
| Household headed | | N* | % | N | % | N | % | N | % |
| Sex | Male | 45 | 95.7 | 32 | 97 | 30 | 100 | 107 | 97.3 |
| | Female | 2 | 4.3 | 1 | 3 | 0 | 0 | 3 | 2.7 |
| Marital status | Married | 47 | 100 | 32 | 97 | 30 | 100 | 109 | 99.1 |
| | Widowed | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0.90 |

Source: Survey result (2015), NF* =Number of frequency

The aggregated average age of sample households was about 40.87 years with standard deviation of 12.15 and the average family size of the sample households was 7.07 persons per household, with standard deviation of 2.67 which is relatively higher than national average agricultural household size which is 5.2 persons per household (Essa, 2011). The aggregated average education level expressed in years of schooling of the sample household heads was about 4.55. With regards to the sex and marital status of respondents, about 97.3% and 99.1% of the sample households were male headed and married headed, respectively (Table 1).

### Farm Characteristics

**Land holding:** The aggregated average own land holding of the sample households was about 2.03 ha while on average 0.65 ha of land were left for grazing (Table 2). The result implies that the study areas have relatively larger land size compared to that of the national average of land farmers in Ethiopia which is 1.2 ha (Essa, 2011).

Table 5: Farming characteristics and land distribution of sample households

| Land allocation | Guto Gida (=47) | | Ilu-Harar (N=33) | | Ilu-Galan (N=30) | | Total (N=110) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std.dev. | Mean | Std.dev. | Mean | Std.dev. | Mean | Std.dev |
| Own land (ha) | 2.36 | 1.45 | 1.57 | 0.32 | 2.53 | 1.94 | 2.03 | 1.25 |
| Cultivated land (ha) | 2.04 | 0.99 | 1.00 | 0 | 1.07 | 0.25 | 1.03 | 0.16 |
| Grazing land (ha) | 0.32 | 0.46 | 0.09 | 0.26 | 0.91 | 0.91 | 0.41 | 0.65 |
| Fallowing land (ha) | 0 | 0 | 0.03 | 0.17 | 0.02 | 0.09 | 0.02 | 0.11 |
| Forest land (ha) | 0.04 | 0.22 | 0 | 0 | 0.08 | 0.26 | 0.04 | 0.20 |

Source: Survey result (2015)

**Livestock Production:** Given a mixed farming system in the study areas, livestock has considerable contribution for household income and food security. The results indicate that cows and oxen are the major important cattle in the study areas. Among others, oxen and bull are the major cattle used for fattening in all areas. Any cattle like oxen, bulls, heifers, cows also used for fattening in some farmers at Guto Gida and Ilu-Gelan study areas (Table 3 & 4).

Table 6: Households' livestock holding during survey period

| Livestock | Guto Gida (=47) | | Ilu-Harar (N=33) | | Ilu-Galan (N=30) | | Total (N=110) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Cow | 3.74 | 4.51 | 1.58 | 1.15 | 3.03 | 2.01 | 2.90 | 3.29 |
| Oxen | 2.47 | 2.91 | 1.76 | 3.49 | 3.01 | 2.01 | 2.44 | 2.90 |
| Heifers | 1.23 | 1.25 | 0.48 | 0.71 | 1.53 | 1.68 | 1.10 | 1.31 |
| Bulls | 1.15 | 1.46 | 1.15 | 1.25 | 0.90 | 0.99 | 0.36 | 0.85 |
| Calves | 1.66 | 1.90 | 0.52 | 0.76 | 1.63 | 1.71 | 1.29 | 1.66 |
| Sheep | 0.60 | 2.25 | 0.40 | 1.03 | 1.00 | 1.64 | 0.65 | 1.79 |
| Goats | 0.60 | 1.65 | 0.60 | 1.17 | 1.70 | 2.63 | 0.89 | 1.91 |
| Donkeys | 0.15 | 0.55 | 0.06 | 0.24 | 0.63 | 0.81 | 0.25 | 0.61 |
| Mules | 0.20 | 0.38 | 0 | 0 | 0.21 | 0.49 | 0.14 | 0.37 |
| Poultry | 6.00 | 6.40 | 3.76 | 4.91 | 7.70 | 5.90 | 5.83 | 6.01 |

Source: Survey result (2015)

Table 7: Sample households cattle used for fattening during survey period

| Fattened cattle | Guto Gida (N=47) | | Chewaka (N=33) | | Ilu-Gelan (N=30) | |
|---|---|---|---|---|---|---|
| | N | Percent | N | Percent | N | Percent |
| Oxen | 19 | 40.43 | 11 | 33.3 | 25 | 83.33 |
| Bull | 15 | 31.91 | 22 | 66.7 | 1 | 3.33 |
| Any cattle | 13 | 27.66 | 0 | 0 | 4 | 13.33 |

Source: Survey result (2015)

**Cattle Feed and Feeding System for fattening**

Small scale farmers in the study areas used different type of feeds to fatten their fattened cattle such as crop residue, hay, natural pasture (grass), purchased supplementary concentrates and combination of them. Accordingly, crop residue and grazing, crop residue and crop residue and hay are the major feeding system for cattle fattening in Guto Gida, Ilu-Harar and Ilu-Gelan, respectively (Table 5).

Table 8: Cattle feed and feeding system used by sample households during survey period

| Feeding types | Guto Gida (N=47) | | Ilu-Harar (N= 33) | | Ilu-Gelan (N=30) | |
|---|---|---|---|---|---|---|
| | N | Percent | N | Percent | N | Percent |
| Crop residue | 9 | 19.15 | 16 | 48.50 | 7 | 23.33 |
| Crop residue and hay | 12 | 25.53 | 10 | 30.30 | 11 | 36.67 |
| Crop residue and grazing | 21 | 44.68 | 2 | 6.00 | 4 | 13.33 |
| Crop residue and concentrates | 5 | 10.64 | 5 | 15.20 | 8 | 26.67 |

Source: Survey result (2015)

**Cattle Fattening Value Chain Analysis**

**Core Functions and Major Actors**

The core functions in cattle fattening value chain of the study areas include: input supply, production, marketing, processing and consumption. These core functions are performed by different actors and the different activities performed by different actors details are described in figure 1.
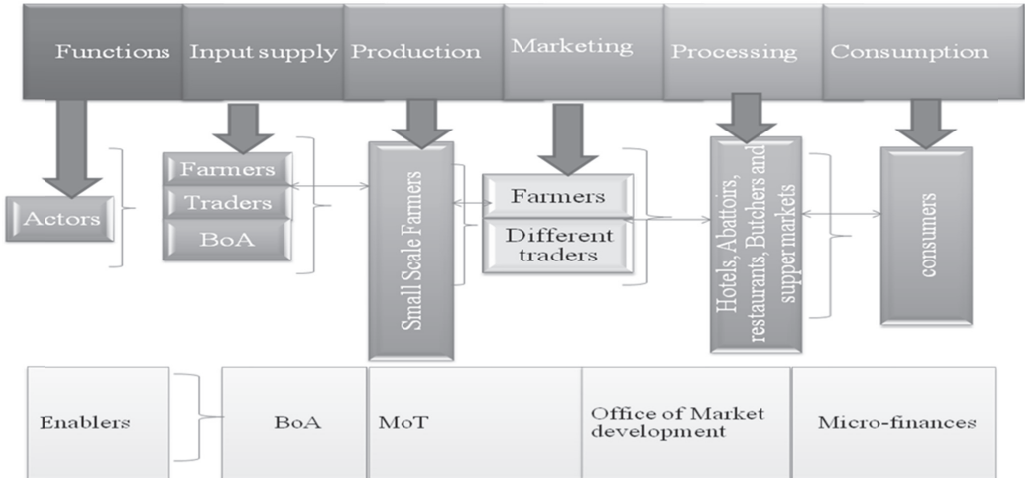


Figure 2: Value chain map of fattened cattle in the study areas

**Input supply:** In cattle fattening input supply includes feeder animals, feed supply, provision of veterinary services and improved husbandry skills (through training on feed and feeding management, housing management and animal health management). The feeder animals were provided by farmers whereas, veterinary services and training on husbandry management provided by districts livestock development and health agency and Bako Agricultural Research Center. The concentrated feed and some drugs were provided by private traders in respective study areas.

**Production:** In the study areas there are high potential for cattle fattening with integral part of the mixed crop-livestock system. Feeding system is almost entirely dependent on crop residue, hay and grazing of natural pasture. Both Ilu-Harar and Ukke areas had developed experience from eastern part of Oromia where their fattened cattle is kwon as ''Harar *Bull*''. Farmers fattened cattle for one or a combination of the following reasons: income generation to buy agricultural inputs like fertilizer and improved seeds and to pay schools fees of their children and health services, to buy livestock reproduction and return stock and other social expenses.

**Marketing:** Marketing involves buying live animals starting from farm gate, transporting, and distributing through different channels to final destination. The destination of these live fattened cattle includes hotels and restaurants in all districts and zone towns in the study areas, butchers, consumers from local to Addis Ababa and live animal export. The purchasing and collection of live fattened cattle from small scale farmers is carried out mainly by traders in all market areas include collecting at farm gate. According to respondents more than 95% of fattened cattle were purchased by traders.

Meat of the fattened cattle and live animals are traded in all the study areas districts and zones as well as outside of the study zones and regional state but live fattened animals from Ilu-Harar and Ukke are also directly supplied to outside the country through Jigjiga to Djibouti finally to Arab countries. Majority of small scale farmers in the study area sell their fattened cattle in their village market found in their areas. Rarely, Guder market; which is the largest live livestock marketing in western central Ethiopia, was supplied by small scale farmers in the study areas.

**Processing:** In the case of our study; value chain of fattened cattle, the primary processing activities is done at abattoirs includes: de-hiding, quartering the whole carcass and transport to their customers (butchers, hotels and restaurants, supermarkets institutions). Butchers, supermarkets, hotels and restaurants process the meat in to different retail consumption food commodities.

Butchers are supplied meat from abattoirs of town's municipality in large towns like Nekemte but in small towns they slaughter the fattened cattle by themselves. But in Addis all butchers buy fattened cattle and give it to abattoir managed by city's municipality for slaughter and the abattoir check for TB, Cancer and some harmful bacteria then slaughter it and transport to customers. In Addis by eye observation deep red meat and clean are the major criteria to measure quality. Depending on these differences we can divide butchers of Addis in to two main classes:

> **Butcher Class I**: these are butchers' shop sell meat on retailing basis, raw meat ('*Kurt*') and roasted meat product in the central part of the city. This central part of the city includes main roads and traditional restaurants on those main roads.
> **Butcher Class II:** these are butchers' shop sell meat on retailing basis, raw meat (Kurt) and roasted meat product in the outside the main roads, periphery and around (like Burrayu, Alem-Gena and other surrounding towns) part of the city.

Supermarkets are only found in Addis Ababa (consider only the value chain of fattened cattle for the study areas), even they are found in the central part of Addis; they sell raw and processed meat for consumption. They are supplied fattened cattle directly by buying and there are also supermarkets that get fattened cattle from their direct supplier depending on their prior relationship. Addis Ababa abattoir is the one that give slaughter service for these supermarkets.

**Consumption:** Beef consumers are domestic individual consumers who buy either processed meat from butchers and supermarkets or those who form groups and purchase live animals to slaughter and share the meat. The consumption function considered under this study is start from local consumption in study areas to the final consumers in Addis Ababa in different form of beef.

## Marketing channels

Marketing channel is an organized network of different agencies and institutions which in combination perform all the activities required to link producers with consumers to accomplish the marketing tasks and only a small portion of goods and services is consumed at the point of production and only a small fraction of any output is purchased by the ultimate consumers directly from the final producers (Jaleta, 2011). Thus, marketing channel is a marketing process which performs several functions by bridging the gap between production and consumption and it is a systematic knowledge of the flow of goods or services from their production areas to the final market or end users. Marketing channels of fattened cattle study areas starts with the collection of fattened cattle from production areas moving on to the 'end markets' (Figure 2). The number and type of market participants are different along the different market channels.

In order to indicate the distribution of marketing costs and margins, some major market channels are identified. The different channels represent available outlets in the areas through which fattened cattle moves from different directions of the production areas to the 'end markets' and end users. Six major sheep marketing channels are identified in the area. These are;

Channel 1: Cattle slaughtered around the study areas butchers
Channel 2: Cattle slaughtered at Nekemte butchers
Channel 3: Cattle slaughtered around Guder butchers
Channel 4: Cattle slaughtered at Finfinne butchers and supermarkets comes directly from Ukke and Illu Harar
Channel 5: Cattle slaughtered at Finfinne butchers and supermarkets come through Guder market to Finfinne
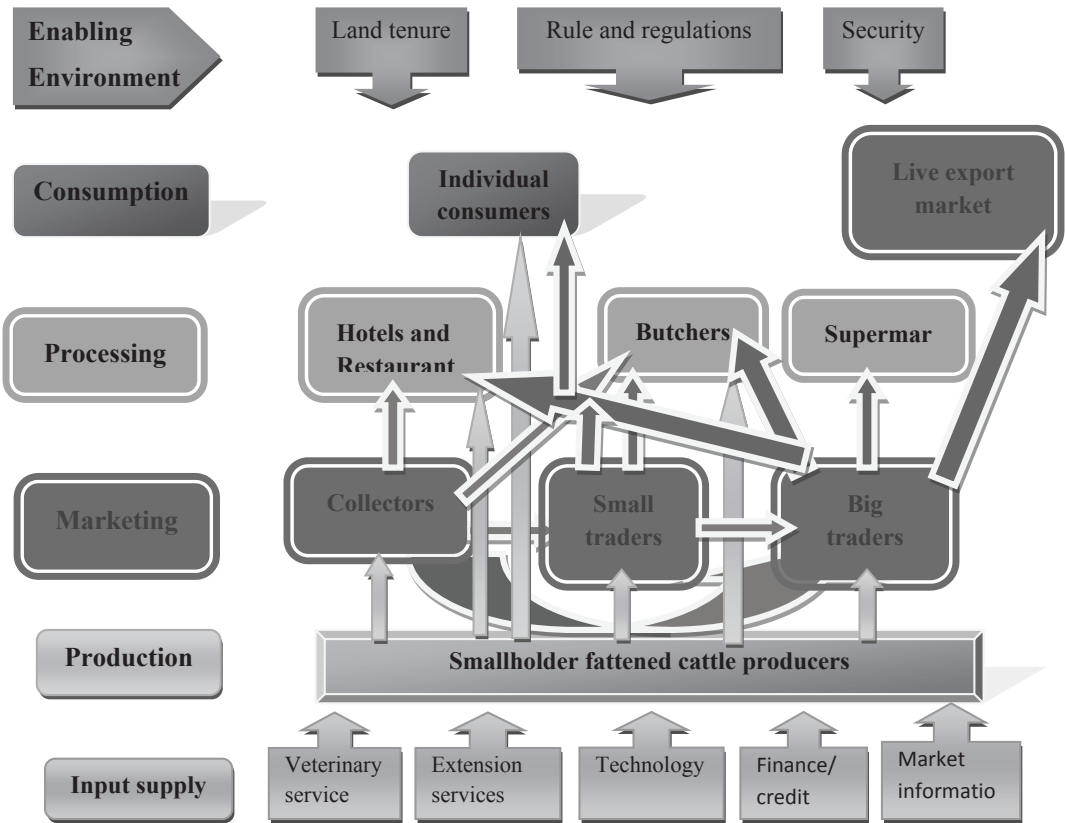Channel 6: Live cattle supplied to export market though Jigjiga



Figure 3: Fattened cattle value chain map in the study areas
**Description of those identified six channels and their sub-channels**

A. The channel which starts from small scale farm household producers in respective study areas and end at their local areas consumers (could be individuals, hotels and restaurants). This channel is the first channel identified in the study areas.

B. The second main channel is which start from Ukke and Chawaka areas fattened cattle and end at the hands of Nekemte town consumers. The consumers her are individuals, hotels, and restaurants and Wallega University.

C. The third main channel start from all small scale farm household producers (Illu Galan, Guto Gida and Chawaka districts) in the study areas to Guder live animals market (the biggest live animal market in Central western region).

D. The fourth main channel start from Ukke and Chawaka small scale farm household producers directly pass to Finfinne market and at Finfinne butchers and supermarkets are considered as retailers.

E. The fifth main channel stars from all small scale farm household producers in the study areas passes through Guder to Finfinne live animal market and at Finfinne butchers and supermarkets are considered as retailers.

F. The sixth main market channel starts from Ukke and Chawaka (both most commercialized in fattening cattle) directly to the export market by traders who supply these fattened cattle exporters. These areas of the study areas are populated by ''Anniya'' and ''Afran Kalo'' clan of Barentu Oromo's inhabitants. These clan of Oromo societies are kwon for their ''Harar Bull'' in the Eastern part of Oromia and they are practicing what has been experienced by their clan in the Eastern part of Oromia her in these study areas.

The first main channel described under letter 'A' above of the study areas can be divided in to three sub channel depending on the origin and destination of the fattened cattle in these study areas. These sub channels are;

1. The first sub channel is the channel which starts from small scale farm household producers of Chawaka area to the local consumers in Chawaka district and around Arjo Gudatu town area in East Wallaga zone.

2. The second sub channel is the channel which starts from small scale farm household producers of Ukke area to local consumers of Ukke area.

3. The third sub channel is the channel which starts from small scale farm household producers of Illu Galan to the local areas in Illu Galan district.

**Distribution of costs and margins**

In the study areas marketing system of the fattened cattle is more complex; being the linkages among different stockholders and the numbers of these stockholders to move these live animals and beef to the final users are many in numbers. These different and many number of linkages in marketing of a commodities indicate that different services and value addition to the product in our case to the beef and live fattened cattle. Therefore, different assumptions were considered during the cost benefit analysis of fattened beef cattle. The first assumption is net marketing margins of the a particular marketing agent as an indicator of the efficiency of the channel, is defined as the residual of the gross marketing margin after paying marketing coast. The second assumption is marketing costs are composed of the total costs incurred in marketing of fattened cattle and/or beef by each agent in the value chain.

As the fattened cattle/beef are transferred trough different marketing agents/value chain actors, the marketing costs incurred in these value chains accumulate and finally determine the price in consumer markets and these facts are presented in annex tables at the end of this paper pages.

It is clear, from the annex table that as the actors in the value chain increases the profit share of the small scale farm household farm decreases. Additionally, as the value addition on fattened cattle increases the share of the small scale farm household farm decreases. The lowest profit share of the small scale farm household farm was observed in the channel where the fattened cattle were passing through Guder market to Finfinne supermarket. In this channel participants of the fattened cattle were more and the value adding activities were also more compared to other channels.

**Constraints in the Fattened Cattle Value Chain**

Input supply for fattening cattle production for producer farmers in the study areas consists of the supply of feeds, veterinary medicines, extension service and credit service. Regarding production the major problems are disease and lack of grazing land about 84.6% where as lack of veterinary technician, lack of improved forage, lack of knowledge and experience, lack of extension services and lack of access credit are the major constraints for cattle fattening. Among the identified inputs at small scale farm household farm level lack of medicines and extension service and lack of improved forage are the more important constraints in the study areas (Table 6).

In case of market transportation, limited market information, lack of vertical and horizontal linkage of cattle value chain actors and seasonality of supply and demand of cattle are the major constraints. The vertical linkages are critical for moving a product or service to the end market where as the horizontal linkages are both formal and informal linkages between producers at level in value chain to reduce transaction costs. Moreover, vertical linkages facilitate the delivery of benefits and embedded services and the transfer of skills and information between firms up and down the chain. Demand is high during cultural and religious holydays and low at other times of the year. Meat processing is mainly performed by hotels, supermarket and butchers in the study areas and end market.

Table 9: Major problems of supplies cattle fattening identified in the study areas

| Major constraints | N* | Frequency | Percent |
|---|---|---|---|
| Lack of medicines and extension service | 110 | 33 | 30 |
| Lack of improved feed | 110 | 25 | 22.7 |
| Unavailability of veterinary medicines | 110 | 15 | 13.6 |
| Farness of extension service on fattening | 110 | 12 | 11 |
| Weak extension service when need on fattening | 110 | 11 | 10 |
| Lack of knowledge and experience of farmers | 110 | 8 | 7.3 |

N*=Number of participants,

**Source:** Survey result (2015)

**Opportunities**

*G***overnment's commitment and support to increase export of meat;** The government envisions earning 1 billion dollar per year from the export of beef and lives animals in the second growth and transformation plane. This plane of the government will make it to work closely with farm households, private actors and other stakeholders to rectify the market, logistics and transport problems in live animal, beef and other crucial export items (MoFED, 2010). Moreover, the Regional Government of Oromia has also established the Livestock Development and Health Agency as a semi-authorized bureau in order to provide necessary support for the livestock

subsector. Therefore, these all attention of federal and regional government is opportunities for the sectoral development of fattened cattle in the study areas as well as in the country as a whole.

Currently, abattoirs have started to process the by-products of fattened cattle to different commodities like dog food, chicken feeds, and different jewelry, soaps, nitrogen fertilizers and others. Such types of processing will increases income from fattened cattle. Therefore, since the income from fattened cattle increases it could be another opportunity to all value chain actors.

Additionally, the policy environment which includes policies like quality and standard assurance, good environment for the chain actor to work together for common benefits has been developed by the government of Ethiopian that could be seen as an opportunity for this sector. Even though, it is too late, the government of Ethiopia announced the 'Live Animals Marketing Proclamation No.819/2014' in the year of 2014 and the regulation cited as 'Live Animal Marketing Council of Regulation No.341/2015' aimed at putting in place a modern and efficient market structure that enables to supply live animals, competitive in quality and price, to domestic and export markets by developing efficient and cost effective live animals market structure supported by up-to-date information and yields proper benefit to live animal keepers, traders consumers and the country though the implementation didn't started yet.

## Conclusion and Recommendations

### Conclusion

This study was conducted to analysis value chain of cattle fattening in western Oromia. Value chain analysis studies on fattened cattle were conducted in order to map and characterize the fattened cattle value chain activities focusing on constraints and opportunities in the study areas. Ethiopia's livestock production system based on integration with crops production, level of input and intensity of production, agro-ecology and market orientation is categorized as pastoral, agro-pastoral, mixed crop-livestock farming, urban and peri-urban farming and specialized intensive farming systems. Despite the fact that Ethiopia is characterized by a high livestock population, its productivity is low, at least in terms of conventional products such as meat and milk and farmers received low benefit for their productive.

In this study, both purposive and a multi-stage random sampling procedure were adopted to select a sample of households that represented the population. The data were collected from both primary and secondary sources. The primary data were collected through household survey using a semi-structured questionnaire, key informant interview, focus group discussion and visual observation. Besides the primary data, secondary data from different sources were collected and organized. Data analysis was carried out using descriptive statistics and costs and margins analysis.

To enhance opportunities for value chain actors, there is need to understand the main value chain actors affecting the entire value chain. The main actors in the fattened value chain in the study areas are input suppliers, producers, brokers, traders, abattoirs, supermarket, hotels and restaurants, butchers and individual/institutional consumers.

Market channels in the study area can be categorized in to seven major channels and these channels can be decomposed to sub channels depending on study areas specific their start and destination. The core functions of fattened cattle in the study areas are input supply, production, marketing, processing and consumption by different individuals/institutions.

Therefore, we can said that small holder cattle value chain practices and linkages remain weak as compared to the anticipated potential because most of the factors necessary for a successful feedlot business in the study in their infancy. These include: inadequate improved feed and grazing land, disease problem, inadequate extension service on fattening cattle and unavailability of veterinary and drugs.

## Recommendations

➢ The respective Government bodies should identify the beef sub-sector as a very important sector and take lead in its promotion. Development of international markets will go a long way in not only boosting beef production, but will also raise the standards and quality of the beef produced.

➢ A set of enabling constraints will deepen the impact of cattle fattening, including inadequate improved feed and grazing land, disease problem, very loose attachment between actors, inadequate extension and training on fattening, unavailability of veterinary and drugs, etc at every stage of the value chain must be prioritized.

➢ Again to increase the profit share of the small scale farm households the value adding activities should have to be accomplished by primary producer farm household themselves.

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# Characterization and Analysis of Farming System in Chiro District, West Hararghe Zone

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## Abstract

*This study was undertaken to characterization and analysis of farming system of Chiro District, West Hararghe Zone. A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which he has access .Therefore, this study was conducted to identify and prioritize the production systems and major production constraints of Chiro district. The selection of the kebeles was done purposively based on the agro ecology. For the study, one PRA group in each kebeles was formed composed of male, female and youth group to collect primary data. The main methods used to gather data were interviews of district Agricultural office experts, focused group discussions (FGDs) and reviewing of different unpublished sources for secondary data. Narration and descriptive ways of analysis method were applied. The study was focused on major constraints of crop production, livestock production and natural resource production with respect to all factors of production. It was found that major constraints of agricultural production in the areas were drought, soil erosion, lack of improved seed, invasive weeds, disease, insect-pests and inadequate feed resources, absence of improved breeds, poor animal health, labor shortages, lack of inputs and market opportunities. Drought tolerant, early maturing, high yield, weed resistance (Striga, parthinieum and etc) and highly demanded crops should be emphasized.*

**Key Words:** Characterization, constraint, farming, prioritize, production

## Introduction

A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which he has access (Mahapatra, 1994). "The household, its resources and the resource flows and interactions at the individual farm levels are together referred to as a farm system" (FAO, 2001). Farming systems research is considered a powerful tool for natural and human resource management in least developed countries such as Ethiopia. This is a multidisciplinary whole-farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself (Behera and Mahapatra, 1999; Singh et al., 2006).

Ethiopian economy is predominantly rural and agricultural, and the declining trend in size of land holding poses a serious challenge to the sustainability and profitability of farming. The crop and cropping system based perspective of research needs to make way for farming systems based research conducted in a holistic manner for the sound management of available resources by small farmers (Jha, 2003). Under the gradual shrinking of land holding, it is necessary to integrate land based enterprises like fishery, poultry, duckery, apiary, field and horticultural crops, etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable (Behera et al., 2004). No single farm enterprise is likely to be able to

sustain the small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year round (Mahapatra, 1992; 1994).

The present critical situation in the countries food supplies, especially in drought prone and food insecure areas demands that all available agricultural resources be utilized to the full to maximize food production through improved agronomy, better soil management and crop husbandry, the use of improved seeds and fertilizers, efficient use of water, effective weed control, effective crop protection and improved livestock husbandry practices.

To implement the above mentioned agricultural technology interventions, farming system study is very crucial and hence, improves agricultural technology interventions in the area. Past experiences show that most of the time technologies disseminated to the farmers did not bring the required change on the livelihood of the farming community. This is mainly due to lack of detail farming system analysis of the environment in which the technology are disseminated. Moreover, farmers` perspectives have been not adequately considered in the development and dissemination of technology to alleviate their problems. Therefore, conducting farming system study is very important to develop and disseminate appropriate agricultural technologies that fit to the environment, which is also important for further agricultural research and development intervention in the area.

## Objective

- ➢ To assess and identify the production systems of the study area and;
- ➢ To identify and prioritize major constraints agricultural production in the study area.

## Methodology

## Description of the study area

The activity was conducted in Chiro district. Chiro district is located in West Hararghe Zone of the Oromia National Regional state at 324 km East of Addis Ababa, the capital city of Ethiopia. The capital town of the district is Chiro, which is also the capital town of the zone. The district bordered with Miesso in the North, Gemechis in the South, Guba-koricha in the West and Tulo in the East.

The total number of population of the district is estimated to 184,705 out which 95,751 are male and 88,954 are female. Out the total number of population in the district about 30,579 are male household and 5,363 are female household (2008 data from Office of Agriculture of the district). Average family size in the district is 3.9.

The district is found in between the range of 1100 and 2500 m.a.s.l. From the total land area/topography of the district 45% is plain and 55% steep slope (data from Office of Agriculture and Rural Development of the district). The district is mainly characterized as steep slopes and mountains with rugged topography, which is highly vulnerable to erosion problems.

The district has a maximum and minimum temperature of 23 °c and 12 °c respectively and the maximum and minimum rainfall of 1800 mm and 900 mm respectively (2011 data from Office of Agriculture of the district). Rainfall type is bimodal and erratic in nature. Main rainy season is from June to September for the highland and midland areas and from March to April for the lowland. Short rainy season is from March to May for highland and midland and for that of lowland around July. The amount of the rainfall is relatively adequate in the highland and midland than the lowland.

In the district there are sandy soil, clay soil (black soil) and loamy soil types covering 25.5%, 32%, and 42.5% respectively according to 2011 data from Office of Agriculture and Rural Development. The soil types vary with the topography mainly black soils are observed in the highland and midlands while one can see red soil in the lowland areas. And mixed farming, both crops and live stocks production, is the dominant practice in the district covering 98% and the rest is of pastoral production system with a share of 2%.

## Sampling procedures, data collection and analysis

Normally the district is divided into three major agro-ecological zones. These are Lowland with 22 kebeles, Midland with 13 kebeles and highland altitude with 4 kebeles. The selection of the kebeles was done purposively collaboration with agricultural experts of the district. Accordingly, three (3) kebeles (Arberekete, Medicho and Nejabas) were selected from the district. For the study, one PRA group in each kebeles was formed composed of male, female and youth group. The multidisciplinary team consisted of 6 members drawn from socio-economics, crop, livestock and natural resource at McARC was organized to conduct the Participatory Rural Appraisal. Prior to conducting the study, awareness on the checklists and PRA was created to the team members. The main methods used to collect both primary and secondary data were interviews with the district agricultural bureau experts, Focused Group Discussions (FDGs) with farmers and reviewing of secondary data from different unpublished documents like quarter and annual report. Gathered data were analyzed through describing and narrating the idea of focused group discussion and key informants.

## Result and Discussion

## Infrastructure Development

The district has all weather main gravel road that connects Chiro to Bedesa highway and asphalt road that connects Chiro to Miesso and Hirna. The rest road rather than the main road is serious problem during rainy season. Infrastructure development is relatively good than the remaining districts in the zone. Road development has a great role for the farming community for agricultural input supply and for supplying their product to the market.

## Marketing and marketing systems

In Chiro district local markets exist at different small market place on different days within a week. The major marketable items supplied by the farmers are chat, coffee, groundnut, hot pepper, onion, banana, poultry, cattle and etc. Among these products like live animals, coffee, groundnut, hot pepper, and chat that are taken to Addis Ababa and Diredawa. Mainly the farmers sell their product to middlemen who later sell to whole buyers in Badesa, Chiro, Harar and Adama. The marketing decision on all items especially when it's in large quantity is the responsibility of household head.

However, there is general complaint that farmers have no bargaining power and traders fix a price that is not reasonably benefit able for farmers with regard to all commodities. This necessitates initiatives, which have already started, to organize farmers in to cooperatives.

The other serious problem of farmers is lack of market information. If they get a price of information that price of a crop is good this year the majority of will allocate most of their land and flood the local markets with produces which favors those blood trusty traders.

**Farm resources**
**Land**

The total land area of the district is 70,912.8 hectare out of which 31,659.1 hectare is cultivated land, 30,667.4 hectare is uncultivated land, 8,104.3 hectare is covered by forest, and 482 hectare is grazing land. Shortage of land is common in the district. Among the main reasons are the increasing population density at a very alarming rate and the land fragmentation due to high number of children in the household. The average land holding status in the area is 4 "qindi" (0.5 ha) & range lies between 2-6 "qindi" (0.25-0.75ha) where (8 "qindi" equals 1 hectare).

Land fragmentation also causes shortage of land in the area, which results in low yield, low income, shortage of grazing land, over cultivation of the land, which highly reduces the fertility of the land, and this causes deforestation in the area because farmers are looking for new land and as a result they deplete the forest. There are different measures taken by the farmers to offset the land shortage and increase production under conditions of land shortage. Those measures are use of fertilizers and improved seeds, compost and manure, crop rotation, share cropping locally called "Hirta", livestock rearing and accomplishing other non-farm activities like daily laborer, selling fire wood, petty trade, selling charcoal and the like as additional source of income. Farmers allocate fertile lands for crops like maize, chat and Teff while allocate infertile lands for sorghum. Land is owned by both female and male and has equal power in decision making on land resources.

**Labor**

The major source of labor for agricultural activities in the area is family labor with some hiring of labor in rare case. In the communities male accomplishes the major farm activities like land preparation, weeding, sowing, weeding, harvesting, threshing, storage, looking after live stock, marketing, etc while women engaged highly in reproductive activities like fire wood collection, cooking, caring for children and aged people, fetching water, washing clothes, etc and also involved in some productive activities like weeding, harvesting, threshing, transporting the harvested crops from the field to home, preparing threshing ground and to some extent in harvesting. Male children herd livestock and help their family on farm activities and female children participate in home activities in addition to learning.

There is seasonal labor shortage in the area. Labor shortage occurred during peak season of agricultural activities mainly in April, March, June, July, December and January. During labor shortage there is a practice to overcome these shortage such as local labor arrangement; like "Debo" and labor exchange and there is labor hiring to some extent.

**Farm implements**

Major traditional farm implements used in the district include Shovel, Saw, hoe, "Mofara", rake and there is no availability of improved farm implements/farm mechanization. Farmers mainly get these farm implements from local and district markets and sometimes made themselves

## Agricultural production constraints

Table 1: Major problems identified by farmers in the district

| Major problems | Rank |
|---|---|
| Drought | 1 |
| Land shortage | 2 |
| Lack of improved technologies | 3 |
| Diseases and pests | 4 |
| High price of fertilizer | 5 |
| Shortage of draught power | 6 |
| Feed shortage | 7 |
| Soil fertility decline | 8 |
| Cash shortage | 9 |
| Low price of agricultural products | 10 |

Source: group discussion

## Crop Production

The production system in the area is predominantly rain fed. Based on the agro ecological classification, the sub-systems vary in such a way that in low land one finds livestock dominated type of production system and as one goes up to midlands and highlands cash and food crop based mixed production system. Among major crops grown in the district are sorghum, maize, teff, barley, wheat among cereal crops; haricot bean, pea, linseed among pulse and oil crops; chat and coffee among cash crops; potato, tomato, sweet potato, Garlic and onion among horticultural crops mainly in highland and midland area were irrigation potentials available. Sorghum, maize and sweet potato are mainly produced for food consumption while chat, onion, tomato and potato are produced and supplied to the market.

Sorghum is the first leading food crop produced in large amount in Chiro district. The reason for high production of this crop is; it is used both for human and animal consumption (stalk and leaf), for home fuel consumption and construction purpose, adaptable to weather condition of the area. Maize is the second major cereal crop produced next to sorghum mainly for household food consumption.

Table 2: Area coverage of different crops in the district in 2011

| No. | Crop type | Area allocated in hectare | Total yield harvested (Qt) |
|---|---|---|---|
| 1 | **Major cereal crops** | | |
| | Sorghum | 9,881 | 192,766 |
| | Maize | 5,520 | 80,596 |
| | Wheat | 749 | 5988 |
| | Teff | 586.5 | 3520.5 |
| | Barely | 805 | 6440 |
| 2 | **Pulse and oil crops** | | |
| | Haricot bean | 495 | 1039.5 |
| | Ground nut | 15 | 105 |
| | Sesame | 80 | 184 |
| 3 | **Cash crops** | | |
| | Coffee | 1,815 | 19,230 |
| | Chat | 2,330 | - |

| 4 | **Vegetable crops** | | |
|---|---|---|---|
| | Onion | 9,884 | 65,554 |
| | Banana | 85 | 17,000 |
| | Mango | 17 | 680 |
| | Papaya | 13 | 1,300 |
| | Orange | 5 | 120 |

## Improved Varieties Used

Both local varieties in majority and improved to some extent are available in the area. Major problems with local cultivars are late maturing, susceptible to disease, low yield due to drought etc.

Table 3: Crop type, available local varieties, farmers' selection criteria and its sources

| Crops type | Local name/varieties | Selection criteria for improved variety | Seed preservation methods | Improved varieties | Source of varieties |
|---|---|---|---|---|---|
| Sorghum | Shafare, Abdalloota, Gababe, Masugii, Wagare, Waraabe | Large head and seed size, disease resistant, drought tolerant, smut free, high yield, suitable for food, early maturity | Tied and hanged outside the resident room by mixing with hot pepper, Using chemical | Bombered, Calanqoo, Chiro | DAO, NGOs, Research centers |
| Maize | Bukuri (early maturing) Shashamane | Cob size and number, early maturity, seed uniformity | | Nazirit, Katumani, BH-660 | DAO, NGOs, Research centers |
| Haricot bean | Folodde(white), Sartu | High yield, demanded at market | | Phosolia red and white, keniyaa | DAO, NGOs, Research centers |
| Barley | Hifaato (late maturing) | High yield | | | DAO, NGOs, Research centers |
| Onion | Habasha | | | Qinijito, Fadiso, Bombered | DAO, NGOs, Research centers |
| Potato | Sargal, Mokkor"(late maturing) | High yield | | | DAO, NGOs, Research centers |

**Source: - group discussion**

## Cropping system

The major cropping systems in the study area are intercropping, relay cropping, mixed cropping and double cropping. Maize relayed with teff, haricot bean, chickpea, linseed, and fenugreek while intercropped with cash crops such as chat, coffee, haricot bean and with food crop sorghum. Teff is mixed with safflower, etc. Double cropping is also practiced in the area.

## Agronomic practices

Table 4:- Land preparation and major crops production calendar

| Crops | 1st plowing | 2nd plowing | Planting | Methods of planting / sowing | Seed covering methods |
|-------|-------------|-------------|----------|------------------------------|------------------------|
| Maize | February | April | May | Row planting and Broadcasting | Oxen and hand |
| Sorghum ` | February | March | April | Row planting and Broadcasting | Oxen and hand |
| Teff | May | June | July | Broadcasting | |
| Haricot Bean | April and March | May | June | Broadcasting- local Row– improved | Oxen and hand |

**Source: - Group discussion**

In the communities land preparation is carried out dominantly by male group. Female also participate by helping male farmers by performing activities such as providing meal and water, feeding oxen at farm, clearing weed and crop residues from the land etc. Major problems encountered in land preparation were late starting of rainfall and lack of draught power and farm implements for plowing.

## Weed and its control mechanism

Weed is among the top problems faced by the farmers in crop production in the district which hampered production and productivity of agricultural production?

Table 5:- Major weeds and control methods

| Major Weeds | methods used to control | Frequency of weeding of major crops |
|-------------|--------------------------|--------------------------------------|
| Coach grass Bidenpilosa | -Hand weeding -Frequent plowing -Hoeing -Ploughing between row | Maize – 3 times Teff – 3 time |
| Parthinieum* | -Use of chemical(especially for Coach grass) in rare case because farmers can't afforded the price of chemical | Sorghum – 3-5 times Wheat and barley – once |
| Striga* Cynodundactylon | | H. Bean- 2 times |

Source: Group Discussion, * Shows very serious weeds which are difficult to control

## Fertilizer and manure utilization

Fertilizer and manure are the most common inputs used by the farmers to increase crops productivity in the area. Fertilizer type available to the area are DAP and UREA. Farmers use/apply DAP during planting while UREA applied at ploughing between row locally called "babeqa/shilshaaloo". Major crops receiving fertilizer in order of importance as suggested by farmers were sorghum (1), maize (2), onion (3), chat (4), wheat (5), barley (6).

Problems encountered by farmers in using fertilizer are high fertilizer price, rainfall shortage and inadequacy, lack of awareness of some farmers and unavailability at the right time and place. Manure collection, preparation /storing and application is also commonly practiced in the area. Manure is collected during dry season and applied mainly to; chat, sorghum, and maize. Problems related to manure preparation are low number of livestock possession especially in high and mid lands and lack of means of transporting from source to the field.

## Harvesting, Threshing and Storage

In the district, farmers use traditional harvesting materials like Saw, and use oxen and hand for threshing. There is no improved harvesting and threshing technology available in the study area. Farmers have their own traditional knowledge of storing their products. There is no improved storage technology available in the study area. Storage types used by farmers are indicated in the table below as follows.

Table 6: storage types used farmers in the district

| Storage type | Crop(s) | Duration |
|---|---|---|
| underground storage /"Boolla" | maize and sorghum | 2-5 years depending on construction method of the ground |
| aboveground storage/"Gotera" | Maize, wheat, barley | 1-2 years |
| Sack | Maize | - |

The underground storages were treated with tobacco while mixing aboveground storage/"gotera" and sacks with hot pepper, exposing crops to the sun; tetracycline treatment to reduce the prevalence of storage pests. The major storage pests are rodents (rat) and weevil are prevalent on maize, sorghum, haricot bean, wheat and barley.

## Crop diseases and Pests

Disease and pest is another problem of crop production in study area. These diseases attack crops mainly at the very beginning of germination, vegetative stage, at flowering stage and grain filling stage of the crops. Diseases and pests and crop(s) affected summarized in the tables below.

Table 7: Major diseases and crops damaged

| Disease | Crop(s) |
|---|---|
| Honeydew | Maize, sorghum |
| Smut | Sorghum |
| Cancer | Chat |
| Rust | Onion, potato |

Source: - group discussion

Table 8: Major Field pest and crop(s) attacked

| Pests | Crop(s) | Control methods used by farmers |
|---|---|---|
| Stalk borer | Sorghum | |
| Moulds | Khat | Cutting stalk at vegetative stage, spraying DDT and Malathyne |
| Termite | Maize, sorghum | |
| Grass hopper | All crops | |

Source: - Group Discussion

Finally, the major constraints of crop production identified are drought (lack of sufficient rainfall), diseases and pests, shortage/lack of improved (early maturing and drought tolerant) crop varieties.

**Livestock Production in the study area**

Table 9: Livestock population of the district in 2011

| No. | Livestock type | Population |
|---|---|---|
| 1 | Cattle | 86,251 |
| 2 | Sheep | 29,479 |
| 3 | Goat | 60,717 |
| 4 | Donkey | 14,257 |
| 5 | Horse | 167 |
| 6 | Mule | 165 |
| 7 | Camel | 549 |
| 8 | Poultry | 97,716 |

Source: DOA

Livestock production is also one of the main sources of income practiced in the area next to crop production. Farmers in the low land area of the district are agro pastorals that are currently started crop production in small amount and are mainly dependent on livestock production. All the breeds of the livestock species kept by the farmers are local breeds except for poultry; there are exotic poultry, which is distributed by agricultural office of the district in few Peasant Associations.

Table 10: Livestock species, purpose, preferred animals and their local name

| Type | Purpose | Local name | Preferred animals | Reason |
|---|---|---|---|---|
| Cattle | For breed source, for milk, meat, draft power and marketing (fattening) | Ogaden (thin, long horn) Dobba, Arsi (short) | Arsi and Ogaden | Gives good milk production, tolerate harsh conditions |
| Goats | For breed source, milk, meat and marketing | Mayo (big in size) Shanyo( small in size) | Shanyo | Gives twins, good milk |
| Sheep | For breed source, meat and market purpose | Adal (big in size) Wanke (small in size and thin) | Adal | Highly preferred at market |
| Donkey | Transportation | | | |

| Horse and mule | Transportation | | | |
|---|---|---|---|---|
| Camel | Transportation, milk, meat, market | Iisoo (thin in size, red and black in color) | Iisoo | Fast moving, good for production |
| Poultry | Egg, meat, market | Habesha | | |
| Honey bee | Honey, wax | Red and Black | Red | Good honey production |

Source: - Group discussion

## Breeding system in the area

Natural mating is the most common breeding system experienced in the area. Farmers in the highland and midland areas mainly use purposive natural mating method. Farmers have traditional knowledge of detecting heat period of their cattle by observing symptoms like mucus discharge, sound production, jumping on other cattle. When they observe the above symptoms they make their cow to mate with the bull they prefer. Most of the time farmers prefer bull in terms of size and color for breeding system. Artificial insemination (AI) services are also available in the area but the use of AI by farmers is minimum due to the availability of the service in very few areas and lack of awareness. In highland and midland areas since the number of livestock population is small, farmers mainly tether their cattle near their home due to shortage or unavailability of grazing land. Milk production is seasonal in the area being high in wet seasons due to tremendous availability of feed and water resources for livestock and low in dry seasons because of feed shortage.

## Feed resources and Feeding system

In the midland and highland parts of the district where there is no enough communal grazing land, they practice cut and carry feeding system. They use pasture that is grown on the boarder of the farm, crop residues of sweet potato, sorghum and maize, straw of wheat and barley they also use weeds and thinned crops as a feed source. Feed is commonly scarce from January to July in the area. During feed shortage or dry season farmers use and tree species such as Cordial Africana, Veronica amygdaline, Lantana camera, as a feed source for their livestock. The feeding system in the lowland area is a little bit different from the highland and midland in this area there is no problem of grazing land they practice free grazing and transhumance that is a seasonal migration of livestock to distant places in search of feed and water during dry season. There are also few improved forage varieties such as elephant grass, oats and Rhodes grass which are distributed by District Agricultural office.

## Watering and Housing practice

The community in the district waters their live stock in two ways. The first one is fetching water from the source by donkey especially for fattened animals and calves. This is mainly practiced by farmers in the mid and highlands since farmers in this area rear very small number of livestock due to shortage of grazing land. The second one is taking or moving animals to the area of water point/river this is specially practiced in the lowland areas where the majority of the livestock populations exist/found. The housing practices in the area for animals are different based on the species of the animals. Goats, sheep and calves share house (locally called sekela) with farmers while cattle and donkey are either kept in barn or tethered outside the compound.

## Livestock ownership pattern and responsibilities within household

In most cases all the livestock species are commonly owned both by male and female and has equal decision role when selling their livestock as well as on the money/income gained. In addition female are responsible for the sale of small ruminants and animal products (milk, egg). In the community livestock management activities like cleaning barn, product harvesting (milking) and processing are done by female adults while watering and herding are responsibilities of male adults and youngsters.

### Livestock Diseases

Livestock disease, their symptoms, season of occurrence and traditional treatments are listed below in the following table.

Table 11: Livestock disease, their symptoms and cultural treatment(s)

| Disease type in local language | Symptoms | Affected livestock species | Treatment |
|---|---|---|---|
| Emergence disease | Paralyzes the animal, vibration | Cattle | Vaccination |
| Diarrhea | Diarrhea Affects eye | Cattle | Providing pure water, feeding properly |
| Anthrax | Fever Chronic and zonotic | Cattle | Providing garlic, vaccination |
| Foot and Mouth Disease | Attacked animal cannot move and cannot take feed and water | Cattle | Feeding honey mixing with Garlic |
| Pasteurellosis | Inflammation of body | Cattle | Bleeding the skin |
| Inflammation | Bloating, fever (common for camels) | Camel and cattle | |
| New castal disease (NCD) | Common for poultry | Poultry | Giving tablet |

Source: group discussion

## Apiculture

### Honeybee production and management

The farming community in the area also practices bee production. Honeybee production system in the area is mainly at backyard. According to information from the Agricultural office of the district, estimated number of traditional, transitional and modern beehives in the district is 5884, 165 and 307 respectively. Bee management practices like feeding, watering, protecting from enemies, cleaning the hive are responsibilities of women while harvesting honey and constructing the hive is mainly performed by men.

Main honeybee feed source is natural trees (Acacia saligna, Cactus, Cordia africana, Croton macrosytchos, Olea africana, eucalyptus) where as a toxic plant called Lantana camara appears in some areas of the district. During feed shortage supplementary foods like barley flour, bean flour, and sugar are commonly given by dissolving with water. In some places of the district hunting practices is also practiced. Main honey harvesting seasons are September, October, and November and time of abscond is March and May due to feed and water shortage.

Major pests/enemies attacking honey bees are birds, butterfly, termites, honey beggar, and worms. Control measures taken by farmers locally are constructing fence around the hive, hanging the hive far up from the ground, supervising and cleaning the hive frequently, and smoking crop residues and dried coffee leaf. Honey is used for different purposes like for house hold consumption, for medicinal purpose and above all for income generation purpose. However, high price of modern beehive becomes unaffordable for farmers.

## Natural Resources

### Soil and water

### Soil type

Table 12: Soil type with its color

| Soil types | Color |
|---|---|
| Clay | Black |
| Sandy | Brown |
| Limestone | White |

Source: group discussion

In the district, severe soil erosion, wind erosion, declining soil fertility and inadequate soil moisture availability are the common soil related problems. The severity of soil erosion increases as one goes up to steep slopes, extent of soil erosion is relatively less in the low land areas of the district. In the highland and midland areas there is water lodging problem during heavy rainy season and inadequate soil moisture especially in the year of low rain fall. In the lowland areas due to low rain fall availability soil moisture is highly inadequate and there is also no water lodging problem in this area. Generally, due to the above mentioned problems during the last 10 years soil fertility is declining in the area which leads to decrease in agricultural production.

### Soil conservation practices

Farmers in the district use different physical and biological soil conservation practices by their indigenous technical knowledge and by training they obtain from Agriculture Development office of the district on soil conservation practices. The physical conservation methods are; stone and earth/soil bunds, counter ploughing, check dam (stone, wood), grass strips, micro basins, trench for coffee and chat, tide ridging, cut off drain…etc and biological conservation methods used by farmers are; crop rotation, crop residues, manure application, mulching specially under coffee and chat.

### Water sources and Management practices

Common water sources found in the district are rivers, springs, ground water, hand dug well, and ponds. Farmers use the above water sources for different purposes such as irrigation, domestic uses and for livestock consumption. Major crops produced through irrigation are high value cash crops like chat, coffee and different vegetables and fruits like onion, tomato, cabbage, and banana.

In the district, scarcity of water occurs during September to March. At the time of scarcity communities use these water sources through rotation mechanism especially for irrigation purposes. There is water management committee who is locally elected by the community itself. The committee is responsible for controlling water usage and initiating the surrounding farmers to participate in water management practices like construction of fence to prevent the damage by animals, rehabilitation works and protection from inappropriate utilization.

## Problems related to soil and water

During this survey work farmers identified many problems related to soil and water. These problems are: deforestation, overgrazing, soil erosion, declining soil fertility, scarcity of water and water sources, decrease in agricultural production, food insecurity problem, migration to other places, poverty, wastage of time and incurring extra cost in search of water from distance areas, etc.

## Forestry

Table 13: Tree species found in the district

| S.no. | Tree species | Socio-economic benefits |
|-------|-------------|-------------------------|
| 1 | JuniPerus procera | Home construction |
| 2 | Podocarpus falcatus | For construction of local furniture (eg., box) |
| 3 | Olea Africana | For construction of local farm tools |
| 4 | Casurainae evistifelia | Timber production |
| 5 | Hagenia absinica | Timber production |
| 6 | Cordia africana | Timber, for feeding animal |
| 7 | Acacia Senegal | For shade, charcoal |
| 8 | Acacia saligna | For charcoal, house construction |
| 9 | Croton macrosytchos | Timber production |
| 10 | Vernonia amygdaline | For animal feed |
| 11 | Scinuss molle | For shade |
| 12 | Gravillia | |
| 13 | Eucalyptus tree | House construction |

In the district Cordia african and Hagenia absinica are among the most preferred indigenous trees while Gravillia, Eucalyptus, and Casurainae evistifelia are among preferred exotic trees in the area.

Extent of forest at present has decreased from the past situation in the area. Among the factors for the declining of forest were increasing population, increasing demand for construction and fire wood consumption, deforestation of forest for cultivation land, etc which leads to the problem of drought due to shortage of rainfall, soil erosion, climate change, desertification, shortage of water, migration of wild animals and shortage of animal feed and feed sources. Currently, the farming community in the area is being carried out different rehabilitation practices such as; soil and water conservation practices, massive tree planting, replacing immediately after cutting the tree, protecting the forest from destruction, etc. As a result of these rehabilitation works done damaged forest has been recovering in the past few years.

## Conclusion and Recommendation

### Conclusions

The survey has generally surfaced the following issues with respect to farming system

1. Major constraints of agricultural production in the area are drought, soil erosion, lack of improved seed, invasive weeds, disease, insect-pests and inadequate feed resources, absence of improved breeds, poor animal health, labor shortages, lack of inputs and market opportunities.
2. As compared to highland and midland areas severity of drought is relatively high in the lowland areas causing livestock death and migration to other places in search of feed and water.

3. The extent of forest in the area now a day is increasing when relatively seen with the previous condition. This is due to community role in natural resource conservation practices (soil and water conservation practices, replanting of trees)

4. In the farming community male farmers are engaged in productive activities (land preparation, sowing, weeding, harvesting and threshing, storage, marketing, looking after livestock and milking) while females mostly perform reproductive works (caring for child, sick and aged peoples, fetching water, cooking, collection fire wood, cleaning and the likes) and sometimes participate in productive activities. This is from the assumption in the community that there is division of work for male and female.

5. There are various institutions in the district (GOs and NGOs) which are working different activities concerning agriculture. These institutions have a crucial role in the development of agricultural sector.

**Recommendation**

The survey also has highlighted some of the areas which demand special attention in the study area. These include:

1. Agricultural Research center should:
    ➢ Introduce and scale up improved and high value crops which provide high yield, early maturing, drought tolerant and weed resistant (Striga and Perthinium etc), for farming community.
    ➢ Introduction, development and promotion of improved forages, improved livestock species and improved management practices.

2. Agricultural Research mechanization should introduce improved farm mechanization (especially coffee harvesting and cleaning machines).

3. Government should:
    ➢ Establish soil and water conservation and improvement activities to solve soil and water related problems.
    ➢ Rehabilitating the deforested areas to protect climate change and establish good weather condition.
    ➢ Expand and strengthening the livestock veterinary service stations especially in the lowland areas of the district.
    ➢ Finally, attention should be given to infrastructure development (especially road) in the area to connect the farming community with market.

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# Characterization and Analysis of Farming System in Gemechis District, West Hararghe Zone

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## Abstract

*This study was undertaken to characterization and analysis of farming system of Gemechis District, West Hararghe Zone. A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which he has access. Therefore, this study was conducted to assess, identify and prioritize the production systems and major production constraints, to describe the major aspects of the farming system of Gemechis district, and to document the information. The representative kebeles selection was done purposively and from those kebeles two kebeles were selected randomly. For the study, one PRA group in each kebeles was formed composed of male, female and youth group. Both primary and secondary data was collected. The main methods used to gather the data were interviews with the district Agricultural office experts, Focused Group Discussions (FGDs) with selected farmers and reviewing of secondary data from different unpublished sources. Descriptive and narrative ways of analysis method were applied. The study was focused on major constraints of crop production, livestock production and natural resource production with respect to all factors of production. It was found that drought, soil erosion, lack of improved seed, invasive weeds, disease, insect-pests and inadequate feed resources, lack of inputs and market opportunities were major constraints of agricultural production in the area. Attention should be given to introduce and scale up of drought tolerant and early maturing crop and infrastructure development (especially road) in the area to connect the farming community with market.*

**Key Words:** Characterization, constraint, farming, prioritize, production

## Introduction

A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management to which he has access (Mahapatra, 1994). "The household, its resources and the resource flows and interactions at the individual farm levels are together referred to as a farm system" (FAO, 2001). Farming systems research is considered a powerful tool for natural and human resource management in least developed countries such as Ethiopia. This is a multidisciplinary whole-farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself (Behera and Mahapatra, 1999; Singh et al., 2006).

Ethiopian economy is predominantly rural and agricultural, and the declining trend in size of land holding poses a serious challenge to the sustainability and profitability of farming. The crop and cropping system based perspective of research needs to make way for farming systems based research conducted in a holistic manner for the sound management of available resources by small farmers (Jha, 2003).

Under the gradual shrinking of land holding, it is necessary to integrate land based enterprises like fishery, poultry, duckers, apiary, field and horticultural crops, etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable (Behera et al.,

2004). No single farm enterprise is likely to be able to sustain the small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year round (Mahapatra, 1992; 1994).

The present critical situation in the countries food supplies, especially in drought prone and food insecure areas demands that all available agricultural resources be utilized to the full to maximize food production through improved agronomy, better soil management and crop husbandry, the use of improved seeds and fertilizers, efficient use of water, effective weed control, effective crop protection and improved livestock husbandry practices.

To implement the above mentioned agricultural technology interventions, farming system study is very crucial and hence, improves agricultural technology interventions in the area. Past experiences show that most of the time technologies disseminated to the farmers did not bring the required change on the livelihood of the farming community. This is mainly due to lack of detail farming system analysis of the environment in which the technology are disseminated. Moreover, farmers` perspectives have been not adequately considered in the development and dissemination of technology to alleviate their problems. Therefore, conducting farming system study is very important to develop and disseminate appropriate agricultural technologies that fit to the environment, which is also important for further agricultural research and development intervention in the area.

## Objective

> ➢ To assess and identify the production systems of the study area and;
> ➢ To identify and prioritize major constraints agricultural production in the study area.

## Methodology
## Description of study area

The activity was conducted in Gemechis district. It is one of the fourteen districts in West Hararghe zone which is located at 343km east of Addis Ababa and about 17 km south of the Chiro, capital town of zone. The district is bordered with Chiro district in the west and north, Oda Bultum district in the south and Mesala district in the east.

It receives an average annual rainfall of 850 mm and the average temperature is estimated to 20 degree Celsius. The district has bi-modal distribution in nature with small rains starts from March /April to May and the main rainy season extends from June to September/October.

The black, brown and red soils are the three dominant soil types constitute 55%, 25% and 20% respectively according to 2011 data from Office of Agriculture of the district. The soil types vary with the topography mainly black soils are observed in the highland and midlands while one can see red soil in the lowland areas.

The district found at an altitude ranges from 1300 to 2400 meters above sea level (m.a.s.l). Agro-ecologically, the district has three climatic zones classified as temperate climatic zone (highland) constituting (15%), warm mild climate (midland) (45%) and hot lowland climate (40%). The district is mainly characterized as steep slopes and mountains with rugged topography, which is highly vulnerable to erosion problems. Mixed farming, both crops and live stocks production, is the dominant practice in the district and the rest is of pastoral production system.

The total population of the district is 184,032 of which 93,659 are males and 90, 373 are females (CSA, 2007/08). The number of agricultural households in the district is estimated to 38,500 with 32,308 male

headed and 6,192 female headed. The average family size is estimated to be 6 and 4 per household in rural and urban respectively.

## Sampling procedures, data collection and analysis

The selection of representative kebeles was done with experts of the district Agricultural office purposively. Accordingly, two kebeles (Kuni-segeriya and Wel-argi) were selected from the district randomly. For the study, one PRA group in each kebeles was formed composed of male, female and youth group. Multidisciplinary team of enumerators drawn from socio-economics, crop, livestock and natural resource research processes at Mechara Agricultural Research Center was arranged to conduct Participatory Rural Appraisal on the two kebeles to collect data. Both primary and secondary data was collected. The main methods used to gather the data were interviews with the district Agricultural office experts, Focused Group Discussions (FGDs) with selected farmers and reviewing of secondary data from different unpublished sources like quarter and annual report.

## Result and Discussion
## Infrastructure Development

The district has all weather gravel main road that connects Kuni to Chiro and Bedessa highway. The problem of road is much serious during rainy season. Even during the dry season the roads are destroyed and hinder easy transportation. But, recent time road construction was get attention and some roads are being constructed to connect rural areas with each other and to Kuni. These indicate that road development has a great role for the farming community for agricultural input supply and for supplying their product to the market.

## Marketing and marketing systems

In Gemechis district a few local markets exist at different small market place. The major marketable items supplied by the farmers are chat, coffee, linseed, banana, hot pepper, onion, cattle and etc. Among these products like live animals, coffee, groundnut, hot pepper, and chat are taken to Addis Ababa and Dire dawa. Mainly the farmers sell their product to middlemen who later sell to whole buyers in Badesa, Chiro, Harar and Adama. The predominant problems of majority of the farming community however are lack of market information and road.

## Farm resources

## Land

The total land area of the district is 65,117.42 out of which 32,994.5 ha is cultivable, 6,185 ha is grazing land, 1,385ha is covered by forest, bushes and shrubs, 6603.62 ha is not arable and 17,949.34 ha is being used for other purposes such as encampments and infrastructure facilities.

The average land holding status in the area is 0.44 hectare (3.5 qindi) & range lies between 0.25 - 0.625 ha (2-5 qindi) where 8 qindi equals 1 hectare. Land shortage is common problem in the district due to the increasing population density at a very alarming rate and the land fragmentation due to high number of children in the household. Land fragmentation which results in low yield, low income, conflict, migration, shortage of grazing land, food self insufficiency and deforestation the existing forest because farmers are looking for new land. There are different measures taken by the farmers to offset the land shortage and increase production under conditions of land shortage. Those measures are use of fertilizers and improved seeds, compost and manure, crop rotation, share cropping locally called "Hirta", livestock rearing,

producing two times per a year and accomplishing other nonfarm activities as additional source of income. Farmers allocate fertile lands for crops like sorghum, maize, chat, barley, wheat, onion and bean, while infertile lands for finger millet.

**Labor**

The major source of labor for agricultural activities in the area is family labor. In the communities male accomplishes the major farm activities like land preparation, weeding, sowing, guarding, harvesting, and threshing while women are engaged mainly in reproductive activities and in productive activities in part. Reproductive activities handled by female are fire wood collections, cooking, caring for children and some of the productive activities are weeding, harvesting, threshing, and transporting the harvested crops from the field to home, preparing threshing ground and to some extent in harvesting. Male children herd livestock and help their family on farm activities and female children participate in home activities.

There is seasonal labor shortage in the area. Labor shortage occurred during peak season of agricultural activities mainly in April, March, June, July, December, and January. Farmers use different mechanisms to overcome labor shortage that happen during these months. Those mechanisms are local labor arrangements; like "debo" and labor exchange.

**Farm implements**

Major traditional farm implements used in the district include Shovel, Saw and Hoe. However, there is no availability of improved farm implements introduced so far. Farmers mainly get these farm implements from local and district markets and sometimes made for themselves.

**Agricultural production constraints**

Table 1: Major problems identified by farmers

| Major problems | Rank |
|---|---|
| Drought | 1 |
| Land shortage | 2 |
| Lack of improved technologies | 3 |
| Diseases and pests | 4 |
| High price of fertilizer | 5 |
| Shortage of draught power | 6 |
| Feed shortage | 7 |
| Soil fertility decline | 8 |
| Cash shortage | 9 |
| Low price of agricultural products | 10 |

Source: Group discussion

## Crop Production

Among major crops grown in the district are sorghum, maize, wheat, barley, finger millet, teff, among cereal crops; haricot bean, field bean, groundnut, pea, linseed, among pulse and oil crops; chat and coffee among cash crops; potato, sweet potato, cabbage, garlic, banana, beet root, carrot, fenugreek and onion among horticultural crops mainly in highland and midland area were irrigation potentials available. Sorghum, maize and sweet potato are mainly produced for food consumption while chat, onion, and potato are produced and supplied to the market.

Maize is the first leading food crop produced in Gemechis district. Sorghum is the second major cereal crop produced next to maize mainly for household food consumption. In addition, it is used both for human and animal consumption (stalk and leaf), for home fuel consumption and construction purpose, adaptable to weather condition of the area.

### Improved variety used in the study area

Both local varieties in majority and improved to some extent are available in the area. Major problems with local cultivars are late maturing, susceptible to disease, low yielder etc.

Table 2: Crops type, available local varieties, farmers' selection criteria and its sources

| Crops type | Local name/varieties | Selection criteria for genetic resources | Seed preservation methods | Improved varieties | Source of varieties |
|---|---|---|---|---|---|
| Sorghum | Fandisha, Muyra, Gababe, Jangatalil, Shafare, Taklawalad | Large head and seed size, disease resistant, drought tolerant, smut free, high yield, suitable for food, early maturity | Tied and hanged outside the resident room by mixing with hot pepper, Using chemical | Bombered, Calanqoo, chiro,allahualam | Farmer's, DoA, Melkassa ARC, NGOs |
| Maize | Bukuri Shashamane Dima, ifatoo | Cob size and number, early maturity, seed uniformity | | katumani, BH-660,BH-140 | Farmer's, DoA, Melkassa ARC, NGOs |
| Haricot bean | Oshongore | High yield | | Awash-1 (Red), Awash-2, keniya | Farmer's, DoA, Melkassa ARC, NGOs |
| Teff | Manya | | | | Farmer's, DoA, Melkassa ARC, NGOs |
| Onion | Habasha Dimbix | | | Fadiso, Bombered | Farmer's, DoA, Melkassa ARC, NGOs |

**Source: - group discussion**

### Cropping system

The major cropping system in the study area is intercropping, mixed cropping, and double cropping. Maize relayed with teff, haricot bean, chickpea, linseed, and fenugreek while intercropped with cash crops such as chat, coffee, haricot bean and with food crop sorghum. Teff is mixed with safflower, etc. Double cropping is also practiced in the area.

## Agronomic practices

Table 3: Land preparation and major crops production calendar

| Crops | 1st plowing | 2nd plowing | Planting | Method of planting/ sowing | Seed covering methods |
|---|---|---|---|---|---|
| Maize | January, February | March, April | April, May | Row planting and Broadcasting | Oxen and hand |
| Sorghum ` | January and February | April | March | Row planting and Broadcasting | Oxen and hand |
| Teff | May | June | July, August | Broadcasting | Oxen and hand |
| Haricot Bean | April and March | May | June, July | Broadcasting and row planting | Oxen and hand |
| Red root | July | July | August | Row planting | Hand |

**Source: - Group discussion**

In the communities land preparation is carried out dominantly by male group. Female also participate by helping male farmers by performing activities such as providing meal and water, feeding oxen at farm, clearing weed and crop residues from the land etc. Major problems encountered in land preparation were late starting of rainfall and lack of draught power and farm implements for plowing.

Table 4:- major weeds and control methods practiced in the district

| Major Weeds | Its control methods | Frequency of weeding of major crops |
|---|---|---|
| Coach grass | -Hand weeding | Maize – 3 times |
| Bidenpilosa | -Frequently plowing | Teff – 5 times |
| Perthinium* | -Hoeing | Sorghum – 3 times |
| | -Ploughing between row | |
| | | Wheat and barley – once |
| Striga* | | |
| Datura stramoniem | Use of chemical(especially for Coach grass) in rare case because farmers can't afforded the price of chemical | Haricot bean-once Onion- 4 times |

Source: Group Discussion, * shows serious weeds which are difficult to control

## Fertilizer and manure utilization

Fertilizer and manure are the most common inputs used by the farmers to increase crops productivity in a given area. Fertilizer type available to the area were DAP and UREA farmers use/apply DAP during planting while UREA applied at ploughing between row (which locally known as "babeka/shilshalo"). Major crops receiving fertilizer in order of importance as suggested by farmers are maize(1), teff(2), sorghum(3), onion (4), chat(5), carrot(6), wheat(7), barley(8), Finger millet(9).

Problems encountered by farmers in using fertilizer are high price which is unaffordable for the poor, rainfall shortage and inadequacy especially in the low land areas, lack of awareness of some farmers on improved fertilizer application and unavailability at the right time and place.

Manure application is also common in the area. Manure is collected during dry season and applied mainly to: chat, sorghum, maize, wheat, barley and onion. Its preparation is performed dominantly by female while male are responsible for transporting to the field and its application. Problems related to manure preparation are low number of livestock ownership and problem of means of transportation to the field.

## Harvesting, Threshing and Storage

In the district farmer's use traditional harvesting materials like Saw and oxen and hand for threshing. There is no improved harvesting and threshing technology available in the study area.  Farmers have their own traditional knowledge of storing their products. There is no improved storage technology available in the study area.

Table 5: storage types used in the district

| Storage type | Crop(s) | Duration |
|---|---|---|
| Underground storage /"Boolla" | Sorghum | 4-8 years |
| Aboveground storage/"Gotera" | Maize, wheat, barley | 1-2 years |
| Sacks | Maize, groundnut, onion | - |

## Crop diseases and pests

Diseases and pests are common problems of crop production in the district. These diseases attack crops mainly at the very beginning of germination, vegetative stage, at flowering stage and grain filling stage of the crops.

Table 6: major diseases and crop(s) attacked

| Disease | Crop(s) |
|---|---|
| Honeydew | Maize, sorghum |
| Smut | Sorghum, finger millet |
| Frost | Chat |
| Rust | Onion, potato, sorghum |

Source: - group discussion

Table 7: Major pests and crop(s) attacked

| Pests | Crop(s) | Control methods used by farmers |
|---|---|---|
| Stalk borer | Sorghum | |
| Moulds | Chat | Cutting stalk when at vegetative stage, spraying DDT and Malathyne |
| Termite | Maize, sorghum | |
| Grass hopper | All crops | |

Source: - group discussion

In the area the major constraints of crop production identified are lack of sufficient rainfall, crop diseases and pests, lack of improved (early maturing, disease resistant, weed resistant and drought tolerant) crop varieties, lack of improved farm implements, weed, and frost.

## Livestock Production

Table 8: Livestock population of the district in 2011

| No. | Livestock type | Population |
|-----|----------------|-----------|
| 1 | Cattle | 9,4391 |
| 2 | Sheep | 1,309 |
| 3 | Goat | 91,769 |
| 4 | Donkey | 17,958 |
| 5 | Horse | 576 |
| 6 | Mule | 1,064 |
| 7 | Camel | 3,705 |
| 8 | Poultry | 95,055 |
|   | Beehives | 42 modern |
|   |  | 20 transitional |
|   |  | 8,970 traditional |

Source: DOA

## Livestock species, its purpose and local name

Table 9: Livestock species, purpose, preferred animals and their local name

| Type | Purpose | Local name | Preferred animals | Reason |
|------|---------|-----------|-------------------|--------|
| Cattle | For breed source, milk, meat, draft power, marketing (fattening) | Borena, Doba, Arsi | Dobba | Gives good milk, tolerate harsh conditions and big in size |
| Goats | For breed source, for milk, for meat, for marketing | Mayo, Maxe | Mayo | Gives twins, good milk production, big in size |
| Sheep | For breed source, for meat, for marketing | Adal | Adal | Highly preferred at market, big in size, fast growing, adaptable to the area |
| Donkey | Transportation |  |  |  |
| Poultry | For meat, for market |  |  |  |
| Honey bee | Honey for consumption and for sale | Red, black | Red | Good honey production |

Source: - Group discussion

## Breeding system in the area

Natural mating is the most common breeding system experienced in the area. Farmers in the highland and midland areas mainly use purposive natural mating method. Farmers have traditional knowledge of detecting heat period of their cattle by observing symptoms like mucus discharge, sound production, jumping on other cattle. When they observe the above symptoms they make their cow to mate with the bull they prefer. Most of the time farmers prefer bull in terms of size and color for breeding system. Recently, AI services are available in the area but only a few farmers use this breeding system due to lack

of awareness. In this area since the number of livestock population is small and farmers mainly tether their cattle near their home due to shortage or unavailability of grazing land.

### Feed resources and Feeding system

Major livestock feeds available in the district include: pasture that is grown on the boarder of the farm, crop residues of sweet potato, Stover of sorghum and maize, elephant grass, hay, straw of wheat, teff and barley they also use weeds and thinned crops. There are also few improved forage varieties such as elephant grass, oats and Rhodes grass which are distributed by District office of Agriculture. Feed is commonly scarce from January to July in the area. During feed shortage or dry season farmers use and tree species such as Cordia Africana, strawberry, as a feed source for their livestock. In the midland and highland parts of the district where there is no enough communal grazing land, they practice cut and carrying feeding system. The feeding system in the lowland area is a little bit different from the highland and midland areas. In the lowland area there is no problem of grazing land they practice free grazing and transhumance (i.e. a seasonal migration of livestock to distant places in search of feed and water during dry season).

### Watering and Housing practice

The community in the district waters their live stock in two ways. One is fetching water from the source by donkey especially for fattened animals and calves. This is mainly practiced by farmers in the mid and highlands since farmers in this area rear very small number of livestock due to shortage of grazing land. The second one is taking or moving animals to the area of water point/river this is specially practiced in the lowland areas where the majority of the livestock populations exist/found.

The housing practices in the area for animals are different based on the species of the animals. Goats, sheep and calves share house (hile); cattle and donkey are either kept in barn or tethered outside the compound.

### Livestock ownership pattern and responsibilities within household

In the district all the livestock tenure is owned by all members of the family. Both husband and wife decide on the income gained from livestock sale. In addition female are responsible for the sale of small ruminants and animal products (milk and egg). In the community livestock management activities like cleaning barn, milking and processing are done by female adults while watering and herding are responsibilities of male adults and youngsters.

### Livestock Diseases

Livestock disease, their symptoms, season of occurrence and traditional treatments according to farmers are listed below in the following table.

Table 10: Livestock disease, their symptoms and cultural treatment(s)

| Disease type in local language | Symptoms | Affected livestock species | Treatment |
|---|---|---|---|
| Emergence disease | Lameness Irritate | Cattle | Vaccination |
| Diarrhea | Diarrhea Tail cutting Eye sickness | Cattle | -Feeding balanced diet -Watering clean water |
| Anthrax | Fever | Cattle | Skin burning, Garlic |

| | Chronic and zonotic | | painting, vaccination |
|---|---|---|---|
| Foot and mouth disease | Lemeness, cutting under tongue, in appetite | Cattle | Feeding honey mixing with Garlic |
| Pastrollosis | Inflammation of body | Cattle | Burning to bleed |
| Inflammation | Bloating, fever (common for camels) | Camel and cattle | |
| New Castile disease (NCD) | Common for poultry | Poultry | |

Source: group discussion

As identified during group discussion with farmers major problems related to livestock production are: lack of grazing land, back ward live stock husbandry, feed shortage, lack of water, animal diseases and absence of improved livestock breeds.

**Apiculture**

**Honeybee production and management**

The farming community in the area also practices bee production. Honeybee production system in the area is mainly at backyard. Bee management practices like feeding, watering, protecting from enemies, cleaning the hive, smarting of traditional hive are responsibilities of women while harvesting honey, swarm catering, constructing the hive, fencing and honey marketing are mainly performed by men. Main honeybee feed source is natural trees Carissa Edulis, Climber, Cordia africana, Croton macrosytchos, Olea africana, eucalyptus).

During feed shortage supplementary foods like barley flour, bean flour and sugar are commonly given by dissolving with water. Main honey harvesting seasons are November, December and June. Major bee enemies are birds, butterfly, spider, termites, honey beggar and worms. Farmers protect bees from their enemies by constructing fence around the hive, hanging the hive far up from the ground, supervising and cleaning the hive frequently, smoking crop residues and dried coffee leaf. Honey is used for different purposes like for house hold consumption, for medicinal purpose and above all for income generation purpose. Major constraints of honeybee production as identified during the survey were feed and water shortage, bee enemies, high price of modern beehives, etc.

**Natural Resources**
**Soil and water**
**Soil type**
Table 11: Soil type with its color

| Soil types | Color |
|---|---|
| Clay | Black |
| Sandy | - |
| Limestone | White |
| Red soil | Red |

Source: group discussion

In the district, severe soil erosion and declining soil fertility are the common soil related problems. The severity of soil erosion increases as one goes up to steep slopes, extent of soil erosion is relatively less in the low land areas of the district. In the highland and midland areas there is moisture stress during heavy rainy season and inadequate soil moisture especially in the year of low rain fall. In the lowland areas due to low rain fall availability soil moisture is highly inadequate and there is also no water lodging problem

in this area. Generally, due to the above mentioned problems during the last 10 years soil fertility is declining in the area which leads to decrease in agricultural production.

**Soil conservation practices**

Farmers in the district use different physical and biological soil conservation practices. The physical conservation methods are: stone and soil bunds, contour, check dam (stone and wood), grass strips, micro basins, trench for coffee and chat, tide ridging,…etc and biological conservation methods used by farmers are: crop rotation, manure application, mulching specially under coffee and chat.

**Water sources and Management practices**

The water sources are river, springs and ponds. Farmers use the above water sources to irrigate mainly high value cash crops like Horticultural crops and chat. They mainly use to irrigate different vegetables and fruits (like tomato, onion, cabbage, red root and banana).

They use of the water was based on rotation distribution. Water committee who is elected by the farming community of the area manages the usage of the water. The members of the committees are all men. Farmers face shortage of water during November to march, in the low land shortage of water occur during September to march. During shortage of water farmers' travel on average 2-5 hours in search of water they also incur additional cost to buy donkey for transporting water. Farmers in the low land even travel more than the specified hour.

**Constraints related to soil and water**

Farmers in the area identified many problems, which are directly and indirectly related to soil and water. The problems are listed below: climate change, shortage of water, repeated occurrence of drought, poor soil fertility due to Soil erosion problems, high rate of land fragmentation or less land holding due to high population and increase in desertification. The cause of this problem is population pressure, over cultivation of land.

**Forestry**

Table 12: Tree species found in the district

| Tree species | Socio-economic benefits |
| --- | --- |
| Podocarpus falcatus | For construction of local furniture (eg., box |
| JuniPerus procera | Home construction |
| Olea Africana | For construction of local farm tools |
| Hagenia absinica | Timber production |
| Cordia Africana | Timber, for feeding animal |
| Acacia saligna | For charcoal, house construction |
| Croton macrosytchos | Timber production |
| Eucalyptus tree | House construction, used as income source |

Source: Group discussion

In the district Cordia africana and Hagenia absinica are among the most preferred indigenous trees while Eucalyptus is among preferred exotic trees in the area. From own observation and the discussion made with selected farmers the status of the forest at present is increasing in a good situation from the past situation in the area. This is due to decreasing extent of deforestation, resettlement of the community from mountain areas for rehabilitation purpose and different rehabilitation practices such as; soil and water

conservation practices, massive tree planting, replacing immediately after cutting the tree, protecting the forest from destruction, etc. As a result, the damaged forest has been recovering in the past few years, soil erosion decreased, amount of rainfall increased, creation of tourism due to existing of different wild life and good weather condition created.

## Conclusion and Recommendation

### Conclusions

The survey has generally surfaced the following issues with respect to farming system:

1. Major constraints of agricultural production in the area are drought, soil erosion, lack of improved seed, invasive weeds, disease, insect-pests and inadequate feed resources, absence of improved breeds, poor animal health, labor shortages, lack of inputs and market opportunities.
2. As compared to highland and midland areas severity of drought is relatively high in the lowland areas causing livestock death and migration to other places in search of feed and water.
3. The extent of forest in the area now a day is increasing when relatively seen with the previous condition. This is due to community role in natural resource conservation practices (soil and water conservation practices, replanting of trees), decreasing extent of deforestation, resettlement of the community from mountain areas for rehabilitation purpose.
4. As a result, the damaged forest has been recovering in the past few years, soil erosion decreased, amount of rainfall increased, creation of tourism due to existing of different wild life and good weather condition created.
5. In the farming community male farmers are engaged in productive activities (land preparation, sowing, weeding, harvesting and threshing, storage, marketing, looking after livestock and milking) while females mostly perform reproductive works (caring for child, sick and aged peoples, fetching water, cooking, collection fire wood, cleaning and the likes) and sometimes participate in productive activities. This is from the assumption in the community that there is division of work for male and female.
6. There are various institutions in the district (GOs and NGOs) which are working different activities concerning agriculture.

### Recommendation

The survey also has highlighted some of the areas which demand special attention in the study area. These include:

1. Agricultural research centre should:
   - ➢ Introduce and scale up improved and high value crops which provide high yield, early maturing, drought tolerant and weeds resistant (striga and parthinieum etc) for farming community.
   - ➢ Introducing, development and promotion of improved forages, improved livestock species and improved management practices..
2. Government should:
   - ➢ Establish soil and water conservation and improvement activities to solve soil and water related problems.
   - ➢ Expand and strengthen the livestock veterinary service stations especially in the lowland areas of the district. Finally, attention should be given to infrastructure development (especially road) in the area to connect the farming community with market.

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# Characterization and Analysis of Farming System in Mieso District, West Hararghe Zone

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## Abstract

*This study was undertaken to characterization and analysis of farming system of Mieso district, West Hararghe Zone. A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labor, capital and management. Therefore, this study was conducted to assess production systems and identify &prioritize major production constraints of Miesso district. The selection of the kebeles was done purposively collaborate with district agricultural experts. For the study, one PRA group in each kebeles was formed composed of male, female and youth group to collect primary data. Descriptive statistics and narrative analysis method were used to analysis. The study revealed that drought, soil erosion, lack of improved seed, invasive weeds, disease, inadequate feed resources, poor animal health, lack of inputs and market opportunities were major constraints of agricultural production in the area. Upgrade marketing system, improving input supply system, expand and strengthen the livestock veterinary service stations, introduce, develop and promote improved forages should be get focused.*

*Key Words: Characterization, constraint, farming, prioritize, production*

**Introduction**

A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labour, capital and management to which he has access (Mahapatra, 1994). "The household, its resources and the resource flows and interactions at the individual farm levels are together referred to as a farm system" (FAO, 2001). Farming systems research is considered a powerful tool for natural and human resource management in least developed countries such as Ethiopia. This is a multidisciplinary whole-farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself (Behera and Mahapatra, 1999; Singh et al., 2006).

The Ethiopian economy is predominantly rural and agricultural, and the declining trend in size of land holding poses a serious challenge to the sustainability and profitability of farming. The crop and cropping system based perspective of research needs to make way for farming systems based research conducted in a holistic manner for the sound management of available resources by small farmers (Jha, 2003). Under the gradual shrinking of land holding, it is necessary to integrate land based enterprises like fishery, poultry, duckery, apiary, field and horticultural crops, etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable (Behera et al., 2004). No single farm enterprise is likely to be able to sustain the small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year round (Mahapatra, 1992; 1994).

The present critical situation in the countries food supplies, especially in drought prone and food insecure areas demands that all available agricultural resources be utilized to the full to maximize food production through improved agronomy, better soil management and crop husbandry, the use of improved seeds and fertilizers, efficient use of water, effective weed control, effective crop protection and improved livestock husbandry practices.

To implement the above mentioned agricultural technology interventions, farming system study is very crucial and hence, improves agricultural technology interventions in the area. Past experiences show that most of the time technologies disseminated to the farmers did not bring the required change on the livelihood of the farming community. This is mainly due to lack of detail farming system analysis of the environment in which the technology are disseminated. Moreover, farmers` perspectives have been not adequately considered in the development and dissemination of technology to alleviate their problems. Therefore, conducting farming system study is very important to develop and disseminate appropriate agricultural technologies that fit to the environment, which is also important for further agricultural research and development intervention in the area.

**Objective**

- ➢ To assess and identify the production systems of the study area and;
- ➢ To identify and prioritize major constraints agricultural production in the study area.

## Methodology

### Description of the area

The activity was conducted in Miesso district. Miesso district is found in West Hararghe Zone of the Oromia National Regional state at about 300 km East of Addis Ababa, the capital city of the country and at the longitude, $09^o$ 13' 05.2" North and $040^o$ 45' 27.7" East. The capital town of the district is Miesso, which is located at 25 km North of Chiro, the capital town of the zone. The district is bordered with Doba district in the East, Afar National Regional State in the West, Somale and Afar National Regional State in the North and Chiro in the South.

The district is founded at an average altitude of 1310 m.a.s.l. Almost about 95% of the district has plain topography (data from Office of Agriculture of the district). And have a maximum and minimum temperature of 28 $^o$c and 16 $^o$c respectively and the maximum and minimum rainfall of 750 mm and 500 mm respectively (2011 data from Office of Pastoral and Agro-pastoral Development of the district). Rainfall type is mono-modal and erratic in nature. Main rainy season is from mid June to mid August and the amount of the rainfall is inadequate.

In the district there was sandy soil, clay soil (black soil) and loamy soil types covering 10%, 75%, and 15% respectively according to 2011 data from Office of Agriculture and Rural Development.
The district has only one major agro ecological zone which is lowland.. There are 45 kebeles in the district. In the district the more of the farming community is agro-pastoralist covering 98% and 2% is of pastoral community.
The total number of population of the district is estimated to 105,321 out of which 54,013 are male and 51,308 are female. Out of the total number of population in the district there are about 21, 405 households out of which 16,513 are male households and 4,892 are female household (2011 data from Pastoral and Agro-pastoral office of the district). Average family size in the district is 5.

### Sampling procedure, Data collection and Analysis

The selection of the kebeles was done with experts of the district Agricultural office. Accordingly, three kebeles (Husey, Bililo and Torbeyu) were selected from the district. For the study, one PRA group in each kebeles was formed composed of male, female and youth group. Multidisciplinary team of enumerators drawn from socio-economics, crop, livestock and natural resource research processes at Mechara Agricultural Research Center was arranged to conduct Participatory Rural Appraisal on the three kebeles to collect data. Both primary and secondary data was collected. The main methods used to gather the data were interviews with the district Agricultural office experts, Focused Group Discussions (FGDs) with selected farmers and reviewing of secondary data from different unpublished sources(quarter and annual report).

## Result and discussion

### Infrastructure Development

The district has one all weather asphalt road that connects Miesso to Chiro and Awash. There is also some all weather gravel road that connect some rural areas with each other and to Miesso district. Infrastructure development like electricity is low in the rural areas of the district. Infrastructure development has a great role for the farming community for easy access to agricultural inputs, for supplying their product to the market and to mitigate lack of market information.

## Marketing and marketing systems

In the district there exist different local market places on different days. The major marketable items supplied by the farmers are coffee, chat, hot pepper, onion, poultry, cattle, camel and shoats. Among these products like live animals, hot pepper and chat are taken to Adama, Addis Ababa and Diredawa. Mainly the farmers sell their products to middlemen and retailers who later sell to wholesalers in Miesso, Chiro, Harar and Adama. The marketing decision on all items especially when it's in large quantity is the responsibility of household head. The major problems related to markets were lack of market information, interference of brokers and lack of infrastructure.

## Farm resources

### Land

The total land area of the district is 257,344 hectares out of which 24,737 hectare is cultivated land, 57,157 hectare is uncultivated land, 6160 hectare is covered by forest, 55,448 hectare is covered by bush and shrubs, 66,422 is waste land, and 38,645 hectare is grazing land. The average land holding status in the area is 1.5 ha (12"qindii") & range lies between 0.5-2.5ha (4-20"qindii") where 8"qindii" equals 1 hectare. There is land fragmentation caused by high population. This land fragmentation causes shortage of land in the area, which results in low amount of yield, low income, food insufficiency, dependency, etc. There are different measures taken by the farmers to offset the land shortage problem and increase production under such circumstances. Those measures are using fertilizer and improved seed, compost and manure, share cropping locally called "Hirta", renting land and accomplishing other non-farm activities as additional source of income. Land is owned by both female and male and has equal power in decision making on land resources.

### Labor

The major source of labor for agricultural activities in the area is family labor. In the communities male accomplishes the major farm activities like land preparation, weeding, sowing, guarding, harvesting and threshing while women engaged highly in reproductive activities like fire wood collections, cooking, caring for children and also involved in some productive activities like weeding, harvesting, threshing, transporting the harvested crops from the field to home, preparing threshing ground and to some extent in harvesting. Male children herd livestock and help their family on farm activities and female children participate in home activities in addition to learning.

There is seasonal labor shortage in the area. Labor shortage occurred during peak season of agricultural activities mainly in April, March, June, July, November and December. During labor shortage farmers use local labor arrangements like, "guza/debo", "Wejino /Merro" and labor exchange and labor hiring in order to overcome labor shortage problem.

### Farm implements

Major traditional farm implements used in the district include Saw, Shovel and Hoe, 'qanbara' and 'Mofara / Nugaya' where as tractor and BBM are improved farm implements available in the district. Farmers mainly get these farm implements from local and district markets and sometimes made by themselves.

## Agricultural production constraints

Table 1: Major problems identified by farmers in the district

| Major problems | Rank |
| --- | --- |
| Drought | 1 |
| Shortage of grazing land | 2 |
| Water shortage | 3 |
| Feed shortage | 4 |
| Diseases and pests | 5 |
| Lack of improved technologies | 6 |
| High price of fertilizer | 7 |
| Soil fertility decline | 8 |
| Lack of sufficient animal health stations | 9 |
| Low price of agricultural products | 10 |

Source: Group discussion

## Crop Production

Major crops grown in the district are sorghum, maize, teff, wheat and barley among cereal crops; coffee and chat among cash crops; sesame and haricot bean among pulse and oil crops; hot pepper, onion, salad and cabbage among horticultural crops. Sorghum and maize serve as major food crops while chat, onion, hot pepper, sesame and coffee are directly supplied to market. Sorghum is the first leading food crop produced in the district because of sorghum is used for both human being and livestock consumption, home construction, fuel consumption and its adaptability to the environment.

Table 2: Area coverage and yield of different crops in the district in 2003E.C

| Crop type | Area allocated in hectare | Total yield harvested (Qt) |
| --- | --- | --- |
| **Major cereal crops** | | |
| Sorghum | 15500 | 133,290 |
| Maize | 5818 | 46,181 |
| Wheat | 42.75 | 373 |
| Teff | 12.25 | 60 |
| Barely | 26 | 238 |
| **Pulse and oil crops** | | |
| Haricot bean | 60 | 180 |
| Sesame | 1424 | 3016 |
| **Cash crops** | | |
| Coffee | 22 | 88 |
| Khat | 328 | 3280 |
| **Vegetable crops** | | |
| Onion | 57 | 5700 |
| Hot pepper | 18 | 1800 |

Source: DAO, 2013

## Improved variety Used in the study area

Both local and improved crop varieties are available in the area. Major problems with local cultivars are late maturity, susceptibility to disease and low yield.

Table 3: Crops type, available local varieties, farmers' selection criteria and its sources

| Crop types | Local varieties | Selection criteria for genetic resources | Improved varieties | Source of improved varieties |
|---|---|---|---|---|
| Sorghum | Boko, Wagare, Masugi and Abdalloota | Large seed size, disease resistance, early maturity, drought tolerant, yield, smut free | Jabbiyaas, Teshale, Meko, Jabbi-dhorki | BoAD, Melkassa ARC |
| Maize | Bukuri (early maturing) Shashemene and , Nazireti | Cob size and number, early maturity, drought tolerant | Katumani | |
| Sesame | Red | | | BoARD, Melkassa ARC |
| Haricot bean | Keniya | High yield, demanded at market | Masho, | BoARD, Melkassa ARC |

Source: - group discussion

## Cropping system

The major cropping system practiced in the district is intercropping. Major crops intercropped are: maize with haricot bean, sorghum with haricot bean and chat with maize.

## Agronomic practices

## Land preparation

Table 4: Land preparation, planting time and methods of major crops

| Crops | 1st plowing | 2nd plowing | Planting | Methods of planting / sowing | Seed covering methods |
|---|---|---|---|---|---|
| Maize | February | March and April | May and June | Row planting and broadcasting | Oxen |
| Sorghum ` | February | March | March and May | Row planting and broadcasting | Oxen and hand |
| Teff | March | June | July | Broadcasting | Oxen and hand |
| Sesame | April | - | May | Broadcasting | Oxen |

**Source: - Group discussion**

In the communities land preparation is carried out dominantly by male. Female also participate by helping male farmers by performing activities such as providing meal and water, feeding oxen at farm, clearing weed and crop residues from the land. Major problems encountered in land preparation were late starting of rainfall, lack of oxen for plowing and lack of improved farm implements.

## Weed and its control mechanism

Weed is among the top problems faced by the farmers in crop production in the district.

Table 5: Major weeds, weed control methods and frequency of weeding for major crops

| Major Weeds | Weed control methods | Frequency of weeding of major crops |
|---|---|---|
| Coach grass | ☐ Hand weeding | Maize – 1 to 2 times |
| Psydrax schimerian | ☐ Hoeing<br>☐ Ploughing between row | Teff – 3 times |
| | ☐ Use of chemical herbicides in rare case | Sorghum – 2 to 4 times |
| Perthinium* | | Sesame – 2 times |
| Striga* | | H. Bean- 2 times |

Source: Group discussion,    * shows very serious weeds which are difficult to control

Among the above major weeds, Striga affects/damages mainly Sorghum where as the rest weeds affect all types of crops as observed during the study.

## Fertilizer and manure utilization

In most parts of the district farmers use both inorganic and organic fertilizer to increase   production.  In organic fertilizers available to the area are DAP and UREA. Farmers use/apply DAP during planting while UREA is applied during between row ploughing activity. Major crops receiving fertilizer in order of importance as suggested by farmers were maize, wheat, sorghum, teff, barley and hot pepper. Problems regarding fertilizer usage are high fertilizer price so that for most farmers it is not affordable, lack of awareness about fertilizer and its application, low amount of rainfall and unavailability of fertilizer at the right time and the right place.

Manure collection, preparation /storing and application are commonly practiced in the district. Its preparation is performed dominantly by female while male are responsible for transporting to the field and its application. Manure is collected mainly during dry season. Farmers apply manure to the crops like maize, sorghum, and sesame. Problems related to manure preparation are low number of livestock ownership and problem of means of transportation to the field.

## Harvesting, Threshing and Storage materials

Harvesting time differs from crop to crop such that sorghum is harvested in November and December while maize, haricot bean and sesame are harvested in September. Farmers use traditional harvesting materials like Saw, sacks and locally made basket. For threshing purpose the farming community uses oxen and hand. There is no improved harvesting, threshing, storage technology available in the study area.

Table 6: storage types used in the district

| Storage type | Crop(s) | Duration |
|---|---|---|

| Underground storage | Sorghum | 7-8 years |
| Aboveground storage/"Gotera" | Maize, haricot bean | 2-3 years |
| Sacks | Haricot bean, sesame | - |

## Crop diseases and pests

Table 7:- major diseases and crop(s) it attacks

| Disease | Crop(s) |
|---------|---------|
| Rust | Maize, sorghum |
| Smut | Finger millet, sorghum |
| Cancer | Chat |
| CBD and branch die back | |
| Leaf rust | Coffee |
| Wilt | |

Source: - group discussion

Table 8:- Major field and storage pests and crop(s) attacked

| Pests | Crop(s) |
|-------|---------|
| Stalk borer | Sorghum |
| Weber | Coffee |
| Termite | Orange and mango |
| Rat | Maize, sorghum, Teff |
| Grass hopper | Hot pepper, Sorghum |
| Weevil | Maize, Sorghum, Sesame |

Source: group discussion

In the area farmers use different traditional and modern control measures for the above diseases and pests. This control measures are; Treating with Goat urine, spraying mixture of hot pepper, and dried tobacco leaf, using DDT, etc. Finally, the major constraints of crop production identified are drought, diseases and pests and lack of early maturing, drought tolerant and disease resistant crop varieties.

## Livestock Production

Livestock production is also one of the main stay of life in the area in line with crop production.

Table 9: Livestock population of the district in 2011

| Livestock type | Number of livestock |
|----------------|---------------------|
| Cattle | 119,557 |
| Sheep | 32,117 |
| Goat | 61,039 |
| Donkey | 14,614 |
| Horse | - |
| Mule | - |
| Camel | 27,489 |
| Poultry | 56,274 |

## Livestock species, purpose and their local name

Table 10: Livestock species, purpose and their local name

| Livestock type | Purpose | Local name | Preferred species | Reason |
|---|---|---|---|---|
| Cattle | For milk, for meat, draft power, for market | Dobba Aruso | Aruso | Adaptable to environment (drought tolerant), disease resistant |
| Goats | For breed source, for milk, for meat, For marketing | Mayo | Mayo | Preferred at market |
| Sheep | For breed source, For meat, For marketing, For slaughtering | Adal, Dhuko | Adal | Grow fast, meat production |
| Donkey | Transportation | - | | |
| Camel | For milk, for meat, for sale, for transportation | Adal, Issoo | Issoo | Good milk production, drought tolerant, can travel long distance |
| Poultry | Egg, for slaughtering at home, for market purpose | Habesha, Hybrid | Hybrid | High price at market, high meat and egg yield |
| Honey bee | Honey production for home and for market | Black    Black | | Good honey yield |

Source: - Focused Group discussion

## Breeding system in the study area

In the district natural mating is the most common breeding system used by the farmers. Farmers have traditional knowledge of detecting heat period of their cattle by observing symptoms like mucus discharge, sound production, jumping on other cattle and so on. When they observe the above symptoms they make their cow to mate with the bull they prefer. Most of the time farmers prefer bull in terms of size and color for breeding system. Farmers do not use Artificial insemination breeding system due to lack of awareness.

## Feed resources and Feeding system

Major feed resources available in the area includes: natural pasture that is grown on the boarder of the farm, crop residues of sorghum and maize, weeds and thinned crops, cactus, etc. There is also availability of improved animal feeds like elephant grass and cow pea in some parts of the district. Feed is commonly scarce at dry season (from January to June) in the area. During feed shortage farmers use tree species such as Sesbania, Lucinia and Cactus as a feed source for their livestock. In most parts of district there is no problem of grazing land. Farmers practice free grazing feeding system. During dry season the community practice transhumance (i.e. seasonal migration of livestock to distant places in search of feed and water).

## Watering and Housing practices

Water sources for livestock consumption are rivers and ponds. Farmers water their livestock by taking or moving animals to the area of water point (river) and by fetching water from the source by donkey especially for fattened animals and calves. As observed during PRA work farmers water their animals at river during wet season (June to November) while ponds are used as water sources for animals during dry season (December to May) when the existing river dry out. In the district the housing practice differs from place to place and based on the type of the animals. In some areas all type of animals kept in the house while in some places kept in the barn except calves which share house with farmers.

## Livestock ownership pattern and responsibilities within household

In the district all the livestock tenure is owned by all members of the family. Both husband and wife decide on the income gained from livestock sale. Female are responsible for the activities like barn cleaning, milking and processing. Responsibilities of children are herding and watering where as husband and adult male children are responsible for barn construction and watering.

## Livestock Diseases

Livestock diseases, their symptoms, season of occurrence and traditional treatments are listed below in the following table.

Table 11: Livestock disease, their symptoms and cultural treatment(s)

| Diseases type in local language | Symptoms | Affected livestock species | Treatment |
|---|---|---|---|
| Pasteurellosis | Inflammation of body | Cattle | Skin Burning |
| Diarrhea | Diarrhea Eye sickness | Cattle | Feeding balanced diet Watering clean water |
| Skin disease | Change body color to black | " | Treating skin with gasoil |
| Foot and Mouth disease | Lameness Cutting under tonge In appetite | All livestock type | Feeding honey mixing with Garlic |
| Anthrax | Diarrhea Eyen sickness | Cattle and donkey | Giving garlic, vaccination |
| Inflammation | Bloating, fever | Camel | Drinking fat meat Drinking bean flour |

Source: group discussion

Generally, major constraints regarding livestock production in the district are feed and water shortage, shortage of grazing land, animal diseases, backward animal husbandry and lack of improved animal breeds.

## Apiculture

## Honeybee production and management

The farming community in the area also practices bee production. Honeybee production system in the area is mainly at backyard. Bee management practices like feeding, watering, protecting from enemies, harvesting honey, cleaning the hive are responsibilities of women while swarm catching and constructing the hive is mainly performed by men. Main honeybee feed source available in the district are Carissa edulis, cactus, Acacia Sieberiana, Scinuss molle, flowers of sorghum and maize, and Acacia Oerfota.

During feed shortage supplementary foods like barley flour, bean flour and sugar are commonly given by dissolving with water. Main honey harvesting seasons are September, May and June and time of abscond is February and March due to feed and water shortage. Major honey bee enemies are birds, termites, small ants and honey beggar. Control measures taken by farmers locally are constructing fence around the hive, cleaning the hive frequently, and smoking crop residues. Honey is used for different purposes like for house hold consumption, for medicinal purpose and above all for income generation purpose. Major constraints of honeybee production as identified during survey were feed and water shortage, bee enemies, high price of modern beehives, etc.

## Natural Resources

### Soil and water

Table 12: soil type with its color

| Soil type | Color |
|-----------|-------|
| Clay | Black |
| Sandy soil | - |
| Vertisoil | Red |

Source: Focused group discussion

### Soil conservation practices

Farmers in the district use different physical and biological soil conservation practices. The physical conservation methods are: stone and soil bunds, contour, check dams, grass strips, micro basins, trenches and tide ridging; and biological conservation methods used by farmers are crop rotation, crop residues in rare case and manure application.

### Water sources and Management practices

The water sources found in the district are rivers, ground water, springs, hand dug well and ponds. Farmers use these water sources for irrigation purpose mainly for chat and different vegetables (onion and cabbage), and for human and livestock consumption. Farmers in the district practice different water conservation practices. Among water conservation practices pond constructed with plastic sheet is the common one. Farmers face shortage of water during September to march. During shortage of water farmers' travel on average 2-5 hours in search of water they also incur additional cost to buy donkey for transporting water.

### Constraints related to soil and water

Farmers in the area identified many problems which are directly and indirectly related to soil and water. These problems are: shortage of water, recurrent drought, soil erosion problems, high rate of land fragmentation or less land holding due to high population and increase in desertification are direct problems while incurring extra cost for purchasing donkey to transport water during water shortage is indirect problem.

**Forestry**

Table 13: major tree species found in the district

| S.no. | Major tree species | Socio-economic benefits |
|-------|--------------------|--------------------------|
| 1 | Acacia oerfota | Charcoal, animal feed, shade |
| 2 | Acacia saligna | House and barn construction, charcoal |
| 3 | Acacia Sieberiana | Making farm implements, house construction |
| 4 | Acacia Senegal | House construction |
| 6 | Cactus | For livestock and human consumption |
| 7 | Carissa edulis | For livestock consumption |
| 8 | Ziziphus mauritiana | Used as animal feed |
| 9 | Olea Africana | To make farm implements |
| 10 | Albizia gummifera | House construction |
| 11 | Ehretia Cymosa | To make farm implements, house construction |
| 12 | Scinuss molle | Shade |

Source: group discussion

In the district Acacia oerfota and Acacia saligna are among indigenous trees most preferred by the farmers due to their tremendous benefits to the society. These trees have many uses like for house construction, barn construction, for making different farm implements, for animal shelter, shade during dry season, and also for making charcoal to generate additional income.

Extent of forest at present has decreased from the past situation in the area. Among the factors for the declining of forest were increasing population, increasing demand for construction and fire wood consumption, deforestation of forest for cultivation land, making charcoal in search of additional income, etc. In order for the forest to recover the farming communities in the area carried out different rehabilitation practices such as; soil and water conservation practices, massive tree planting, replacing immediately after cutting the tree, protecting the forest from destruction, etc. As a result of these rehabilitation works done damaged forest has been recovering in the past few years.

**Conclusion and Recommendation**

**Conclusions**

The survey has generally surfaced the following issues with respect to farming system

1. Major constraints of agricultural production in the area are drought, soil erosion, lack of improved seed, invasive weeds, disease, insect-pests and inadequate feed resources, absence of improved breeds, poor animal health, labor shortages, lack of improved farm implements, and lack of agricultural inputs.
2. As observed from this task severity of drought is high in the district causing livestock death, low yield and migration to other places in search of feed and water.
3. The farming system analysis of the district shows that agricultural activities are backward or traditional. This is due to lack of improved farm implements, lack of awareness of farmers on improved agronomic practices, and lack of capital to purchase the existing few farm implements.
4. The extent of forest in the area now a day is decreasing as observed during the discussion made the farming community. Among the factors for the declining of forest are increasing population, increasing demand for construction and fire wood consumption, deforestation of forest for cultivation land, making charcoal in search of additional income, etc.

5. In order to rehabilitate the damaged forest, the community in the area has been performing different natural resource conservation practices such as soil and water conservation practices, replanting of trees, protecting the existing forest from destruction.
6. Wind erosion and flood erosion are common problems of the area causing soil fertility decline.
7. There are various institutions in the district (GOs and NGOs) which are working different activities concerning agriculture. These institutions have a crucial role in the development of agricultural sector.

## Recommendations

The survey also has highlighted some of the areas which demand special attention in the study area. These include:
1. Agricultural research center should:
    ➢ Introduce improved and high value crops which are early maturing, drought tolerant, disease resistant and weed resistant is crucial to change the livelihood of the farming community.
    ➢ Introduce, develop and promote improved forages, improved (high yielding, highly demanded and diseases resistant) livestock breeds and improved livestock management practices,.
2. Agricultural research mechanization should introduce improved farm implements like, tractor, maize and sorghum threshing machines and milk churner are crucial to accelerate agricultural sector development.
3. Government should:
    ➢ Establish soil and water conservation and improvement activities to solve soil and water related problems.
    ➢ Rehabilitating the deforested areas to protect climate change and establish good weather condition.
    ➢ Expand and strengthen the livestock veterinary service stations and improving the existing traditional control mechanisms of different animal diseases by conducting different researches.
    ➢ Upgrade marketing system/environment, improving input supply system, strengthening role of farmer groups and labor utilization to improve efficiency and effectiveness, creating market opportunities for small holder farmers

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# Challenges and Opportunities of Horticultural Crops Marketing in Daro Lebu, Boke & Oda Bultum Districts of West Hararghe, Oromia Regional State.

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## Abstract

*This study was undertaken to investigate challenges and opportunities of horticultural crops marketing in Daro Lebu, Boke and Oda Bultum districts of west hararghe, oromia. The study was conducted with the objectives of identifying opportunity and constraints of horticultural crops marketing system. The districts were selected purposively based on their horticultural crops production potentials from the zone. Similarly, Kebeles from the districts were selected purposively with collaboration of kebele officials and DAs. Finally, simple random sampling was used to select total 178 respondents. Descriptive statistics and SPSS version 20 were employed for data analysis. The study indicated that broker's interference, low price of product, lack of transport, lack of storage and lack of market information were found to be the main constraints in horticultural crops marketing system in the study area. On the other hand availability of improved variety, having high demand from time to time and government attention to high value crops, reported as future opportunities of horticultural crops in the study area. So, horticultural crop production are profitable if there is improvement of: infrastructure (i.e. road and horticultural crop storage facility), improved seed supply system and fair market information on horticultural crop production system which enhance smallholders incomes.*

**Key Words:** Horticultural crops, market, market Constraint, opportunity

## Introduction

More than 85 percent of the Ethiopian population, residing in the rural area, is engaged in agricultural production us a means of livelihood. However, the agricultural productivity is low due to use of low level of improved agriculture technologies, risks associated with weather conditions, diseases and pests, etc. Moreover, due to ever increasing population pressure, the land holding per household is declining leading to low level of production to meet the consumption requirement of the households. As a result, intensive production is becoming a means of promoting agro-enterprise development in order to increase the land productivity. Horticulture production gives an opportunity for intensive production and increases smallholder farmers' participation in the market (DCG, 2007).

The Ethiopian Rural Development Strategy document has given emphasis to market-led agricultural development that will be achieved by establishing and implementing grades and standards, improving the provision of market information, expand and strengthening cooperatives, and improving and strengthening private sector participation in the agricultural system. The growing government support for market integration and agro-enterprise development provides an opportunity for the horticulture growers and market actors. This indicates that the government is using policy support as one of the mechanisms for creating investment opportunities in the horticulture sector for production, transportation, grading, exporting and financing the venture (DCG, 2007).

There exist production potentials of horticultural crops like potato, tomato, orange and mango, etc. in west Hararghe. However, this product has poor marketing system, poor market access and lack of market information that discouraging farmers' involvement in production and hinder farmers benefit from the product and no research was addressing the horticultural crops marketing system in west Hararghe.

Therefore this study intended to identify constraints and opportunities of horticultural crop marketing in the study area.

## Methodology
## Description of the Study Areas

The study was conducted in three districts (Daro Lebu, Boke & Oda Bultum) of west Hararghe zone. Darolebu is located at $8^0 10' N 40^0 30' E$ and bordered on the south by the Shebelle River which separates it from the Bale Zone, on the west by the Arsi Zone, on the northwest by Guba Koricha, on the north by the Habro, and on the east by Boke districts (Abdi E., et.al, 2013). The district is characterized mostly by flat and undulating land features with altitude ranging from 1350 up to 2450 m.a.s.l. The minimum and maximum temperature of the district ranges from 14 to $26^0$C with average of $16^0$C while average annual rainfall is 963 mm/year.

According to Aman, Anteneh & Fekede, 2010 research report, Oda Bultum district was located at 365 km of east Addis Ababa, capital city of Ethiopia and 37km of south Chiro, West Hararghe Zone town. The altitude of the district ranges between 1040-2500 m.a.s.l with maximum and minimum temperature of $15^0$c and $28^0$c, respectively. The district receives annual average rainfall of 900mm to 1100mm. Boke is one of districts of West Hararghe zone. It is located at 391 km east of Addis Ababa and about 69 km south of Chiro, capital town of the zone. The altitude of the district ranges between 1762-1855 m.a.s.l. The district receives an average annual rainfall of 850 mm while average temperature is 20 $^0$C (DOA, 2013).

## Sample and Sampling Method

The population for this study comprise of all horticultural crop producing households in the selected kebeles of Daro Lebu, Boke and Oda Bultum districts of west Hararghe zone. This study employed multi-stage sampling procedures. In the first stage, the districts were selected purposively based on horticultural crop production potential from west Hararghe zone. Accordingly, Daro Lebu, Boke and Oda Bultum were selected with collaboration of Zonal experts. In the second stage, kebeles from Daro Lebu, Habro and Boke districts were selected randomly from horticultural crops producing kebeles. Finally, a total of 178 households were selected from Daro Lebu, Boke and Habro districts.

## Data Sources and Collection Methods

Data for the study were collected from both primary and secondary sources. Primary sources of data were collected through household survey with structured questionnaires while secondary data were collected from both published and unpublished source.

## Methods of Data Analysis

The data generated were coded and entered into SPSS version 20 software for statistical analysis and management. Descriptive statistics like mean, standard deviation, frequency distribution and percentage were used to understand the socio economic situations and constraints and opportunities of horticultural crops marketing of the sample respondents of the study area.

## Results and Discussion

## Respondent's Characteristics

From the total of 178 sample respondents interviewed to generate qualitative and quantitative data on horticultural crops marketing, about 96.1% were male headed and the rest 3.9% were female headed. This

is due to the fact that even though parts or all of the Horticulture activities were performed by women these are reported as the work of men (head of the household).

Regarding educational status, among the sample respondents 25.28% had not received any education, while 17.98% had taken adult education. The rest were at stages of literacy ranging from elementary to high school level. More specifically, 37.64%, 17.98% and 1.12% of the sample respondents had attended 1-5 Grades, 6-10 Grade and 10th complete, respectively as revealed (Table 1). Marital status of the sample respondent revealed 84.27% were monogamy,12.91% were polygamy, 1.12% were unmarried,1.12% divorced and 0.56% were widowed. From this we can conclude that most of the respondents were married where as the widowed and divorced respondents were little in number which is less than two percent.

Table 1: Sex, Education status and marital status of the respondents

| Socio-economic characteristics | Variables | N | % |
|---|---|---|---|
| Sex of Respondents | Male | 171 | 96.1 |
| | Female | 7 | 3.9 |
| | Total | 178 | 100 |
| Education Level of Respondents | Illiterate | 45 | 25.28 |
| | Adult Education | 32 | 17.98 |
| | 1-5 Grade | 67 | 37.64 |
| | 6-10 Grade | 32 | 17.98 |
| | Complete | 2 | 1.12 |
| | Total | 178 | 100 |
| Marital Status of Respondent | Monogamy | 150 | 84.27 |
| | Polygamy | 23 | 12.91 |
| | Unmarried | 2 | 1.12 |
| | Divorced | 2 | 1.12 |
| | Widowed | 1 | 0.56 |
| | Total | 178 | 100 |

Source: survey results

The mean age of the respondents were 38.42 years (with standard deviation of 11.168 years) ranging from 20 to 85 years. This result shows that horticultural crop production is mostly performed by economically active age groups and in some cases people at younger and old age is actively engaged in horticultural crop production activities. The producers had an average experience of 19.43 years ranges from 1 to 52 years as revealed (Table 2).The level of farming experience was taken to be the number of years that an individual was continuously engaged in horticultural crop production. This is what one would expect in a situation where people are actively engaged starting from an early age in helping older horticultural crop producers to undertake basic tasks. Based on this exposure, young people gradually move on to become independent horticulture producers as soon as they obtain their own assets (Derso *et. al*, 2003). They continue accumulating experience by seeking technical advice from fellow horticulture producers and Development agents whenever necessary.

Table 2: Age of the respondents

| Variables (yrs) | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| Age of respondents | 175 | 20 | 85 | 38.42 | 11.16 |
| No. of male households members | 167 | 1 | 12 | 3.14 | 2.04 |
| No. of female household members | 167 | 1 | 14 | 3.42 | 2.13 |
| Age of male HH members less than 15 yrs | 156 | 1 | 8 | 2.47 | 1.41 |
| Age of male HH members between 15 & 64 yrs | 65 | 1 | 11 | 2.12 | 1.63 |
| Age of male HH members greater than 64 yrs | 4 | 1 | 1 | 1 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Age of female HH members less than 15 rs | 148 | 1 | 8 | 2.36 | 1.43 |
| Age of female HH members between 15& 64 yrs | 126 | 1 | 12 | 1.78 | 1.57 |
| Age of female HH members greater than 64 yrs | 6 | 1 | 1 | 1 | 0 |
| Farming Experience of respondents | 166 | 1 | 52 | 19.43 | 11.43 |

Source: survey results

## Resource Endowment

The average land holding of the sample respondents was 1.05 hectares with the standard deviation of 0.71 (Table 3) which is in the range of the National average household land holding of 1.0 - 1.5 hectares. Of this total land allocated for horticultural crops production is averagely 0.32 hectares. The average irrigated land or land which is accessible for irrigation is about 0.34 hectares and mean of land used twice per year is 0.31 hectares.

Table 3. Land allocation for horticultural crops

| Land holding in hectare | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| Farm size owned | 148 | 0.125 | 8 | 1.05 | 0.71 |
| Rent in land | 12 | 0.125 | 1.125 | 0.54 | 0.35 |
| Rent out land | 26 | 0.125 | 2 | 0.74 | 0.48 |
| Irrigated land | 55 | 0.125 | 1 | 0.34 | 0.202 |
| Total land allocated for horticultural crops | 178 | 0.04 | 1.19 | 0.32 | 0.24 |
| Size of land used twice per year | 87 | 0.06 | 1 | 0.31 | 0.196 |

Source: Survey results

## Horticultural crops production in the study area

As the result shows, there are different horticultural crops are produced in the study areas. These horticultural crops categorized within three groups: vegetables, fruits and root & tubers. From vegetables: Cabbage, Onion, Hot pepper and Tomato were potentially produced while Potato, Beet root, Carrot and Sweet potato root and tubers produced. Similarly, Mango, Papaya, Banana, Orange, Apple and Guava were fruits that produced in the study areas. Among these horticultural crops: Cabbage, Red root, Carrot, Onion, Shallot, Sweet potato, Irish potato, Hot pepper and Tomato are the majorly produced horticultural crops in the districts.

The study revealed that about 37.1% used local varieties, 22.5% of them used improved variety. While around 40.4% seed is both local and improved type of varieties. The sources of improved seeds indicated as 34.6% from Bureau of Agricultural Development, 34.6% from market, 5.6% from traders, 3.7% from Non Government Organizations, 0.9% from cooperatives, 14% from both Bureau of Agricultural Development and market, 2.8% from both Bureau of Agricultural Development and Non Government Organizations as well as 3.7% from exchange of neighboring farmers. Types of problems encountered in usage of improved seeds are 44.8% germination problem, 19.5% quality problem, 20.7% High price which is beyond the farmers buying ability, 3.4% from unknown origin and 11.5% other problem like lack of full information as shown in table 4.

Table 4. Types of variety used and their source for horticultural crops

| Variables | Types variety used | N | % |
|---|---|---|---|
| Type of seed used for horticultural crop production | Local variety | 66 | 37.1 |
| | Improved variety | 40 | 22.5 |
| | Both | 72 | 40.4 |
| | Total | 178 | 100 |
| Source of improved seeds | BoAD | 37 | 34.6 |
| | Market | 37 | 34.6 |
| | Cooperatives | 1 | 0.9 |
| | Traders | 6 | 5.6 |
| | NGOs | 4 | 3.7 |
| | Others | 4 | 3.7 |
| | Both BoAD and Market | 15 | 14 |
| | Both BoAD and NGOs | 3 | 2.8 |
| | Total | 107 | 100 |

Source: Survey results

## Marketing of Horticultural Crops

As the result respondent gave shows the mean times it take to transport Horticultural Crops from farm gate to reach local market is 2.46 hours with the maximum of 5 hours and minimum of 1 hour. They sold on average 21.33 kilograms with maximum of 200 kilograms and minimum of 10 kilograms horticultural product in one week. Generally on average 1058.03 birr was got from sell of horticultural crops in which it was sold at minimum of 20 birr when the price fall ( during cheap) and maximum of 80000 birr when to price is good or at the period of expensive time in a year see table 5.

Table 5. Time taken and cost of transportation for horticultural crop marketing

| Variables | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| Times taken to reach market(hr) | 146 | 1 | 5.0 | 2.46 | 3.52 |
| Amount of product sell per week (Kg) | 119 | 10 | 200 | 21.33 | 183.16 |
| Total Price of amount of product sold (Birr) in year | 149 | 20 | 80000 | 1058.03 | 6669.487 |
| Number of months respondents sold | 62 | 1 | 8 | 1.89 | 1.32 |

Source: Survey results

Horticultural crop producers employ different mechanisms of transportation to move the products from place to place where market access is available. As the result shows the respondent use 22.22% donkey, 20.99% vehicle, 9.26% human back(carrying),14.20% all combination (donkey, vehicle, human back) and 33.33% only donkey and carrying. From this we can understand that more of the horticultural product is transported by donkey due to road inaccessibility. They sell 24.7% of their product to whole seller, 27.2% to retailer,22.2% to household consumers,1.2% to both whole seller and household consumers as well 24.7% to whole seller, retailer and household consumers table 6. From these we can recognize that retailer has more market share in the study area.

Table 6. Means of transport and buyers for horticultural crops

| Variables | Means of transport and demand of products. | N | % |
|---|---|---|---|
| Means of transport | Donkey | 36 | 22.22 |
| | Vehicle | 34 | 20.99 |
| | On foot (being carried) | 15 | 9.26 |
| | All | 23 | 14.20 |
| | Both donkey and on foot | 54 | 33.33 |
| | Total | 162 | 100 |
| Buyers of product | Whole seller | 40 | 24.7 |
| | Retailers | 44 | 27.2 |
| | Household consumers | 36 | 22.2 |
| | Both whole seller and household consumers | 2 | 1.2 |
| | Whole seller, retailers and household consumers | 40 | 24.7 |
| | Total | 162 | 100 |

Source: Survey results

## Horticultural Crops Marketing Constraints

## Marketing constraints for vegetable

In order to utilize the Horticultural crops production, identifying the existing constraints and Searching for solutions are of paramount importance. The participants identified seven major constraints for horticultural crops marketing in the study area. Major problems in vegetable and fruit a crops includes perish ability the crop, poor marketing infrastructure and storage facilities. Interference of brokers, low price of the product, lack of market access and market information other bottlenecks for horticultural crops marketing.

Table 7.Constraints of Vegetable Crop

| Constraints | Constraints Vegetable marketing (%) | | | | | | | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Lack of market | 18.6 | 21.2* | 13.6 | 21.2* | 16.1 | 6.8 | 2.5 | 6 |
| Low price of product | 26.9* | 25.2 | 19.3 | 10.9 | 11.8 | 3.4 | 2.5 | 3 |
| Lack of storage | 16.5 | 22.3* | 13.6 | 15.5 | 13.6 | 10.7 | 7.8 | 5 |
| Lack of transport | 25.7* | 17.4 | 11.9 | 13.8 | 9.2 | 19.3 | 2.8 | 4 |
| Lack of market information | 19.5* | 16.9 | 18.6 | 10.2 | 11 | 14 | 9.3 | 7 |
| Brokers (hinders fair sales) | 29.1* | 19 | 11.4 | 15.2 | 7.6 | 6.3 | 11.4 | 2 |
| Perish ability | 13.8 | 14.9 | 29.9* | 13.8 | 10.3 | 4.6 | 12 | 1 |

Source: Survey results

## Marketing constraints for fruits

According to the response of the producers and available information on major challenges of the producers, the first constraint of fruit crop production is Perish ability nature of the crop, the second most disturbing incident that restricts the productivity of fruit is an accessibility of transport, the third dilemma of fruit production is brokers which hinders fair sale of the product, fourth lack of storage, followed by lack of market information, then lack of market access and low price of the products as indicated on table 13 below .

Table 8.  Constraints of fruit marketing

| Constraints | Constraints Vegetable marketing (%) | | | | | | | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Lack of market | 23.7* | 7.9 | 13.2 | 18.4 | 21.1 | 10.5 | 5.3 | 6 |
| Low price of product | 18.4 | 23* | 13.2 | 21.1 | 15.8 | 7.9 | 0 | 7 |
| Lack of storage | 33.3* | 18.5 | 22.2 | 11.1 | 11.1 | 3.7 | 0 | 4 |
| Lack of transport | 15.4 | 43.6* | 10.3 | 15.4 | 7.7 | 7.7 | 0 | 2 |
| Lack of market information | 6.3 | 25 | 31.3* | 9.4 | 15.6 | 6.3 | 6.3 | 5 |
| Brokers (hinders fair sales) | 6.7 | 6.7 | 13.3 | 13.3 | 6.7 | 13.3 | 40* | 3 |
| Perish ability | 50 * | 7.9 | 15.8 | 7.9 | 7.9 | 7.9 | 2.6 | 1 |

Source: Survey results

## Marketing constraints for root and tuber crops

According to the response of the producers and available information on major challenges of the producers, the first constraint of root and tuber crop production is Low price   of the crop, the second most worrying thing that limit the productivity of root and tuber is storage problem, the third barrier of root and tuber production is Lack of transport, fourth lack of market information , followed by lack of market access, then perish ability  and brokers which hinders fair sale of the product as pointed out respondents.

Table 9. Constraints of root and tuber marketing

| Constraints | Constraints Vegetable marketing (%) | | | | | | | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Lack of market | 14.3 | 26.2* | 19 | 14.3 | 21.4 | 2.4 | 2.4 | 5 |
| Low price of product | 59.6* | 17 | 8.5 | 6.4 | 4.3 | 2.1 | 2.1 | 1 |
| Lack of storage | 40.9* | 22.7 | 15.9 | 13.6 | 4.5 | 0 | 2.3 | 2 |
| Lack of transport | 3 | 36.4* | 12.1 | 21.2 | 9.1 | 15.2 | 3 | 3 |
| Lack of market information | 8.3 | 16.7 | 30.6* | 11.1 | 13.9 | 8.3 | 11.1 | 4 |
| Brokers (hinders fair sales) | 9.5 | 14.3 | 19* | 14.3 | 9.5 | 14.3 | 19 | 7 |
| Perish ability | 6.3 | 9.4 | 15.6 | 18.8 | 9.4 | 25* | 15.6 | 6 |

Source: Own computation survey results

## Opportunities of Horticultural Crops Production in the Study Areas

 Horticultural Crops production is the major income generating cash crop to feed households in the study area. On the other hand availability of improved variety, having high demand from time to time and

government attention to high value crops were reported as future opportunities of horticultural crops in the study areas.

## Conclusions and Recommendations

### Conclusions

Horticulture production gives an opportunity for intensive production and increases smallholder farmers' participation in the market. Increasing horticulture production contributes commercialization of the rural economy and creates many off-farm jobs. This study was conducted to cover gaps: identifying the opportunity and constraints of horticultural crops marketing system. The study was conducted in three (3) districts of west Hararghe zone, namely: Daro Lebu, Boke and Oda Bultum based on their horticultural crops production potentials. Total sample of 178 respondents interviewed and generated qualitative and quantitative data on opportunity and constraints of horticulture marketing.

The study concluded that lack of market access, low price of product, lack of storage, poor transport facility, lack of market information, interference of brokers and perish ability of crops were reported as major constraints of horticultural crops marketing in the study areas. However, horticultural Crops production is the major income generating cash crop to feed households in the study area. Therefore, availability of improved variety, having high demand from time to time and government attention to high value crops were reported as future opportunities of horticultural crops in the study areas.

### Recommendations

 ➤ Build the capacity of farmers as cooperatives/unions to engage more on horticultural crop production and marketing. This also requires integrating them into the horticultural crop value chain to improve the share of producers from their product. Therefore, one should give attention for this issue.
 ➤ Improvement of the market information delivery system in horticultural crop marketing is necessary. With a strong relationship between traders and producers, searching for market information and dissemination will be crucial.
 ➤ Improving the marketing functions such as the packaging, storage and transportation system and invests in processing industries for horticultural crop production should get consideration to increase farmers share from their products

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# Analysis of Camel Value Chain in Borana Zone, Southern Ethiopia

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## Abstract

Camel is an important livestock species uniquely adapted to arid environments. In spite of the great ecological, cons and pros of its production compared to that of other domestic animal, little is known about economic value of the camel production. This study was undertaken in Borana zone to identify challenges and opportunities in camel marketing, to evaluate camel market performance and to map camel value chain. The required data was collected from different actor using a semi-structured questionnaires and checklists and analyzed using SPSS. The primary data was collected using predefined questionnaires. Since recently, different factors have been induced suppressor impacts on livestock production system of Borana pastoralists. As a result, camel production becomes the most common livestock species where most of the Borana pastoralists were commonly need to have. However, along different marketing center and actors, price difference was observed during field data collection. Moreover, seven-market channel was observed. During marketing of camel, pastoralists rely on informal market information to market their camel. Furthermore, the number of people keeping camels is increasing due to it was opportunely dependent on browses of bushes and trees. Moreover, to improving the productivity and production of camel; developing systematic analogous research system to improve the milk production and disease resistant, improving the marketing system of a camel, linkage of producers along the market chain actors and improving access to marketing information a very critical.

**Keywords: camel, pastoralist, value chain, market channel, actors, margin**

## Introduction

### Background and justification

Camel (*Camelus dromedaries*) is an important livestock species uniquely adapted to arid environments. It is the most numerous in the arid areas of Africa, particularly in the arid lowlands of Eastern Africa namely, Somalia, Sudan, Ethiopia, Kenya and Djibouti. Approximately 11.5 million animals in this region represent over 80% of the African and two thirds of the world's camel population (Schwartz, 1992). With increasing human population pressure and declining per capita production of food in Africa, there is an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands. Hence, to optimize their utilization through appropriate livestock production systems especially camel production is certainly the most suitable one (Schwartz, 1992). The major ethnic groups owning camels in Ethiopia are the Beja, Rashaida, Afar, Somali and Borana (Workneh, 2002). Camel have a significant contribution to the livelihood of the pastoralist society who have little alternative mode of production system.

However, recently the camel has been one of the neglected domestic livestock by scientific community in Ethiopia (Yesihak and Bekele, 2003). Despite all its ecological advantages, the camel have continually losing importance, unless solutions are found for turning camel economic value into an activity that is profitable enough to sustain livelihoods. It represents a commodity that neither animal scientists and veterinarians nor wildlife conservationists feel responsible for. Unless young people perceive camel breeding as a livelihood option that generates a certain minimum income, there is no way that the camel can be saved, except in a zoo (Kohler-Rollefson, 2004). In spite of the great ecological, cons and pros of its production compared to that of other domestic animal, little is known about economical value of the camel production. Previous works conducted on camels are more concentrated on diseases, reproductive physiology and characterization. The information on camel production and its contribution to herders especially in Borana zone is inadequate. Therefore, identifying the major production areas of camel, their market, opportunity and challenges of camel production and marketing, cost of production, price margin, actors in camel production and marketing system are vital issues for further interventions to improve the livelihood of the community within this sector. This study is therefore, initiated to bridge the information gap on camel value chain development in reference to Borana zone.

### Objectives of the study

. The specific objectives of the study include:
- ➢ To identify challenges and opportunities in camel production and marketing
- ➢ To evaluate camel market performance along the value chain
- ➢ To map camel value chain and marketing channels

**Methodology**

**Description of the Study Area**

The pastoral rangeland of Borana is found in the southern part of Ethiopia along ethio-kenya border. It covers about 50,000 km[2] (Homann*et al*., 2008). It is located at about 570km from Addis Ababa along Addis Ababa-Moyale road from its main town of the zone, Yabello. It characterized mainly by lowlands, which falls within the Rift Valley System of East Africa (Leykun Abune, 1991; Coppock, 1994). Except these few mountains with peak elevation of 2200 meters a.s.l., the landscape is gently undulating across an elevation of 1450- 1600 meters a.s.l (Fikadu, 2011).

Borana zone is characterized by bi-modal monsoon rainfall type, where 60% of the 300-900 mm annual rainfall occurs during March to May (*Ganna*) and 40% between September and ovember (*Hagayyaa*) (Fikadu, 2011). The period from June to September is characterized by heavy cloud cover, mist and occasionally short showers, while the main dry season (*Bona Hagayyaa*) occurs from November to March with high evapotranspiration (BLPDP, 2004). The overall average temperature ranges from an annual mean minimum of 13.3oC to annual mean maximum of 25.1oC (Sintayehu, 2007).

The predominant soil types of the area are characterized as red soil, black soil, white or gray soil and sandy soil. Mostly, the soil is well-drained red sandy loam type whereas in a valley bottoms with impeded drainage, cracking black clay soils and volcanic light colored silt clays predominate with relatively higher fertility (higher content of nitrogen, phosphorus and organic matter) and higher water holding capacity than the upland soils. The upland soil is characterized by shall and well-drained red sandy soils that are widespread on flat lands and hills with relatively lower fertility and lower ability to retain water and nutrients as compared with the vertisols in the bottomlands (Coppock, 1994).

In the study area, livestock production is the main stay of the pastoral and agro-pastoral communities of the Borana people due to its good ecological potential for livestock production. However, today the production of cattle became endangered by recurrent drought than other livestock type. As a result, goat and camel production are increasingly populated    at the expenses of cattle. Moreover, crop production has been expanding at the expenses of rangeland resources.

**Sampling Design**

Borana zone is characterized obviously by diverse agro-ecological zone and farming system. This generated a difference in the potential for different livestock and crop productions. Therefore, it needs to implement different sampling procedure to arrive at the representative respondents. Moreover, due to the production of camel is a recently increasing production option to cope with climate change, it need a specific targeted strategy to arrive at the respondent.

For this study, purposive sampling procedure was used to select the potential districts and PAs of study followed by simple random sampling to select the households. Purposive sampling method involves purposive or deliberate selection of particular units of the universe for constituting a sample, which represents the universe (Kothari, 2004). Initially, the Yabello district and Moyale district was purposively selected due to their high potential and early production of camel production beyond accessibility and conducive environment.  From the selected districts, *Bake* and *Suruphha* from *Yabello district* and *Dambi, Xillemaddo, Mado* and *Tuqaa* were purposively selected. Finally, 71 households were randomly selected from the selected PAs of selected districts.

**Methods of Data Collection and Analysis**

The required data was collected from deferent actor using a semi-structured questionnaires and checklists. The survey was undertaken to collect primary data from selected respondents using predefined questionnaires. To triangulate the primary data collected key-informant interview, FGD and secondary data review was performed. Moreover, interview of traders along different value chain was undertaken using predefined checklists.

Data analysis was undertaken using SPSS (Version 20). Finally, descriptive statistics was drawn from the data to ease the conclusion and recommendation. Secondary information was collected from district offices of agriculture and district livestock and marketing agency. Moreover, relevant literatures and documents was consulted to provide technical background and to develop a basic understanding of how camel production and marketing system operates in the study areas.

*Margin Analysis and Cost of Marketing*

*When there are several participants in the market chain the margin is calculated by finding the price variations at different segments and then comparing them with final price to the consumer. The consumer price then is the base or common denominator for all marketing margins. Computing the Total Gross*

Marketing Margin (TGMM) is always related to the final price or the price paid by the end consumer is expressed as a percentage (Mendoza, 1995).The formula to calculate TGMM is given as:

$$TGMM = \frac{CP - FP}{CP} \times 100 \quad - - - - - - - - - - - - - - - 2$$

Where: CP= Consumers' Price

FP= Farmers' Price

It is useful to introduce here the idea of ''producer participation'', ''farmer's portion'' or "producer's gross margin'' (GMM) which is the portion of the price paid by the end consumer that belongs to the farmer as a producer. The producer's margin or share in the consumer price (GMMp) is calculated as:

$$GMM_p = \frac{PC - MGM}{PC} \times 100 \quad - - - - - - - - - - - - - - - - 3$$

Where     PC=Price Paid by the consumer

MGM= Gross marketing margin

Similarly, the consumer price share/portion of market intermediate is calculated as:

$$MM = \frac{PSP - BPC - MGM}{FCP} \times 100 \quad - - - - - - - - - - - - - - 4$$

Where: MM= Marketing Margin (%)

SP= Selling Price at each level

BP= Buying Price

FCP=Final Consumer Price

In marketing chain with only one trader between producer and consumer, the net marketing margin (NMM) is the percentage over the final price earned by the intermediary as his net income once his marketing costs are deducted. The percentage of net income that can be classified as pure profit (i.e., return on capital) depends on the extent to which factors such as the middleman's own, often imputed, salary are included in the calculation of marketing costs.

$$NMM = \frac{GM - MC}{PC} \times 100 \quad - - - - - - - - - - - - - - - - - -5$$

Where:

GM= Gross Margin

MC= Marketing Costs

NMM=Net Marketing Margin

## Conceptual Framework

The word value chain comprised of two words value and chain. The word value indicates the additional importance added to the products or service beginning from the idea of production to consumption of the products or services while the word chain indicates the stages of process at which the service can gate its value or importance. In this study of camel value chain analysis, beginning from the origin/idea of camel production, all inputs and services that enable camel production (Feeds, housing, herding and veterinary services etc.), transporting, marketing, processing, creation of added value products such as meat through consumption of the animal source foods and related products. Input suppliers, producers, processors and buyers, collectors are actors along the value chains. A range of technical, business and financial service providers supports the different actors. A value chain also includes the institutional and governance arrangements that enable these systems to function. Value chain analysis considers how and by whom the value in the value chain is captured (Gereffi and Kaplinsky, 2011, Legese and Hordofa, 2011).

### Result and Discussion

### Descriptive Statistics

### Household Characteristics

The major part of the respondent were involves male household heads. From the survey result, about 81.7% were male-headed households. As matter facts, more than 60% of the respondents were involved in the livelihood of agro-pastoralism followed by pastoralism as their main livelihood. Unlike the earlier eras now days Borana pastoralists are driving on the track of transposing out of pastoralism. This study clearly approves that the larger parts of the respondents were dominated by agro-pastoralism livelihood system.

**Table 10.sex across economic activity**

| Sex | Cross tab | economic activity | | | Total | χ² |
|-----|-----------|--------|------------|------------------|-------|-----|
| | | Farmer | Pastoralist | Agro-pastoralist | | |
| Male | Count | 1 | 21 | 36 | 58 | 0.619 |
| | % within sex | 1.7 | 36.2 | 62.1 | 100.0 | |
| | % within activity | 100 | 77.8 | 83.7 | 81.7 | |
| Female | Count | - | 6 | 7 | 13 | |
| | % within sex | - | 46.2 | 53.8 | 100.0 | |
| | % within activity | - | 22.2 | 16.3 | 18.3 | |
| Total | N | 1 | 27 | 43 | 71 | |
| | % within sex | 1.4 | 38 | 60.6 | 100 | |
| | % within economic activity | 100 | 100 | 100 | 100 | |

With sex disaggregation, larger female respondents were involved in the livelihood of pastoralism compared to male households. Though there is no significance difference among the sex across the activity, the survey output indicates that about 46% of the female households involved in pastoralism as compared to only about 38% of male households. Similarly, about 84% of male households were involved in agro-pastoralism livelihood system as compared to only about 16% of female households (See Table 1).This indicates compared to female households; male households have more opportunities to diversify their livelihood.

### Off-farm and Non-farm Activities

The livelihood system of Borana pastoralists were commonly known by it is traditionally livelihood system based on traditional livestock production in the Borana rangeland. However, the livelihood of Borana pastoralist transitioned from time to time from pure pastoralism to non-pastoralism livelihood system. However, trader, broker and labor works were the major works identified during filed survey. Especially, female households were increasingly involved in petty trades such as rural traditional alcohol drinks. In the contrary, male households were involved in labor works and brokering activities than female households.

**Table 11. Off-farm and non-farm activities**

| Sex | Cross tab | Activities | | | | | χ² |
|-----|-----------|-------|---------------|---------|-------|-------|-----|
| | | Trade | Labor work | Broking | Other | Total | |
| | Count | 7 | 4 | 3 | 43 | 58 | 0.619 |
| Male | % within sex | 12.1 | 6.90 | 5.20 | 74.10 | 100. | |
| | % within extra acti | 87.5 | 66.7 | 50.0 | 86.0 | 81.70 | |
| | Count | 1 | 2 | 3 | 7 | 13 | |
| Female | % within sex | 7.7 | 15.4 | 23.1 | 53.8 | 100.0 | |
| | % within extra acti | 12.5 | 33.3 | 50.0 | 14.0 | 18.3 | |
| Total | Count | 8 | 6 | 6 | 50 | 71 | |
| | % within sex | 11.3 | 8.5 | 8.5 | 70.4 | 100.0 | |

| Sex | Cross tab | Activities | | | | | χ² |
|-----|-----------|-------|------------|---------|-------|-------|-----|
| | | Trade | Labor work | Broking | Other | Total | |
| Male | Count | 7 | 4 | 3 | 43 | 58 | 0.619 |
| | % within sex | 12.1 | 6.90 | 5.20 | 74.10 | 100. | |
| | % within extra acti | 87.5 | 66.7 | 50.0 | 86.0 | 81.70 | |
| Female | Count | 1 | 2 | 3 | 7 | 13 | |
| | % within sex | 7.7 | 15.4 | 23.1 | 53.8 | 100.0 | |
| | % within extra acti | 12.5 | 33.3 | 50.0 | 14.0 | 18.3 | |
| Total | Count | 8 | 6 | 6 | 50 | 71 | |
| | % within sex | 11.3 | 8.5 | 8.5 | 70.4 | 100.0 | |
| | % within extra acti | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | |

### Migration

Mobility was the most common strategy in pastoral area to manage its resource utilization and health of their livestock. In earlier time, the pastoral communities were migrating with all their family, asset and properties. However, this strategy has been delimited by different factors now days. This survey output found that the pastoralists have been diverts their mobility strategies to different shorten strategies. The survey data indicates that about 94% of respondent household are established sedentary life unlike the earlier time.

**Table 12. Mobility**

| Types of mobility | Sedentary (%) | Transhumant (%) | Nomadic (%) |
|-------------------|---------------|-----------------|-------------|
| Mobility with family | 94.4 | 5.6 | 0 |
| Mobility with cattle | 19.7 | 71.1 | 8.5 |
| Mobility with shoat | 16.9 | 74.6 | 8.5 |
| Mobility with camel | 14.1 | 74.6 | 11.3 |

### Livestock Production

Originally, Borana community is known for its indigenous cattle production where they have a long experience and a very strong attachment to cattle rearing (Adugna and Aster, 2007). Camel production was an almost exclusive to the Borana except Gabbra people. However, now days the proportion of Borana people keeping camels is increasing, even if it is not in accordance with their indigenous knowledge and habits (Solomon *et al*., 2007). As a result, camel populations increased over 20 years by 200% while cattle population is decreased at 20-25% in Borana zone over same time (Yosef and Mengistu, 2013**)**.

**Table 13.Average size of livestock owned by respondent household**

| Livestock size | N | Minimum | Maximum | Mean | Std. Deviation |
|----------------|-----|---------|---------|-------|----------------|
| Cattle | 71 | 1 | 1000 | 24.39 | 117.847 |
| Sheep | 71 | 0 | 70 | 6.55 | 10.918 |
| Goat | 71 | 0 | 100 | 14.03 | 16.99 |
| Camel | 71 | 0 | 70 | 9.70 | 11.619 |
| Poultry | 71 | 0 | 20 | 3.13 | 4.672 |
| Donkey | 71 | 0 | 7 | 1.11 | 1.600 |

This study revealed that the average proportion of camel and goat become proportional to that of cattle in study area. From the survey data the proportion of cattle: goat: camel is 5:3:2 which indicate there is less variation compared the null proportion in the past (Table 4). This indicates that camel and goat are become an important livestock types in Borana production system. .

### Livestock Preference and Rationale

Borana pastoralists were known for its productive livestock production where their livelihood was entirely depends on them. Especially, cattle have multifaceted importance in Borana social system such as high priority for cultural heritage, indication for social position, priority stable food source and the major income source. In case where there is no cattle sheep has a priority value especially in cultural heritage.

However, since recently different factors have been induced suppressor impacts on livestock production system of Borana pastoralists. However, cattle have a priority demand in pastoral area, now a day the preference pastoralists have changed especially due to drought. From survey result, camel and goat become the most important livestock types more importantly as much as cattle only due to climate change.

**Table 14. Prioritization of livestock**

| Livestock | N | Valid Percent |
|---|---|---|
| Camel | 33 | 46.5 |
| Cattle | 17 | 23.9 |
| Goat | 17 | 23.9 |
| Goat & camel | 1 | 1.4 |
| No selection | 1 | 1.4 |

The most reason behind this priority choice is drought resistance, higher income and good price on the market. However, drought tolerance was become the most challenging factor in livestock production system. As a result, since recently camel become the most claimed livestock type especially with regard to climate change.

**Table 15. Reason of preference**

| Reason | Frequency | Valid Percent |
|---|---|---|
| For milk | 2 | 2.8 |
| Good price | 7 | 9.9 |
| Drought tolerance | 24 | 33.8 |
| Generate high income | 20 | 28.2 |
| Earlier reproductive | 2 | 2.8 |
| Mobility restriction | 1 | 1.4 |

### Camel Production

Camel production becomes the most common livestock species where most of the Borana pastoralists were commonly need to have. However, due to they were not the original camel producers except gabra ethnic in Borana zone. As a result, market is the most common source of camel though some pastoralists were access from their neighbor households through different methods like exchange, gifts and other method like **hamessa**[1].

In Borana zone, camel production was perceived to be the most common production specific to gebra ethnic group where they have a long history of camel production. However, camel production become enquires of community in Borana zone in response to climate change. Camel is relatively higher capacity to adapt to the environments of Borana dryland where recurrent cattle loss is the threathining to the livelihood of Borana pastoralists. As a result, relatively drought resistant livestock types become more demanding in Borana.

Moreover, different types of camel identified during field study. Qorti camel types originally from community are the most important. Qorti types of camel is characterized as large body size, long tail with high meat and milk production/camel as compared to Gelaba type of Somali source. The other types of

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[1]**Hamessa** is a traditional practice in Borana zone where a household provide milking livestock for a destitute household for lactating period.

camel become common in Borana zone is geleba camel which originally from Somali community. The Gelaba breed type is characterized by small body size, short tail and low milk and meat production/camel than the other two breed types. But highly resistant to disease, drought and needs much less feed as compared to both Qorti and Shibdara. The third types of camel breed in Borana are called Shibdara, which is a cross of gebra Qorti and Somali geleba camels. This type of camel breeds /cross breed known as Shibdara is medium in body size. Give high production of milk and meat (less than of Qorti). They mostly use Qorti breed male and Gelaba breed female to get cross breed type. They select camels within their herd for the breeding purpose usually Qorti male type with large body size, good standing born from good family breed history mostly  at age of 5 years.

Even though, Borana zone has restocking program by both government and non-government organization for different breeds of cattle and goats, these mechanisms do not apply to camels. Any other Borana self-rehabilitation culture assisting stock replacement after severe drought for severely affected individual household after drought (Busa Gonofa) is also not functional for camel. Each of Borana community neither has camel nor is not only supply of camel breed for the study area market and their local neighbor.

However, pastoralists use their livestock for milk, transportation, cultural ceremony, meat and for breed purpose though are various across livestock types. Relatively, the trends in the proportion of camel relative to other livestock types were increasing. From survey data, more than about 80% of the respondents have less than five camel per household. Only about 6% of households have 20% of households have more than 10 camels per households.

**Table 16. Average camel owned per household**

| PA | Proportion of respondent owned on camel in a range | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6 -10 | 11-25 | >25 | |
| Dambi | 15% | 11% | 7% | 1% | 35% |
| Bake | 13% | 6% | 0% | 1% | 20% |
| Xillemaddo | 4% | 1% | 0% | 0% | 6% |
| Mado | 6% | 1% | 3% | 0% | 10% |
| Suruphha | 10% | 6% | 6% | 3% | 24% |
| Tuqaa | 0% | 4% | 1% | 0% | 6% |
| | 48% | 30% | 17% | 6% | 100% |

**Factors Affecting Camel Production**

**Access to veterinary service**

Veterinary services are among the fundamentals to improve the production productivity of camel. In the study area, community animal health workers (CAHWS), private veterinary pharmacies and private clinics are the major that support camel health service. However, the supplies of drugs and vaccines services are among the major challenges for camel producers. Though public health posts were the most source of health service, it provides insufficient service due to the shortage of drugs. Specially, the camel raisers were hardly access to veterinary services at remote area. Though 84% of respondents reacts as they were access to veterinary services, there was no supply of drugs specific to camel disease in the study area. As a result, they were using the drugs that were pre-designed for cattle.

**Table 17. Access to veterinary services**

| Distance to nearest veterinary service | Do you have access to veterinary services | | | $\chi^2$ |
|---|---|---|---|---|
| | Yes | No | Total | |
| <1 km | 6 | 2 | 8 | 4.244 |
| 1-5 km | 24 | 1 | 25 | |
| 6-10 km | 16 | 5 | 21 | |
| >10 km | 14 | 3 | 17 | |
| **Total** | **60** | **11** | **71** | |

**Camel disease**

Disease is the most horrific though it outbreaks occasionally in camel production. However, it is devastating during its occurrences where the immediate drugs is challenges in Borana zone.      The prevailed camel diseases summarized in the following table. According to the key informants, the

mobility toward the near border country (Kenya) during feed shortage were the major cause of camel disease in Moyale zone.

Table 18. Camel disease prevailed

| No | Local name | Common name | Age susceptible |
|---|---|---|---|
| 1 | Furrii | Respiratory complex disease | All age groups |
| 2 | Dhuguda | Coughing | All age groups |
| 3 | Dhukkaanaa | Trypanosomosis | All age groups |
| 4 | Cittoo | Mangemites | All age groups |
| 5 | Malaa | Caseous lymph a denitis | Adult |
| 6 | Qandhicha | Hemorrhagic septicemia | Young |
| 7 | Bagaa/Finnoo | Camel canal pox | All age groups but severe in maturing ones |
| 8 | Simphirkii/Simphirow | Nervousness | All age groups |
| 9 | Uudaankii | Wry neck syndrome | Adult |
| 10 | Lukmura/miilmura | Lameness | Adult but severe in cow camels |
| 11 | Dhullaa | Abscess | All age groups |
| 12 | Butala | Diarrhea | All age group |
| 13 | Umburura | | Young age |
| 13 | Urgofaa | | Young age |

Sources: Camel disease survey, 2010 (by Dr. Badane Adane, YPDARC)

### Access to Credit Services

Microfinances and donors related fund were the major sources of credit. During survey, Oromia Credit and Saving Company (OCSCO), Household Asset Building Program and their own Credit and Saving Cooperatives are their main credit sources. The OCSCO credit is a group based loan that pastoralists take by forming groups of 3-7 households, which serve as collateral for the loan. The maximum amount a pastoralist can get from this source is 2000 birr in the first round with the interest rate of 15% per annum. This amount increases by 20% if the pastoralist repays the first loan without any problem.

HABP credit is on their other hand, the credit extended to Safety Net (SN) beneficiary households to enable them to create assets up on their graduation from the Safety Net (SN) program. Financial institutions such as OCSCO follow up with a close collaboration with offices of pastoral development administer this credit. In order to be eligible for this credit, the pastoralist should produce a business plan with supports by the extension agent. The credit will be approved after the approval of the business plan by the district steering committee. The maximum amount of money that a pastoralist can get from the HABP credit is 4000 Birr with the interest rate of 10% per annum.

On the other hand, the pastoral can access credit from their member based Pastoral Community Credit and saving cooperatives (PCCSAThe source of their finance is member's contribution as share capital. Moreover, sometimes NGOs were supporting the community with seed money to such cooperatives. They are more flexible in serving the community as compared to OCSCO and other institutions. However, they usually have shortage of capital to address the credit needs of their members.

The most important issue with regard to rural credit services is the level of understanding of the community about its terms and conditions. Since the credit institutions do not have sufficient staff, they could not reach the community and aware them on their terms and conditions. Hence, most of the pastoralists are not clear with what types of credit are available and what they have to fulfill in order to get access to credit service. Occasionally, some elite households uses credit for financing their camel input requirements such as drugs and feed incase where the price of camel is reduced.

### Feeds and Feeding System

In the study area camel feed depends on natural tree browsing of natural communal grazing system which make it not suitable to preserve such feed (leaf will be dried soon). There are no crops or plant deliberately planted for the sole purpose of camel. During extreme feed shortage pastoralist cut large plant trees to support camels and few respondents use crop residue like haricot been for camel life survival. There is no differentiated feed for camel age category.

However, the herding system is differentiated among camel age category to get day and evening milk. For small age category of camel or calves, they collect naturally occurring green fodder materials/plant leaf from surrounding area (cut and carry system).Moyale pastoralists use camel mobility toward the near border country (Kenya) while Yabello pastoralists have limited mobility system. Respondents told that camel feed availability depend on rainfall as any other livestock feed. Pastoralists assume excess feed during long rainy season though the amount of long rainy season and its pattern become irregular (during

our study is below the expectation).Generally, the rain condition in Borana zone challenges the availability of forage for camel production.

Table 19: Feed availability across season

| Main rainy  season | Feed availability |
|---|---|
| Bona/dry season | Shortage |
| Long rainy /Main rainy season | Excess |
| Cool and dry season | Shortage |
| Short rainy season | Adequate |

Source: FGD, 2014

During wet or rainy season pastoralist did not consider camel watering due to ground water such as flood is available. Normally, camels do not need so much water but at dry season when ground water is not available, the source of water for their camel is pond and deep well. Additionally, pastoralists provides different minerals to their camel as to of other livestock.

Table 20: Common mineral supplements for camel

| Camel type | Type of minerals | Season more given |
|---|---|---|
| Camel  calve | Dilo | Rainy season |
| Young male camel | Dilo,magado | Rainy season |
| Young female camel | Dilo&magado | All season |
| Big  male camel | Dilo&magado | All season |
| Big female camel | Dilo&magado | All season |
| Castrated male camel | Dilo&magado | All season |
| Castrated female camel | Dilo&magado | All season |

Source: FGD, 2014

### Shedding Style

Pastoralist use bush fences that do not have roof by separating different age category of camels. The purpose of making house for calves separating from young breeding male calves is to get morning milk while it is used to control mating for young breeding male. The house of camel is different from other animals/livestock so that camel may not hurt other animals kept in one house. The pastoralist often change camel house more importantly than cleaning same house as they don't want their camel to stay in one barn/house for long period as camel simply affected by odor and other disease. Some pastoralist clean camel house once per week in which camel not  stay more than one month while other change the house within shorter period(>10 days) itself so that the barn be new for camel.

### Camel Marketing System

Borana zone is a nationally known for its potential supply of shoats, cattle and camel especially to the export market side. However, the marketing system that meant to benefit the producers is less illustrious for further improvement. Most of the respondents reveal that they were preferred to buy young camel types. From the survey result, about 59.1% of the respondents were buying both young male and female camel types while 29.6% buy only young female camels. About 5.6%, 2.8% and 1.4% of the respondents buy adult female, adult male and both adult male and female.  From the above, pastoralists sell adult camels while they buy young camels for breeding purpose and stock replacement especially female young camels. They asked the main source of camels from where they buy camels. Accordingly, pastoralist purposely buys from each other than any other market participants.

Most of the respondents indicated that prefer the camel type they know more about its backgrounds for breeding purpose. They also pay lower price when they buy from pastoralists for breeding purpose compared to when they buy from traders and other middlemen because pastoralists are loyal to each other. Even though (49%) respondents have no seasonal preference to buy camels, (32.2%) prefer dry season. In addition, it is not common to gate, they seek lower price of camel due to animal's lower body condition because of feed unavailability.
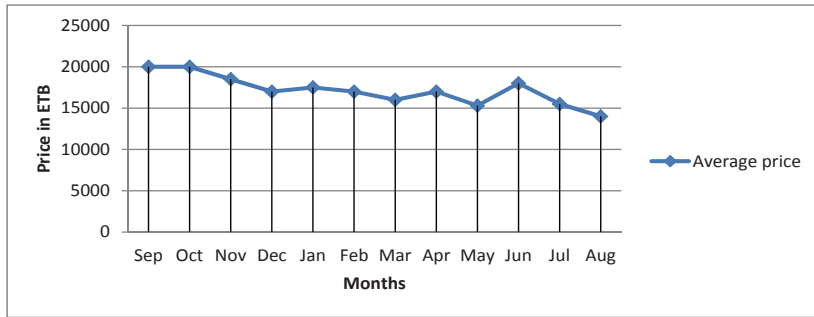
**Figure 4. Average monthly camel market price of 2013/14 year**

### Camel Supply

The supply of camel depends on the demands from foreign countries. As a result, almost camels purchased at a local market to supply for the market is if traders are available. The sell preference of pastoralists also confirm that most of the pastoralists prefer other small ruminants (more frequently) sell to cover family and other expenditures than large animals. Most of our respondents (54.9%) sell camel all around season. They have no seasonal preference (19.7%) to sell both in long rainy season and in drought season while 4.2% and 1.4% prefer to sell during short rainy season and cool dry season respectively. Similarly, 40% of the respondents more frequently sell culled female and male type where as 29.6%, 18.3%, 5.6 %, 2.8%, 1.4% more frequently sell adult male, any fattened, adult female, young female and young male type of camel respectively. This shows that pastoralists do not want to sell both young female and male type of camel. They prefer to sell old/culled camel, adult female and male type.

In most case, traders are the main buyers from pastoralists due to they assume that traders pay more price than other buyers do. On the other hand, collectors and brokers make price down at farm gate and at roadside to make profit from re selling to trades.

Table 21. Price difference among different agents

| Camel type category | Traders (ETB) | Middlemen (ETB) | Difference (ETB) |
|---|---|---|---|
| Castrated (fattened) | 14,000 | 13,500 | 500 |
| Big breeding male | 18,000 | 17,000 | 1000 |
| Breeding female | 14,500 | 9,000 | 500 |
| Small Young male | 6,500 | 6,000 | 500 |
| Small young female | 9,000 | 8,500 | 500 |
| Old male | 9,000 | 8,500 | 500 |
| Old female | 3,500 | 3,000 | 500 |

Moreover, camel has lower demand in domestic market. As a result, the demand and market price as well as animal type extremely depend on an abroad market demand. Hence, the volume of camel supply in the market and the price of camels vary according to the market information diffused to pastoralists from market participants /agents. Pastoralists mostly put confidence to the market information from traders than other intermediaries. Pastoralist always searches for a market price information through different techniques, which helps them to know camel price difference created due to place/location from market center.

Table 22. Price difference at different market location

| Camel type category | Farm gate | Bush market | Market |
|---|---|---|---|
| Big Castrated (fattened) | 13,500 | 14,000 | 14,000 |
| Big breeding male | 16,000 | 20,000 | 20,000 |
| Breeding female | 10,000 | 14,500 | 14,500 |
| Small Young male | 5,500 | 6,000 | 6,000 |
| Small young female | 7,000 | 7,000 | 7,000 |
| Old male | 8,000 | 9,000 | 9,000 |
| Old female | 3,000 | 3,000 | 3,500 |
| **Average price** | **9,000** | **10,500** | **10,571** |

Camels less affected in muscle fatigue and loss of body condition due to long distance trekking compared to other livestock types. Hence, camel owners want to sell at market place than to sell at farm gate and roadside unless they are very far from market place. Recently, bush markets existed in the pastoral area got recognition by traders especially Surupa bush market where only camel marketed. As a result, there is no general camel price difference with that of bake market known livestock market.

**Camel Market Performance**

**Marketing margin analysis**

Marketing margin or price spread is a commonly used as a measure of the performance of a marketing system. It can be a useful in descriptive statistics if used to show how the consumers' expenditure is divided among market participants at different levels of the marketing systems. It is defined as the difference between the price the consumer pays and the price that is obtained by producers, or as the price of a collection of marketing services, which is the outcome of the demand for and supply of such services.

Along different marketing center and actors, price difference was observed during field data collection. Though the price of camel was frequently fluctuated a long period, during the field survey the price analyzed as follow. The result indicates that though the producers have a tiger share of marketing margin, this analysis is undertaken from the producer's prices. Note that this value chain was limited to the price in borane zone, i.e. from the producers to a big market in the zone.

Table 23. Market price margin

| Parameters | Parameter | Market margin |
|---|---|---|
| **Pastoralists** | Average big camel Price | 17,000 |
| | Marketing cost/camel(tax ,transport and labor) | 45 |
| **Collectors** | | |
| | Average Price/camel | 20,000 |
| | Marketing cost/camel(tax, transport, labor) | 375 |
| | Marketing margin | 13% |
| **Traders** | | |
| | Average Price/camel | 23,125 |
| | Marketing cost/camel | 2325 |
| | Marketing margin | 14% |
| | Consumers price * | 23225 |
| | Total marketing margin | 6225 |
| | Total marketing cost | 2745 |
| | Gross marketing margin | 2.27 |
| | Producers share(Ps) | 73% |
| | Rate of returns (Rr) | 2.231 |

*average camel price at Adama at consumer's price

**Market Channel**

From the analysis, seven-market channel was observed. Among the channel the channel consisting: **Producers → Small traders → Big traders → L.A. Export** actors is the main leading of volume of camel reaching live animal exporters. Traders of camel in the area have no option to sell back to the region. Traders buy camel type needed at export which pastoralist has less demand for it. Even, locally demand for camel will be emerged during high margin expectation.
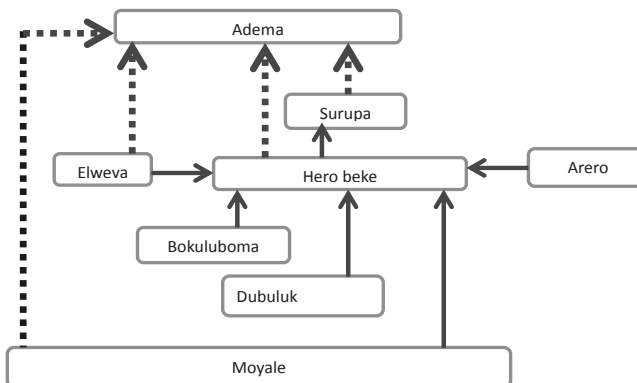


☐ **Figure 3. Camel marketing channels**

There is also no camel processing actors competing in this channel. Hence, the number of camel bought from producer goes to live animal exporters.

number of camel bought from producer goes to live animal exporters.

## Camel Marketing Segment

Along the supply chain of camel marketing, different participants are playing different role from producers through the final live export to final consumers. Along this channel, stating from pastoralists to the final exporters these actors have different share of the market supply (See figure 2 below).



**Figure 5. Share of camel market actors along formal market chain in Borana**

Among the channel actors, pastoralists are the initial point of the market channel followed by collectors, brokers, traders of different level, processing units and finally arrive to the consumers. However, this study didn't address the illegal market actors.

**Pastoralists:** involved in both buying and selling practice. They mostly buy small young female camels for breeding and sell big male and female, old male and female to different actors. The average camel holding size is 8.83 and 8.40 heads per household in Danbi and xile medo of Moyale districts respectively, which is almost similar to bake and Surupa kebeles of Yabello (4.8 and 14.2 respectively) district.

The average camel ownership in Surupa is very high compared to other Kebels of our study areas. Most commonly, it is because of the Gabra ethnic group of Surupa has long experience in camel production unlike other parts of Borana group of the districts. However, it varies according to their wealth category of the community. Well-off pastoralists can have over 70 heads of camel while lower camel owner have up to five camels on average. Pastoralists use camel production as a copping mechanism against the impacts of climate change that reduced the drought cycle in shorter period than before and to use the availability of feed type emerged in the area recently. Even though, cattle are the dominant livestock species reared in the Borana rangeland, camel is becoming the most important livestock species reared due to the nature of its resistivity to drought. Borana do not consume camel. However, camel milk is an option for home consumption especially during drought when cattle milk is unavailable. During their difficulty, Camel sell also provide good margin than any other livestock even to support financially other livestock rearing activities and other household expenditures.

**Table 24. Households access to market information**

| Source of market information | Formal market structure | | | | Total | | |
| | Yes | | No | | | | |
| | Male | Female | Male | Female | Male | Female | % |
|---|---|---|---|---|---|---|---|
| Self-market search | 15 | 1 | 20 | 3 | 35 | 4 | **55%** |
| Pastoralists | 0 | 0 | 1 | 1 | 1 | 1 | **3%** |
| Local collectors | 0 | 3 | 1 | 0 | 1 | 3 | **6%** |
| Traders | 8 | 1 | 0 | 0 | 8 | 1 | **13%** |
| Self-market and pastoralist | 3 | 2 | 7 | 0 | 10 | 2 | **17%** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Self-market and trader | 2 | 1 | 1 | 1 | 3 | 2 | 7% |
| **Total** | **28** | **8** | **30** | **5** | **58** | **13** | **100%** |

Market information is scarce among pastoralists. In order to get market information, at least one person from either the family or the neighbor has to go to the market. From the survey result, about 72% of the respondents were get market information from neighbors and self-market assessment. However, only about 27% of the pastoralist were access to market information from other actors such collectors and traders though it is not reliable. Though collectors go to villages to buy camels, the preferred buyers for pastoralists are small and big traders. They try to go to the market and sell directly to traders since they believe that traders offer them better prices than collectors do.

**Collectors:** Collectors are of pastoralists themselves having more experience in livestock marketing. They collect camels from the area reaching far distance of the margin place from market center. Camel demand depends on abroad market demand than domestic market, which operates in the particular season especially during Ramadan and Arafa seasons. Hence, collectors do not operate year round in collecting camels. During they operate to collect camels, Pastoralists use them as signal of raised abroad camel demand and as the source of domestic market information.

**Brokers:** mediate transaction between buyers and sellers. Camel brokers always mainly support buyers to get camel at minimum price. Such brokers have an agreement with traders paying non-constant birr based on secret agreement with trader per animal bought. They have no idea whether sellers get good margin or not. They give less attention for individuals than collectors. They involve in both to channel numbers of sellers to traders and set price. Since camel trade, transaction is based on visual estimation brokers mainly involve in setting camel price. To maintain their relation with traders they often create information gap between sellers and traders. They provide too high price or too low price confusing sellers not understand market price to sell to other buyers.

**Traders:** are those livestock market actors that supply a number of camels to export abattoirs of Adama. These traders are those mainly involving in cattle trading. They are not permanent supplier because Camel demand is not operating year round as it is solely for abroad market demand of which is not year round. Even though, Camel type and volume in the market is depending on the demand of camel in the abroad market, Traders always need both big female and male of good body condition. Pastoralists do not bring such kind of camels year round waiting for high market demand of this abroad market especially in Ramadan and Arafa seasons because of the high camel demand in the MENA countries (for the Ramadan fasting) and the Sacrifice at the Haji ceremony(Arefa). Hence, Traders of camels also are of cattle traders shifting to camel during such high camel demand. Since they have no their own collectors they reach different market to buy camels from any pastoralists and collectors. As they have no strong relation with export abattoirs, being seasonal work, they operate with their own capital and rented vehicle. They also have no relation for collectors of camels.

**Processors:** Camel meat processing in the study area is not common as other livestock such as goat and cattle due to consumption of camel meat is not common among the pastoralists. Especially, Borana clans do not eat camel meat. Camel meat has also less preferred than other livestock meat confirming less domestic market demand. Hence, hotels and restaurants specialize in cattle and goat meat processing than camel meat. Only two hotels of Moyale and in Surupa one butcher place is the only camel meat-processing place exists in the study area.
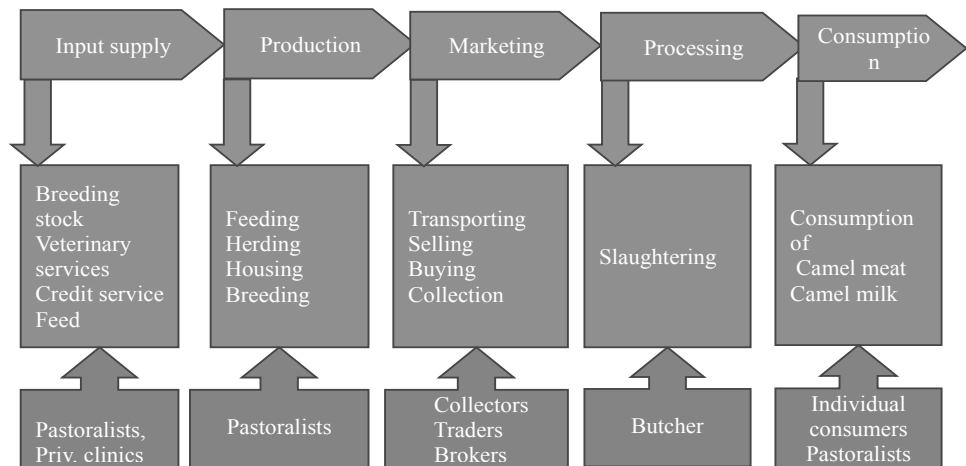


**Figure 6. Core function summary of camel value chain**

**Challenges and opportunities in camel value chain**

Camel production is become the decidedly demanded livestock type in Borana pastoralists since recent time. However, the research and development efforts are hardly pays attention to this sector to improve the productivity, production and marketing system despite its importance. As other livestock types, lack of improved camel type and improved management practice also a difficult challenge in Borana pastoral area. Principally, shortage of drug supply targeted to camel disease exacerbates difficulty in camel production, which increases the incidence of disease and parasites such as abscess, coughing, respiratory disease, canal pox, Lymphadenitis and ticks. Additionally, piousness plants such as Gaaddalla, Gora, Bobiya, Garbicha and Tabari are among the major challenges of camel production.

Besides the camel related problems, expansion of cropping and land grabbing for cultivation and private enclosure increasingly threading the production camel in particular and livestock in general. This limits the mobility of camel population in search of water and forage from area to area that increase the exposure of camels to different risks such as disease and ingestion shortage. This problem are also provide edge other challenges like land degradation and social erosion which threatening the future challenges of the pastoralists.

Limitation of veterinary service focusing on camel production bears another challenge in camel production. Additionally, inconvenience of credit terms and condition for camel production activities plays a vigorous role in limiting camel production. Lack of access to viable credit holds a driving engine to overcome other climatic challenges such as drought that affects the smooth camel production.

Drought is another factor that devastating the development of camel production, which bears and intensifies other problems including feed shortage in drought times, seasonal water shortage and exacerbate camel death and disease. This mutilates the growth of camel production for the sake of drought mitigation strategies in Borana zone. Especially, the challenge related to frequency of drought is the most dramatic fear for the pastoralists involved in camel production, which have detrimental effects on other livestock production in additional of the camel such as camel marketing system.

Camel marketing trend is in recent times increasing attracts stakeholders concern in Borana zone. Though camel production is not culturally accepted in most of parts of Borana, recently the market value and its drought resistant attracted the attentions of these pastoralists. However, lack of formal and appropriate market information and seasonality of camel demand are highly affecting the income of the camel producers. Additionally, this exposes the camel producers to expose to illegal intermediaries and traders in case of early access to information. Especially, high dependence of camel market on abroad market condition highly affects the financial awards from camel production.

Finally, the linkage of camel marketing system across different actors was a big challenge observed during survey. There is no clear linkage of camel producers and other actors such as traders, services providers and consumers. This increase the exposure of camel markets to illegal actors that limit the income from camel for both producers and government revenue. Besides this, the local consumption behavior of the community affects the growth of camel production,

However, there are a number of opportunities to overcome challenges that limiting the benefit package from camel production. The main road from Moyale to Addis Ababa provides a great opportunity to improve the camel marketing system. This provides an opportunity to access large number of traders of different level, which create high completion among the traders on a competitive basis.

**Conclusion and Recommendation**

Camel rearing is the recent phenomena for Borana community and the number of people keeping camels is increasing responding to mainly environment and institutional factors. Camel production in the areas is based entirely on browses of bushes and trees. No supplementary feeds are provided to goats even in drought conditions. Even though camel meat consumption is not known among the community, live camel sell and milk is became the main source of income. Camel milk also serves as substitution for cattle milk especially during drought season. Camel market supply and demand is relatively more seasonal than other livestock depending on abroad market condition.

Pastoralists rely on informal market information to market their camel. Camel owners want to sell at market place than to sell at farm gate and roadside unless they are very far from market place. Collectors involve collecting camels from the area reaching far distance of the margin place during rose abroad. Being seasonal work there is no linkage of camel value chain actors at all level. Despite camel tolerance to drought pastoralist bothered concerning camel disease, parasites and tsetse fly serve as some disease host. Especially, the shortage of drug and vaccine affects the recent phenomenal practices of camel**.**

Furthermore, the number of people keeping camels is increasing due it was opportunely it entirely dependent on browses of bushes and trees. However, supplementary feeds are hardly provided to camels.

Though camel consumption is not common, live camel sell and milk is became the main source of income. Mainly, camel milk serves as substitution for cattle milk especially during drought season. However, to harvest ample income from camel challenges in market system such as high intermediaries bottle necks the operation of production. Principally, the dependency of on external market and seasonal supply is challenging besides shortages of marketing system. Therefore, to enhance the market, production and productivity of camel improving the marketing system establishing coherent information system longed from consumers to improve supply of camels such as price situation, demand stature and expected pricing systems.

Moreover, to improving the productivity and production of camel; developing systematic analogous research system to improve the milk production and disease resistant; frequent establishment of disease prevention such as vaccination, improving access to camel disease drugs locally with reasonable services delivery is important. Moreover, intensive research are required to improve the production and productivity of camel on different direction such as camel feeding and feed supply system beside its nutritional statures, improving the disease resistant of camel and intensive market linkage.

Finally, to improve the market marketing system pf a camel, linkage of producers along the market chain to consumers, improving access to marketing information system and improving access to market place nearby the potential camel production area. Moreover, infrastructure development such as improving access to road and improving access to market information facilities such information desk, delivery system and accessibility improvement can also support marketing system improvements.

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# Assessment of Durum Wheat Production Status, Marketing Systems and Associated Constraints in Bale Zone of Southeastern Ethiopian

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## Abstract

*The study is employed to assess the production and marketing system of durum wheat and associated constraint in Bale zone of southeastern Ethiopia, the case of Sinana, Agarfa and Gololcha districts. For assessment study 100 person were intervied from three districts. Multi stage purposive and random sampling is used to draw the sample unit household farmers' for the interview. The three districts were selected purposively based on their potential in durum wheat production and also district were the project intervention area of Durum wheat value chain project. The kebele also purposively selected as they are project area. The sample unit household is selected randomly from each kebele. Wheat in general and durum wheat in particular produced in the study area widely as a cash crop and for consumption purpose with its constraint of production and marketing. From the production aspect wheat production is constrained; by wheat rust disease, grass weed and shortage of improved seed, while low price, high input cost and weak institutional linkage are some of constraint form marketing aspects.*
**Key words:** *Durum wheat, production and marketing status, production and marketing constraint*

## Introduction

Ethiopia's GDP is $ 47 Billion by end of 2012/13, the economy has been growing by 10.9% on average in the past decade, and agriculture is a leading sector of Ethiopian economy accounted for 43% of GDP. The sector generates over 70% export values and employs 85% of the population (UNDP, 2012/2013). The average share of crop production, livestock, and forestry and other sub-sectors in the total agricultural value added was 60, 27, and 13 per cent, respectively (UNDP, 2012/2013). CSA reported that in 2012/13 cropping season, wheat annual production in Ethiopia was 3.43 million tons cultivated on 1.63 million hectare of land. Cereal crop in general and wheat in particular, is the mostly cultivated crop in Ethiopia mainly for domestic consumption. Wheat ranks fourth in total grain crop production next to Maize, Teff and Sorghum and third in production per hectare next to Maize and Sorghum respectively (CSA, 20012/2013). Two wheat species are dominantly grown in the country. These are bread wheat (Triticum aestivum L.) and durum wheat (*T. turgidum* var. *durum*).

A lot of effort is made to improve durum wheat variety in order to increase the production and productivity of the sector. Farmers are expected to be benefit from adopting the improved varieties. The benefit of adopting improved wheat varieties were the genetic gains in yield, improve disease resistance, maintenance of disease resistance, changes in grain quality, yield stability and early maturity (CIMMYT, 1995). The participatory demonstration approach was proposed as a way to address adoption problems by using the basic principle that selection is conducted by the farmers on their field compatible in their own agronomic practices. Under these circumstances, adoption rates were higher and risks were minimized.

The socio-economic factors are subjective indifferently within the community in the decision making of farmers in production and marketing. Producers are decided to participate in business with the expectation of profit making in both short and long term. The producers' decisions reflect a complex interaction of individual and social characteristics which is connected with family, informal groups, formal organizations and institutions (Ecologistics limited, 1990).

Market oriented production facilitate production and marketing participation of small scale production of agricultural producers (Moti and Gebreab, commercialization of smallholder). Even though the production of durum wheat is practiced by the small scale farmer of Bale zone, large volume of production by the producer farmer is started with the launching of "Durum wheat value chain project in Oromia" initiated by the Ethio-Italian government cooperation and operated and implemented by sinana Agricultural research center. Small scale farmer grow Durum wheat in the study area is for commercial purpose (unpublished survey result, 2015). Durum wheat introduced in to production as a cash crop for small scale producers and raw material for agro-industries employed in production of pasta, macaroni and other durum wheat flour content food making.

Increasing quantity of durum wheat with quality of production aspect is trusted to enhance income of durum wheat producers with the launching of this project in the study area, but the socio-economic and current status of durum wheat production and marketing in the study area is not studied and documented. In order to bridge this gap, by this study provided some firsthand general field information socio-economic profile, production and marketing system, and constraint of the durum wheat growers in the study area with the following specific objective.

### Specific objectives

- ✓ To assess durum wheat production status and associated constraint
- ✓ To identify durum marketing system and associated constraint

### Methodology

### Description of the study area

The study was conducted in southeastern Ethiopia, Oromia region, in three district of Bale zone; namely sinana, agarfa and gololcha. The study districts were selected purposively based on the project area of "Value Chain Project in Oromia" and their potential in Durum wheat production. The study district were located; at distance from the zone, Sinana within the zone, Agarfa 30km to southeast and Gololcha 112km to northeast of the Bale zone.

### Sampling Techniques and Sample Size

A multi-stage purposive and random sampling procedure was used to select the study subjects ranging from higher to lower administrative levels, with farmers being sampling units. The survey was carried out in three districts of Bale zone, namely Agarfa, Sinana and Gololcha. Sampling stage was starting from purposely selecting three districts from durum wheat growing areas as they are project area, selecting two PAs from each district and randomly selecting 15-18 farmers from each PAs, proportional to the population size in the peasant associations. A total of hundred (100) household were sampled from the three districts.

### Types of Data

Both primary and secondary data were collected for the study. Primary data were collected using structured questionnaire prepared in line of the objective of the study. The questionnaire was pre-tested on selected respondents and on the basis of the result necessary modifications were made. Secondary data was gathered from secondary sources (published and unpublished documents), from district agriculture and rural development offices, from farmers organizations, input suppliers, marketing agencies and from different development organizations of the project area.

### Data Analysis

Descriptive statistics such as frequency of occurrence, percentages, mean, range and standard deviations were employed to describe the socio-economic and marketing status in the study area using SPSS and STATA computer software.

### Results and Discussions

### Descriptive Result

### Demography and Socio-economic Characteristics of Respondent

Survey result indicates that in the study area, out of total samples 95% is male headed household where as 5% is female headed household in the three district of study area. The average age of household head of sample respondents was 43.48 with maximum and minimum of 25 and 78, respectively. Education level of the respondent were attain grade 3.5 on average indicated in the table below.

Table 25 Descriptive result of household demography

| Household characteristics | Obs | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Age of household head | 100 | 25.00 | 78.00 | 43.5 | 11.6 |
| Educational level of the household head | 100 | 1.00 | 7.00 | 3.5 | 1.2 |
| Family Size | 100 | 3.00 | 18.00 | 8.9 | 2.7 |

Source: survey result, 2013

### Land Ownership

Land ownership is the set of arrangement under which farmer own and operates the land for production around their residence area. It also contains a set of rights, which determine the manner in which land can

be sold, bequeathed, rented and shared among farm households (*Asefa. et al,* 2005*)*. The extent of renting and sharing varies considerably with the economic and demographic pressures, policy environment and other factors. The overall average land own in the study area was 4.8 hectare.  Land is operated for production by different forms between farmers in the study area, like rent in, rent out, shared in and shared out. Out of total sample, 35% of household rent in land with mean of 1.3 hectare of land and 9% rent out land with mean of 0.55 hectare of land. Out of total sample 28% shared in land and 16% shared out land with mean of 1.4 and 1.1 hectare of land respectively. The mean land allocated to wheat production per sampled household is 3.6 hectare of land.

Table 26 land ownership of household

|  | Percent of HH have farm land | Mean | Std. Deviation |
|---|---|---|---|
| Total size of own land in hectares | 100 | 4.81 | 2.76 |
| Total land rented in | 35 | 1.25 | .94 |
| Total land rented out in hectares | 9 | .55 | 1.01 |
| Total land shared in | 28 | 1.37 | .93 |
| Total land shared out | 16 | 1.13 | .89 |
| Total area of land allocated for wheat in 2011 | 100 | 3.64 | 2.53 |

Source: survey result, 2013

**Main House Description**

House description is the make up of house the respondents reside in. the description include roofing material, wall material and floor material of main house of respondent. The roofing material of respondent contains grass and iron sheet. Out of total sample 91% of respondents roof material is iron sheet, and 9% percent have grass roof material. On the other hand the floor material of main house of respondent is described as earth, cement and tiles. The earth made up has 95%, having highest percentage and cement and tiles have low percentage of 2 and 3% respectively. The wall material is another term to describe make up of house of respondent as mud bricks, iron sheet and stone bricks. A mud brick is 98% the highest proportion of makeup of respondents' house wall material followed by 2% other substance.

**Access to Basic Facilities in the study area**

Access to basic facility is not evenly distributed in the study area as the community doesn't settle in one area.  Service sector is one of the fastest growing and key areas in development of our developing country (UNDP, 2012/13). This difference in access to basic facility affects the socio-economic characteristics of community around the area in one way or another.  Access to and perceptions for those who access basic facility in the study area were described in the table below.

Table 27 Access to and perception of basic facilities

| No | Types of facility | Access status | | Average distance to access | Self-perception | | |
|---|---|---|---|---|---|---|---|
| | | Yes % | No % | | Good % | Normal % | Poor % |
| 1 | All weather road | 74 | 26 | 12 | 39 | 32 | 3 |
| 2 | School | 100 | 0 | 2 | 95 | 5 | 0 |
| 3 | Health service | 81 | 19 | 6 | 35 | 38 | 8 |
| 4 | Animal health service | 62 | 38 | 2 | 19 | 18 | 25 |
| 5 | Credit service | 80 | 20 | 5 | 35 | 32 | 10 |
| 6 | Agricultural extension service | 100 | 0 | 2 | 92 | 5 | 3 |
| 7 | Output market | 100 | 0 | 3 | 57 | 43 | 0 |
| 8 | Input market | 100 | 0 | 3 | 51 | 49 | 0 |
| 9 | Public telephone | 31 | 69 | 2 | 32 | 18 | 5 |
| 10 | Piped water | 79 | 21 | 1 | 30 | 23 | 25 |

Source: survey result, 2013

**Livestock Ownership**

Table below indicates that, household's livestock ownership status and the revenue generated from it. Livestock is one of the most important assets for the rural community of Ethiopia as a general and specifically for the study area. Livestock serve the community in different aspect of social and economic aspect, like being source of drafting power, food, source of income, insurance, and transportation service. The study areas are hallowed by livestock properties of different type like cattle, ship and goat, horse, donkey and chicken.

Table 28 Livestock ownership revenue generated

| No | Livestock type | Average number holding household[-1] | Average sold in 2012 | Average revenue generated |
|---|---|---|---|---|
| 1 | Cow | 2.6 | 1.1 | 4263 |
| 2 | Oxen | 4.01 | 1.4 | 8018 |
| 3 | Heifer | 1.9 | 1.5 | 2807 |
| 4 | Bulls | 1.7 | .8 | 1916 |
| 5 | Calves | 2.01 | - | - |
| 6 | Goats | 5.4 | 2.5 | 1805 |
| 7 | Sheep | 7.7 | 3.6 | 2140 |
| 8 | Mule | .9 | .7 | 2500 |
| 9 | Horse | 1.1 | .7 | 2183 |
| 10 | Donkey | 2.3 | .9 | 957 |
| 11 | Chicken | 6.7 | 4.3 | 174 |

Source: survey result, 2013

**Source of Livelihood**

Rural communities' livelihood making depends on different sources. During the survey the three most livelihood making were identified hence, wheat production, other crop and livestock production are the most livelihood making in the study area.

Table 29 level of enterprises in livelihood making

| No | Source of livelihood making | Level of importance | | | | | Average contribution (Birr) |
|---|---|---|---|---|---|---|---|
| | | Very high % | High % | Moderate % | Low % | Very low % | |
| 1 | Wheat sale | 89 | 8 | 3 | 0 | 0 | 36018 |
| 2 | Other crop | 13 | 28 | 59 | 0 | 0 | 10192 |
| 3 | Livestock and product | 2 | 26 | 29 | 55 | 2 | 7535 |

Source: survey result, 2013

**Durum wheat production trend and constraint**

During the survey period of (2012/2013) production season, 85% of total sample survey are producing durum wheat by allocating on average 1.2 hectare of land. The adopter/producers group at that time plant durum wheat on average for two years. Durum wheat production is preferred by producers for having the attribute of market demand, high price, and good weight on balance and disease resistant compered to bread wheat. Before a survey year only 35% of total sample survey was producing durum wheat while, 85% was producing during the survey period (2012/2013) and there is great change of farmers from non-producers to durum wheat producers due to project intervention.  Before project intervention small number of farmers were participated in durum wheat production, because there is no market linkage, that means durum wheat producers sell their produce to local market only, but due to project intervention value chain of durum wheat were developed and the farmer were benefited from producing and marketing of durum wheat. Due to intervention land allocation and production   were maximized from 0.75 to 1.2 hectare. Information gap and low market demand for the produce are the two dominant factors raised by respondent discouraging producers of durum wheat production. Generally in the study area durum wheat production is habitually constrained by wheat rust disease and grass weed from production aspect and low price and high input cost from market side are the most dominant wheat production constraint.

Table 30 production category of durum wheat during the survey period

| No | Producers category | Before project Innervation | After project Innervation |
|---|---|---|---|
| | | Percent (%) | Percent (%) |

| | | | |
|---|---|---|---|
| 1 | Yes | 35 | 85 |
| 2 | No | 65 | 15 |

Source: survey result, 2013

### Durum wheat marketing system

Even though government launched working together in cooperative, either in marketing or in any other business enterprise; the system is not uniformly understood and taken to action because of information gap and/or socio-economic constraint exist in the community.  A deal on rural community reveals that they are not strong in collaborative working behavior due to financial and socio-economic constraints. In the study area 73% wheat marketing is done individually and 27% through cooperative. Since marketing is done individually there is no strong bargaining power of producers, as a result price of produce is set by traders.

Table 31 Crop marketing system in the study area

| No | Marketing system | Percent |
|---|---|---|
| 1 | Individually | 73 |
| 2 | Cooperative | 27 |

Source: survey result, 2013

### Constraint of durum wheat marketing

In general and particularly in the study area agricultural productions were constrained by different factors of institutional, environmental, infrastructural and socio-economic constraint. The descriptive result in the table below indicates that marketing constraint of Durum wheat in the study area.

Table 32 Durum wheat marketing constraint

| No | Marketing constraint | Level of constraint | | | | |
|---|---|---|---|---|---|---|
| | | Extreme constraint % | Highly constraint % | Medium constraint % | Low constraint % | Very low constraint % |
| 1 | Low quality | 11 | 22 | 9 | 12 | 46 |
| 2 | Low market price | 58 | 20 | 11 | 6 | 5 |
| 3 | Unavailability of market | 8 | 9 | 24 | 16 | 43 |
| 4 | Lack of market information | 2 | 20 | 18 | 27 | 32 |
| 5 | Lack of storage | 2 | 0 | 11 | 16 | 71 |
| 6 | Lack of transport | 4 | 11 | 16 | 22 | 47 |
| 7 | Lack of cooperative | 7 | 22 | 22 | 32 | 17 |
| 8 | Weak bargaining power | 36 | 21 | 11 | 23 | 9 |

Source: survey result, 2013

### Conclusion and recommendation

### Conclusion

The current study was employed to assess durum wheat marketing and production status and constraint in the study area. Durum wheat was produced in the study area for dual purpose of consumption and marketing. Durum wheat production has advantage over bread what in terms of price, disease resistance and weight on balance. Farmers participate in durum wheat production in the study area were constrained by different factors of chronically emerging rust disease, grass weed and shortage of improved durum wheat from production aspect and low price, high input cost and weak institutional linkage from marketing aspects are the major problem in durum wheat production farmers face in the study area. Durum wheat production helps small scale farmer in different ways of livelihood making; for instance, being source of income, for household consumption, nutrient source and other social purpose. Within its constraint, cooperative marketing of different agricultural crop, specifically for durum wheat is flourishing by the effort of different government and non-governmental organization, specifically Ethio-italian cooperation work on "durum wheat value chain project" has great role. By the support of

project and involvement of different institution, the farmer of project area were supported by different aspect of durum wheat production; supply of improved seed, capacity building, market linkage and construction of modern seed and grain store are some of the aid project provided.

### Recommendation

For the observed drawback of production and marketing system of durum wheat in the study area during the survey period, the following recommendations were drawn.

- ✓ The information gap on durum wheat production and importance should be improved through training and capacity development.
- ✓ Low market price of durum wheat affect marketing and production participation directly and indirectly, so the low price should be improved
- ✓ Rust disease is the chronically emerging diseases, so ample of awareness creation for the producer is necessary.
- ✓  Grass weed is raised as a production constraint by respondent, so the alternative possible solution should be initiated by the concerned body.
- ✓ Survey result indicates that marketing is largely done individually; to escape this problem, marketing cooperative should be strengthened.
- ✓ The only possible solution for weak bargaining power is, to make producers market their product through cooperative, so cooperative should be strengthened.
- ✓ In general wheat production in the study area is the most enterprise and it is 89% livelihood making alternative, so any problem that affects production and marketing should be automatically get the solution.

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## Assessment of Wild Coffee Production and Marketing System and Constraint in Selected Districts of Bale Zone

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### *Abstract*

*This study is employed to assess wild coffee production and marketing system practiced and associated constraint in two district of Bale zone. Household sample survey was conducted in the two districts for the study, a total of 95 households were selected and interviewed, from total sample household, 63% households were selected from Dellomana district, while 37% is from Harana Bulluq district based on their potential in coffee forest production and productivity. Purposive and Random sampling strategy was employed to select the sample unit household. The two districts were selected purposively based on the existence of coffee in the district and the kebeles are selected based on their potential in coffee production. Coffee forest production is identified as the most dominating coffee production system in the two districts in terms of land size coverage and basis for others system, while semi-forest coffee production system is better in terms of yield per plot of land. The results of the study explain that there is important production and marketing problem in the study area that should have to be enhanced by the concerned body of different organization.*

**Key words:** *coffee, marketing system, marketing constraint, production system, production constraint*

## Introduction

Coffee production has an enormous relevance for Ethiopia, playing a dominant role in economic, social, cultural and environmental terms. Annually, an average of about 150,000 tons of coffee is produced in Ethiopia and the livelihood of about 20 million people depends directly or indirectly on the production, processing and export of coffee (EEA, 2006). In contrast to other coffee producing countries, the Ethiopian coffee production is dominated by smallholder agriculture, contributing with more than 90 percent to the total harvest (Dercon, 2002). A special feature of Ethiopian coffee production is that domestic consumption is considerably high, as coffee is a traditional beverage throughout the country; FAO estimates that about 50 percent of the total harvest is used within Ethiopia, and that some farmers grow coffee only for home consumption (Dercon, 2002).

Coffee being a commercial crop is very sensitive commodity and very responsive to marketing system and market price signals. Coffee is very important in the economic system of Ethiopia. It serves being a source of livelihood for millions of small holder farmers in which it accounts for 10% of the gross domestic product and supports the livelihoods of around 25% of the population of Ethiopia (representing around 20 million people) in one way or another (Dercon, 2002). Coffee production share total land of 1.29% agricultural production with total production of 1,589,480.99 quintal (CSA, 2005).

The importance of coffee production is not limited to the producers. Instead, it is a concern of the nation since it is important as export commodity and fiches marvelous foreign currency for the country. It accounts for 35% of Ethiopian foreign exchange. Massive socio-economic dependencies of Ethiopian people on these single commodities describe that how much the importance of this commodity for the country as well for the small scale farmer. Specifically in the study area the livelihood of living community mostly depends on coffee production and marketing with its constraint of natural hazards. Specifically wild coffee is endemic to the two districts (Dellomena and Harana Bulluq) of Bale zone.
The study area is blessed by natural resource which is important for the livelihood making of surrounding community. Wild coffee (coffee forest) is one of the natural gifts for the area. In that area coffee is produced like mono-crop production of wheat on the highlands of Bale with its constraint of production and marketing problem. So the study is directed to assess the production and marketing system and associated constraint to coffee in the selected districts of Bale zone with the following specific objective.

### Specific objective(s)

- ✓ To provide the socio-economic profile in the study area
- ✓ To identify production system and associated constraint to coffee
- ✓ To identify marketing system and associated constraint to coffee

## Methodology

### Description of the study area

The selected study areas were hallowed by gift of the natural wild coffee. The selected study districts Dellomena and Harana Bulluq were located to 115km and 150km from Robe (capital city of Bale zone) respectively. The study area is covered with afromontane rainforest, which constitute the largest part of Bale mountain national park. The two district lies between 1300 to 2500m.a.s.l and 1250 to 230m.a.s.l for Dellomena and Harana Bulluq district respectively. Mean annual rainfall in the study area varies from 700 to 1200 mm and mean annual temperature is $18^{o}$c.

### Sampling technique

Multi stage random and purposive sampling procedure have been undertaken to select the household survey. The two districts were selected purposively for the study of wild coffee production and marketing system and associated constraint based on the existence of natural wild coffee in the area and the kebeles are also selected purposively based on the potential in coffee forest production. First and foremost for sample frame, the agricultural office of the two districts was conducted and they assign coffee experts to help on field survey. Based on the assistance of coffee expert at each district level, seven kebeles were selected; four from dellomena and three kebeles from Harana Bulluq and a total of seven (7) kebeles were selected for the study. Both primary and secondary data was collected for the study. Primary data were collected using structured questionnaire developed inline of the objectives of the study in November 2014. From both district 95 households were interviewed. Depending on forest coffee coverage and household engaged in coffee forest production 63% from Dellomena and 37% from Harana Bulluq was interviewed. Checklist of interview includes topics like socio-economic profile of living community,

production and marketing system and constraint and management practice towards wild coffee. Secondary data were collected from recorded document at each district.

**Types of Data**

Both primary and secondary data were collected for the study. Primary data were collected using structured questionnaire prepared in line of the objective of the study. The questionnaire was pre-tested on selected respondents and on the basis of the result necessary modifications were made. Secondary data was gathered from published and unpublished documents, district pastoral and rural development offices, from farmers' organizations, and from different development organizations of the study area.

**Data Analysis**

Descriptive statistics such as frequency of occurrence, percentages, mean, range and standard deviations were employed to describe the socio-economics and marketing status in the study area using SPSS and STATA computer software.

**Result and discussion**

**Socio-economic characteristics of the household**

The average age of household interviewed for the present study is 42. Regarding to sex categories of respondents, majority of respondents in this study area were male, accounted about 97%. Educational level of household ranges from 0 (illiterate) to grade 11 with average value grade three. Marital status of respondent are 98% married, 1% single and 1% is divorced. Religion category of respondents was 97% and 3% Muslims and Christians respectively. The average family size of study area is 9; with the ranges from 3 (minimum) to 26 (maximum).

Table 33 Descriptive result of household general information

| Household characteristics | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Age of household | 22 | 80 | 42 | 14 |
| Education level of | 0 | 11 | 3 | 3 |
| Family size | 3.00 | 26 | 9 | 5 |

Source: own survey, 2014

Table 34 percentages description of HH general information

| Household characteristics | Percent% |
|---|---|
| Male | 97 |
| Female | 3 |
| **Marital status** | |
| Single | 1 |
| Married | 98 |
| Divorced | 1 |
| **Religion** | |
| Christian | 3 |
| Muslim | 97 |

Source: own survey, 2014

**Land holding**

Farmers of the study area practice low input, rain-fed subsistence crop farming. The overall land holding of farmer for food crop production is on average 0.83 in the study area, which is below the country average land holding of one hectare and which is regarded as the absolute minimum for providing sufficient food for one household. The average land holding for crop production for Dellomena and Harana Bulluq is 0.88 and 1.00 respectively. Crop produced in the two districts is mostly cereal crop (maize and teff) with a little management and low return per hectare. Interaction of land use system like rented or/and shared in/out system is almost not known by the community of study area. The largest proportion of land holding is covered by forest coffee which is on average 2.1hectare per household.

Table 35 Land holding of household sample survey

| Land characteristics | Average size land holding of household (ha) |
|---|---|
| Farm land | 0.83 |
| Coffee forest land | 2.1 |
| Semi-forest coffee land | 0.6 |

Source: own survey, 2014

### Livestock holding

Livestock is one of the most important asset types for the rural community of Ethiopian as a general, specifically for the study area. The livestock serve the community in different aspect of socially and economically, like source of drafting power, food, income, insurance, and transportation service. The study areas are hallowed by livestock properties of different type and the average owned and revenue generated from it were indicated in the table below

Table 36 Livestock holding characteristics in the study area

| Livestock type | Number of household own type of livestock | Average number owned | Estimated price/unit | Estimated total revenue generated from total owned |
|---|---|---|---|---|
| Cow | 90 | 5 | 4729.3 | 21333.3 |
| Oxen | 71 | 2.5 | 5995.9 | 15644.4 |
| Heifer | 67 | 3 | 2875.4 | 7549.3 |
| Calve | 78 | 2 | 1345.2 | 3436.3 |
| Bull | 45 | 2 | 3018.1 | 5516 |
| Goat | 34 | 4.5 | 852.7 | 3009.2 |
| Sheep | 4 | 5 | 262.5 | 1812.5 |
| Camel | 0 | 0 | 0 | 0 |
| Donkey | 65 | 1 | 2420.8 | 3166.9 |
| Beehive | 62 | 8 | 70.2 | 771.5 |
| Horse | 13 | 2 | 2387.5 | 3787.5 |
| Mule | 8 | 1 | 3678.6 | 4071.42 |
| Chicken | 52 | 4 | 65 | 545.1 |

Source: own survey, 2014

### Livelihood of sample respondent in the study area

The livelihoods of a given community in the specific area depend on the activities that match with the agro-ecology of that area. 94.7% of the respondent in the study declares that coffee production and marketing were highly important in the livelihood making in the study area. Next to coffee production and marketing livestock rearing were 26.3% highly important in livelihood making in the study area. Different livelihood making were analyzed by the present study, indicated in the table below that coffee production and marketing is top for the livelihood making for the community in the study area.

Table 37 livelihoods making activity for the study area

| Livelihood making activity | Perception of HH's activity Level of importance (%) | | | | |
|---|---|---|---|---|---|
| | Highly important % | Important % | Moderate important % | Less important % | Total % |
| Cereal crop | 10.6 | 56.8 | 16.8 | 15.8 | 100 |
| Pulse and oil crop | 0 | 0 | 9.5 | 90.5 | 100 |
| Horticultural crop | 0 | 6.3 | 17.9 | 75.8 | 100 |
| Coffee production | 94.7 | 2.1 | 3.2 | 0 | 100 |
| Petty trade | 1.1 | 3.2 | 12.6 | 83.2 | 100 |
| Large trade | 1.1 | 0 | 0 | 98.9 | 100 |
| Off-farm activity | 0 | 0 | 1.1 | 98.9 | 100 |
| Non-farm activity | 0 | 0 | 1.1 | 98.9 | 100 |
| Rearing livestock | 26.3 | 26.3 | 16.8 | 30.5 | 100 |
| Honey production | 4.2 | 10.5 | 6.3 | 53.7 | 100 |
| Chat production | 3.2 | 5.3 | 0 | 91.6 | 100 |

Source: own survey, 2014

### Coffee production system in the study area

Households that engage in coffee production are often involved in more than one production system. The four production system was analyzed by the study, but only the two; coffee forest and semi-forest coffee production system are widely practiced in the study area community. As indicated in the table below Out of total sample 96.8% and 70.5% of the total sample has coffee forest and semi-forest coffee on average on 2.3 and 0.9 hectare of land respectively. Area coverage of garden coffee was not measured due to counted number of coffee tree around the home.

Table 38 coffee production system in the study area

| Do you have coffee farm | | Production system and percentage of household ownership | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Coffee forest | | Semi-forest coffee | | Coffee plantation | | Coffee garden | |
| | **%** | % owned | Average (ha) | %owned | Average (ha) | %owned | Average (ha) | % owned | Average (ha) |
| **Yes** | 100 | 96.8% | 2.3 | 70.5% | 0.9 | 0 | 0 | 4.2% | - |
| **No** | 0 | | | | | | | | |

Source: own survey, 2014

### Coffee production stability

The survey result indicates that Production stability fluctuates from year to year in both districts of the study area. Productivity of coffee production was collected for tour (4) consecutive year from 2011 to 2014 production year. The table 8 below shows that the overall four year consecutive coffee production stability of the study area, while table 9 and 10 shows as coffee production stability in each districts of the study area independently.

Table 39 overall coffee production stability in the study area

| Forest type | Household average production obtained for four consecutive year in quintal | | | |
|---|---|---|---|---|
| | **2011** | **2012** | **2013** | **2014** |
| Forest coffee | 10.1 | 10.8 | 11.8 | 11.4 |
| Semi-forest coffee | 11.8 | 9 | 10.7 | 11.8 |

Source: own survey, 2014

Table 40 coffee production stablity for dellomana district

| Coffee production system | Household average production obtained for four consecutive year In quintal | | | |
|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 |
| Forest coffee | 10 | 20 | 13 | 30 |
| Semi-forest coffee | 16 | 6 | 20 | 13 |

Source: own survey, 2014

Table 41 coffee production stability for Harana Bulluq District

| Coffee production system | Household average production obtained for four consecutive year In quintal | | | |
|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 |
| Forest coffee | 8 | 8.4 | 7.5 | 9.1 |
| Semi-forest coffee | 6 | 5.7 | 6.4 | 5.1 |

Source: own survey, 2014

### Management practice

Management practice is the most factors affect agricultural production and productivity in general, particularly coffee production and productivity is highly related to the management given for coffee. Government policy and level of farmer's awareness are the two factors that tackle farmer's management practice. The survey result indicates that only two management activity weeding and hoeing 63.2% and 10.5% respectively were taken to for forest coffee production but, 70.5% and 66.3% of the same management activity were given to for semi-forest coffee in the study area. As indicated in the table below management activity was more intensified on semi-forest coffee as a result of semi-forest coffee under control of farmers' while, forest coffee is not.

Table 42 Percentage of management activity given to coffee in the study area

| Coffee management practice | Household percentage level management given to coffee production system | | | |
|---|---|---|---|---|
| | **Forest coffee** | | **Sami-forest coffee** | |
| | **Yes (%)** | **No (%)** | **Yes (%)** | **No (%)** |
| Weeding | 63.2 | 32.6 | 70.5 | 0 |
| Hoeing | 10.5 | 85.3 | 66.3 | 4.2 |
| Slashing | 0 | 95.8 | 6.3 | 64.2 |
| Shade management | 0 | 95.8 | 35.8 | 34.7 |
| Pruning | 0 | 95.8 | 4.2 | 65.3 |
| Fertilizer application | 0 | 95.8 | 0 | 70.5 |

Source: own survey, 2013

**Coffee marketing system**

Coffee marketing is done mostly in two different forms in the study area, individually and in cooperative are the most dominant forms of marketing system. To sell to local market producers choose individual marketing system, but for the central market and export to foreign country respondent believe marketing in cooperative is the appropriate and powerful. The survey result indicates that, out of total sample 70% and 30% of respondent participate in market individually and in cooperative respectively.

Table 12 marketing system of coffee product

| **Marketing system** | **Percent** |
|---|---|
| Individually marketing | 70 |
| Cooperative marketing | 30 |
| **Total** | **100** |

Source: own survey, 2014

**Coffee marketing place in the study area**

Coffee is produced by the small scale farmers and private investors primarily for marketing purpose. In this case farmers know what to produce and for whom to produce coffee product. Coffee product is sold to the market in the study area in different routine of marketing system. Depending on the transportation service and availability of market for coffee, it sold within the village 12.6%, within the district 69.5%, central market and export to foreign country through cooperative union 17.9%.

Table 13 Different coffee marketing place in the study area

| **Market place** | **Percentage share for market places (%)** |
|---|---|
| Within the village | 12.6 |
| Within the district | 69.5 |
| Central market and Export to foreign country (through cooperative union) | 17.9 |
| Total | 100 |

Source: own survey, 2014

**Marketing actors involved in coffee marketing in the study area**

Different socio-economic and infrastructural development factors influence producers to sell their product to different type of marketing actors at different market level. The survey result indicates that small traders share the largest proportion of marketing actors 30% in the study area. The share of black market and local consumer in the marketing actors were minimum and equal ratio 2.1%. The table below indicates that percentage share of different marketing actors involved in coffee marketing in the study area.

Table 14 types of marketing actors involved in coffee marketing in the study area

| **Types of buyers** | **Percentage (%) market share** |
|---|---|
| Local consumers | 2.1 |
| Local collectors | 14.7 |
| Small traders | 30 |
| Large traders | 13.7 |
| Farmer's coop | 30 |

| | |
|---|---|
| Buna board | 7.4 |
| Black market | 2.1 |
| **Total** | **100** |

Source: own survey, 2014

**Major constraint in coffee production and marketing**

Agricultural productions in general, particularly coffee production in the study areas were inhibited by different factors of natural and socio-economic constraint. Survey result indicate that in the study area coffee production was constrained naturally by weather condition, diseases and decrease in coffee population and socio-economically by lack of management, deforestation, and grazing in forest. From marketing aspect low price, weak institutional linkage and price fluctuation are the most severe problem of coffee marketing in the study area as indicated in the table below.

Table 43 Coffee marketing constraints in study area

| Marketing constraint | Severity of marketing constraint (%) | | | | |
|---|---|---|---|---|---|
| | Most severe % | Severe % | Moderate % | Less severe % | Total |
| Lack of access to market site | 3.2 | 3.2 | 6.3 | 87.4 | 100 |
| Lack of transportation service | 1.1 | 13.7 | 18.9 | 66.3 | 100 |
| Low demand | 3.2 | 14.7 | 9.5 | 72.6 | 100 |
| price fluctuation | 6.3 | 52.6 | 47.9 | 3.2 | 100 |
| Institutional/market linkage problem | 10.5 | 81.2 | 8.4 | 0 | 100 |
| Low price | 10.5 | 88.4 | 1.1 | 0 | 100 |

Source: own survey, 2014

The following listed points below are the major coffee marketing constraints identified during the survey in the study area.
☞ Traders are the price maker, they decide by their own decision, they can't pay fair price for coffee production (monopoly of coffee traders).
☞ Producers untrusted on back payment to sell to the cooperative, so that coffee marketing is done individually (market linkage problem).
☞ Even though the quality of coffee were preserved, but the price offered at market is not attractive (low price).
☞ The cooperative is newly established, so that it is not strong in terms of awareness among the member of cooperative and financially (market linkage problem).
☞ The marketing chain is long and difficult for producers.
☞ Mash bed is the major factor affecting the quality of coffee, lack of Mash bed is the major problem
☞ Prevention of free market system highly affect the price of our product
☞ High transportation cost
☞ Lack of market information
☞ Illegal traders
☞ When producers sell to traders, they ask them whether it is forest coffee or plantation coffee, but they doesn't pay incentive price for forest coffee.

**Conclusion and recommendation**

**Conclusion**

Wild coffee is a natural gift for the study area. In the study area coffee is produced in two forms of production system. Coffee forest and semi-coffee forest is the two different system of coffee production in the study area. Coffee forest production system was the widely practiced production system practiced in the study area and a basis for semi-forest coffee production system as it is a source of seedling. While semi-forest coffee production has advantage in yield per plot as the management given to it is more intensive than coffee forest. Coffee production and marketing in the study area is the first rank in livelihood making within its production and marketing constraint. Coffee production I n the study area were constrained by different factors of natural and socio-economics constraint. Fluctuation of Weather condition, disease and decrease in coffee population from natural aspect and lack of management, deforestation and grazing in coffee forest from socio-economic aspect are the major production constraint in the study area. From marketing side; low price, price fluctuation and weak institutional linkage are the major constraint.

**Recommendation**

The following recommendations are drawn based on the result obtained during the study.

☞ The win-win projects, on forest conservation and coffee production have been studied as the two projects criticize each other from the living community side and national park that limit the management activity given to coffee forest which results to reduction in coffee production and productivity.

☞ Supplying improved agricultural technology to the community to increase their production and productivity of agricultural production to diversify their livelihood dependency rather than depending on coffee production alone.

☞ Promoting semi-forest coffee production as a result of their management is not restricted like forest coffee and its production and productivity is superior.

☞ To scale-up semi-forest and plantation coffee production nursery establishment is necessary for the study area

☞ Quality coffee production is related with Mash Bed availability to households, but the material is not address the whole community of coffee producers, so addressing the whole community by supplying Mash Bed improve the coffee quality.

☞ To increase coffee productivity and to keep the coffee production sustainable, Production problem like; lack of management, decrease in coffee population and disease problem should be enhanced in the study area.

☞ Marketing problems like; low price of coffee product, weak institutional linkage, financial weakness of primary cooperative and monopoly of traders are highly reflected in the study area should have to solved by concerned body.

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# Assessment of Training Small and Micro-Enterprises for Sustainable Production and Dissemination of Agricultural Mechanization Technologies

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## *Abstract*

*In Ethiopia, until resent time, effort made to support the activities of micro-enterprises was very little. However, since the country has transferred to a market economy, the government has given special attention in the area. Since most of them are established recently, study was conducted on 36 microenterprises consisting of 22 wood and 14 metal works to evaluate capacity for multiplication of frequently demanded appropriate technologies such as modern beehive, carts, wheelbarrow, Sheller& thresher, weaving machines, stoves, etc to the rural farmers taking the current responsibility of Agricultural Mechanization Research Centers. The study shows that mainly three types of income sources (member's contribution, credit and private fund) are used for establishment are generally in a good financial condition though their technical and production capacity varies based on their acquired capital level at present ranging from 15,000 to 300,000 ET. Birr .The machinery they have depends on financial capacity. As it was observed both metal & wood work enterprises, have at least machines and hand tools that helps to perform their day to day activities. As their main objective is maximizing profit, precisely 90% fully engaged in house and office furniture where as only 10% of them are reported that have produced agricultural development farm implements namely beehive, wheelbarrow, Treadle pump and broad bed maker (BBM) at least once in besides to their usual house and office furniture. Strange enough, during the study visit only one enterprise was observed producing one item (beehive) among many other agricultural development farm implements.*

**Key words**: micro-enterprises; market economy; multiplication; appropriate technologies, farm implements

## Introduction

It is obvious that Ethiopia is poor country whose economy is lead mainly by agricultural sector engaging the greatest population in subsistence farming. Land degradation, poor cultivation practices, frequent drought and sometimes excessive rainfall is among the common factors causing the country unable to feed its population and has relay on massive food import.

To alleviate these preceding problems and upgrade the country's economy, industrialization through small scale industry promotion is important as it is the source of income, employment, skills, goods and services…for people in developing countries (Getachew Abebe and Getachew Belay,1997).Since the issue of small scale industries in both developed and developing countries has got priority, there has been a substantial growth in both privet and public interest in its development in developing countries and also throughout the world.(Andualem Tegegne, 1997)

In Ethiopia, until resent time, effort made to support the activities of micro-enterprises was very little. However, since the country has transferred to a market economy, the government has given special attention in the area .For example, about 351 micro -enterprises including 62 small scale industries have established even in one zone (Jimma) though most of them are at a very infant stage (un published Zonal documents).

Nevertheless, because these enterprises are established recently, most of them are anticipated to have a capacity problem for multiplication of frequently demanded appropriate technologies such as modern beehive, carts, wheelbarrow, Sheller and thresher, weaving machines, stoves, etc to the rural farmers taking the current responsibility of Agricultural Mechanization Research Centers.

Although the centers has been multiplying those appropriate rural technologies in the mandate areas so far, the current focus is on research and hence have less potential to respond for increasing demand of technology multiplication. However, the establishment of micro-enterprises was expected to be a good chance for those technology multiplication but most of them are not in a position to solve the problem because mostly they focused on producing office and household furniture. As a result, the rural farmers kept on frequently demanding the research center for the supply of improved agricultural mechanization technologies.

Therefore, identification of the existing micro-enterprise and up grading its skill and capacity particularly those engaging in wood and metal work through training is vital before the center's complete handover of multiplication activities so as to make the technology dissemination sustainable.

## Objective

☞ To assess and identify currently operating and potential private and micro enterprises on small scale industry activities

☞ To evaluate their capacity for appropriate technology production and multiplication taking current responsibility of the Agricultural Mechanization Research Centers.

☞ To collect feedbacks and generate information on improved agricultural mechanization technology production and dissemination system

### Scope and limitations

The study focused its investigation on small-scale industries supposed to be representative involving in technical activities mainly metal and wood manufacturing enterprises.

## Methodology:-

The research was conducted in selected areas of Jimma and Illubabor zones, which are thought to be good representatives of the enterprises in the mandate area of the technology research centers.

### Method of data collection

The significant information that assisted for this research was collected from primary and secondary sources of data that subsist in the hands of Zonal and district level concerned agencies. Primary data was collected by structured questioner and researcher's group observation. Secondary data was taken from respective microenterprise organizers of Jimmaa and Ilubabor zones to encompass the general background information about the enterprises for analyzing.

### Sampling procedure

Two types of micro-enterprises (wood and metal work) were purposively selected from Jimma and Ilubabor zones based on the enterprises potentials. Thus, 22 technical work enterprises from Jimma and other 14 from Illubabor zones were selected.  Finally a total of 36 micro-enterprises were considered for

the study. Accordingly, a group consisting of enterprise members working at managerial positions and other workers from every enterprise were identified and interviewed.

Finally, interviewed were conducted at total of 36 metal and wood work oriented enterprises for feedback information through the structured questionnaires as well as general observation about the workers interest and participation in the enterprise production activities, the existing machineries and other resources.

**Method of Data Analysis**

The data was analyzed by using descriptive statistical analyzing method mainly frequency distribution, percentage, average etc.

**Result and Discussion**

**Description of Currently Operating Micro Enterprises in Two Zones**

In Ethiopia, until recent time, effort made to support the activities of micro-enterprises was very little. However, since the country has transferred to a market economy, the government has given special attention in the area .For example, the information obtained from two zones indicates that about 351 micro enterprises including 62 small scale industries have established in Jimma and just about similar figure in Ilubabor zones though most of them are at infant stage that needs improvement in its technical, financial and man power capacities. A total of 36 microenterprises consisting of 22 wood and 14 metal works were considered. Among the 22 wood work enterprises, 14 were from Jima &the rest 8 were from the Ilubabor zones. In this study the sample enterprises for the wood works were taken from three different sites in Jimma zone namely Agaro, Asendabo and the Jimma town But only enterprises from Matu town were taken as representative of Ilubabor zone.

Table1. The distribution of the manufacturing enterprises in the two zones

| The activity type | Location | Frequency | %. |
|---|---|---|---|
| Wood work | Jimma | 4 | 11.11 |
| | Asandabo | 2 | 5.56 |
| | Matu | 8 | 22.22 |
| Sub total | | 22 | 61.11 |
| Metal work | Jimma | 9 | 24.99 |
| | Agaro | 2 | 5.56 |
| | Matu | 1 | 2,78 |
| | Badele | 2 | 5.56 |
| Sub total | | 14 | 38.89 |
| Ground total | | 36 | 100 |

Likewise, Jima and Agaro towns and Matu and Bedele are selected for sample representation for metal work enterprises in Jima and Ilubabor zones respectively. The study result shows that 69.45% of the manufacturing enterprises are located in Jima zone where as only 30.55 % belongs to Ilubabor zone for both wood and metal enterprises representatives based on the existing potentials in the two zones

**The micro enterprises capacity for production and Multiplication**

**A. Financial capacity: Capital sources of the enterprises**

The study shows that mainly three types of income sources are used for the establishment of the enterprises. The member's contribution has a loin share about 55.56% where as credit 30.55% and the rest percent belongs to private fund (in the case of private enterprises).

Table2. The existing technical enterprises & their capital sources

| The Enterprise | Sources of capital | Quantity | %. |
|---|---|---|---|
| Wood work | Members contribution | 15 | 41.67 |
| | Credit | 7 | 19.44 |
| Sub total | | 22 | 61.11 |
| Metal work | Contribution | 5 | 13.89 |
| | Credit | 4 | 11.10 |
| | Private fund | 5 | 13.89 |
| | Badele | 2 | 5.56 |
| Sub total | | 14 | 38.80 |
| Ground total | | 36 | 100 |

Contribution of the members was the initial source for the activities of some enterprises for both the wood and metal working activities. As the members stated during the study time, the individual members contribution was about 300-500 Et.bir in average 30.55% .In view of that, about 25% of the enterprises under the study has established having the initial capital of less than 2000 Et.bir. But in the contrary there were still the enterprises being established with higher initial capital of more than forty thousand birr though they are initially private enterprises and some reorganized themselves under microenterprises while some are still operating privately

Table 3:The existing technical enterprises& the amount of their initial capital

| The Enterprise | Initial capital | No of enterprises | %. |
|---|---|---|---|
| Wood work | < 2000 | 5 | 13.89 |
| | 2001-5000 | 3 | 8.33 |
| | 5001-20000 | 6 | 16.67 |
| | 20001-40000 | 6 | 16.67 |
| | 400001-70000 | 2 | 5.56 |
| Sub total | | 22 | 61.11 |
| Metal work | < 2000 | 4 | 11 |
| | 2001-5000 | 5 | 13.89 |
| | 5001-20000 | 3 | 8.38 |
| | 20001-40000 | 1 | 2.78 |
| | 400001+ | 1 | 2.78 |
| Sub total | | 14 | 38.89 |
| Ground total | | 36 | 100 |

As far as the current capacity of the enterprises with regard to their financial and capital circumstance is concerned, it is observed that they are generally in a good condition though their technical and production capacity varies based on their acquired capital level at present.

**B. Capital status of the enterprises**

Table 4 Current capital of the existing technical enterprises

| The Enterprise | Current capital | No of enterprises | %. |
|---|---|---|---|
| Wood work | < 15000 | 0 | 0 |
| | 15000-20000 | 6 | 16.67 |
| | 20001-50000 | 10 | 27.78 |
| | 50001-80000 | 3 | 8.33 |
| | 200000-300000 | 3 | 8.33 |
| Sub total | | 22 | 61.11 |
| Metal work | < 15000 | 0 | 0 |
| | 15001-20000 | 6 | 16.67 |
| | 20001-50000 | 3 | 8.33 |
| | 500001-80000 | 1 | 2.78 |
| | 80000+ | 4 | 11.11 |
| Sub total | | 14 | 38.89 |
| Ground total | | 36 | 100 |

The enterprises having relatively lower amount of capital for production range from 15000 to 20000 ET. Birr is estimated to about 33.34 percent of the total figure considered for this study for both wood and metal works. Whereas there are some others that can be model enterprises whose capital is relatively much advanced specially 3 enterprises covering 8.33 percent among those involved in wood work activities owning a total capital ranging from 200000 to 300000 ET. Birr. But this figure is less in the case of those enterprises under the study sites that engaged in metal work production which amounts 11.11perscnt have a current capital around more than eighty thousand ET, Birr. These micro enterprises having good potential for production are very few in number .Besides that they are engaged in office and house furniture production and has very less or almost no interest for development farm implements due to different associated problems.

**Organization and Management**

Most currently operating micro enterprises are organized in the interest of the state to reduce unemployment problems while some enterprises were primarily established by the private individuals and gradually organized as formal micro enterprises according to the current government micro enterprises organizational principles, rules and regulations while a few others are still functioning independently being managed by privet individual ownership producers.

**Manpower and Managerial skill**

**Manpower**

The man power of the enterprises is consists of different genders that participates in managerial and technical production. Wood work enterprises have more number of man powers which is about 65.53% while that of metal work shop is 32.47 % of the total enterprises' workers.

Table 5 Man power resources of the enterprises

| The Enterprise | Frq | No Members | Male | Female | Total | %. |
|---|---|---|---|---|---|---|
| Wood work | 8 | <5 | 26 | 7 | 33 | 14.285 |
| | 12 | 6-10 | 86 | 11 | 97 | 14.992 |
| | 2 | 10+ | 20 | 6 | 26 | 11.255 |
| Sub total | 22 | | 132 | 24 | 156 | 67.530 |
| Metal work | 10 | <5 | 27 | 7 | 34 | 14.719 |
| | 3 | 6-10 | 21 | 5 | 26 | 11.255 |
| | 1 | 10+ | 12 | 3 | 15 | 6.494 |
| Sub total | 14 | | 60 | 15 | 75 | 32.470 |
| **Ground total** | **36** | | **192** | **39** | **256** | **100** |

As of conventional way enterprises foundation originally the manpower that involves in production activity acquire skill from long term practical exercises. As a result its impact also takes time to be materialized. But presently the existence of technical and vocational training centers at different localities is the accessible opportunity to fill the gaps in improving the product quantity and quantity as we. Consequently the recently establishing technical production oriented enterprises are involving members being trained and equipped with skill and experiences. Likewise, the considered sample representative microenterprises of this study have also about 19% trained, skilled and experienced type of group members which can help them to improve their administration and technical capacities for better outcome though the majority of them were unskilled and hence need on job training.

Table6. The educational status of the enterprises members'

| The activity type | Educational status | No. of members | %. |
|---|---|---|---|
| Wood work | Read and Write | 6 | 5.597 |
| | 1-6 | 14 | 6.060 |
| | 7-8 | 26 | 11.255 |
| | 9-10 | 76 | 23.900 |
| | TVT | 34 | 14.719 |
| Sub total | | 156 | 67.532 |
| Metal work | Read & Write | 0 | 0 |
| | 1-6 | 10 | 4.329 |
| | 7-8 | 10 | 4.329 |
| | 9-10 | 45 | 19.480 |
| | TVT | 10 | 4.329 |
| Sub total | | 75 | 32.468 |
| Ground Total | | 231 | 100 |

**Technical & production capability of the enterprises**

**a) Workers' skill and experience capability**

Actually it may not be expected that perfect come once in all direction. Infect some products really require precision. For example this problem has been observed on farm in the bee hive and treadle pumps that were produced at different microenterprises before about five years but most of them have become non functional because of lack of quality.

**b) Training opportunity**

Training on agricultural development equipments and other activities were given at early stage of the microenterprises establishment thought it is very short term for only few members. But, it lacked continuous training and follow-up and quality controlling system.
Table7 the trainings given to theent4erprisesmember

| The Enterprise type | Area of the training | Duration | Total person | %. |
|---|---|---|---|---|
| Wood work | Beehive production | 16 days | 10 | 13.16 |
| | General Wood work | 15 days | 15 | 19.73 |
| | Business management | 5 days | 25 | 32.89 |

| | | | | |
|---|---|---|---|---|
| Sub total | | 36 days | 50 | 65.78 |
| Metal work | General Wood work | 15 days | 15 | 19.73 |
| | Treadle pump production | 10 days | 3 | 3.94 |
| | Construction beam | 15 days | 8 | 10.53 |
| Sub total | | 40 days | 26 | 34.21 |
| Ground Total | | **76 days** | **76** | 100 |

## c) Working tools and machineries

The type and quantity of machinery that the enterprises owned depends on their financial capacity to acquire it. It was observed that the wood workshops of the enterprises have at least one of machines like hand operated, combination and universal machine but enterprise has found to be good model workshops with highly organized machines that can enable them to produce the farm implements including medium size machines such as crop Sheller and thresher. Similarly Sheet metal cutter, Portable hand drill, Arc welding, Grinding and Drilling machines are normally owned by some metalwork enterprise owners while the majority of the workshops at all level have simple manual machines and hand tools used to perform their daily activities that can nor enable most of the enterprise to produce same farm implements and machines that requires well organized working machines and workshop capacity for complete production and assembling purposes..

## d).The main production items of the micro enterprises

The general objective of micro enterprises is to get income generation in order to improve their family livelihood. For this reason they focus on the production of locally demanded house and office furniture that can be produced from wood and metal materials. As it stated on table 11, precisely 90%of the total micro enterprises incorporated in this study are fully engaged in house and office furniture since the purpose of micro enterprises is to get profit to improve their livelihood where as only 10% of them are reported that have produced agricultural development farm implements namely beehive, wheelbarrow, treadle pump and broad bed maker (BBM) at least once in addition to their usual production of house and office furniture as their demand is relatively law for farm implements due to loss linkage between the producers and rural farmers, and other stalk holders. Strange enough, during the study visit only one enterprise was observed producing even one item (beehive) among the agricultural development farm implements. Hence, a sort of information channels need be developed between rural farmers and micro enterprises through extension workers to provide feedback that minimizes the gap between the supply and demand of the improved farm implements.

Table8. The items usually produced by the enterprises.

| **Enterprise** | **Enterprise** | **No of Enterprises** | **%.** |
|---|---|---|---|
| Wood work | House and office furniture | 22 | 61.11 |
| | Beehive | 2[*] | 5.56 |
| | Wheelbarrow | 1[*] | 2.78 |
| | House and office furniture | 14 | 38.89 |
| Metal work | Treadle pump | 3[*] | 8.33 |
| | BBM | 2[*] | 5.56 |
| Total | | **36** | 100 |

* The enterprise that produced farm development implements at least once in its working duration

## Factors affecting the development of the micro enterprises

### Working environment

Suitable and safety working area is necessary in the enterprises activities. In average nearly 80 percent of them lack appropriate workshops and perform production in rental houses using the same area for working, assembling, and storage and office purposes.

The enterprises owners indicated also that lack of appropriate working area has an adverse effect on their marketing condition. Most workshops are found at far and hidden areas where they can not attract the customers easily. This problem is worst in the case of agricultural development farm implements production since their get in touch with the customer farmers is too less.

### Raw material availability

### a) Timber

Almost all Micro enterprises indicated shortage of timber for wood work activities as the timber factories are established at a distant and their price is too costly. As a result they depend on local supplier sometimes informal, illegal and of poor quality having more wastage.

**b) Metal**

Since the raw material supply is from a distant mainly the central market, its price at zonal and district level gets higher. Moreover, it is difficult to get by the quantity and quality that is required to manufacture the products for those districts at very remote areas besides unavailability of electric power and frequent discontinuity of the rural electric supplies.

**Other limitations**

Less opportunity to participate in bid process: the newly established enterprises lack capacity to participate in local biding computation due to inadequacy in financial capacity.

### Conclusion and recommendation

#### Conclusion

It is observed that about 351 micro enterprises were currently established in Jimma but less quantity in Ilubabor zones though most of them were at infant stage that needs improvement in technical, financial and man power capacities. The study shows that income sources are member's contribution, credit and private fund (for private enterprises). Financially, they are generally in a good condition having financial capacity of 15000 to 300000 ET. Birr though their technical and production capacity varies based on their acquired capital level.

Most are established according to formal organizational principles, rules and regulations while a few is still functioning independently being managed by privet individual producers. Most enterprises are involving members being trained and equipped with skill and experiences different from conventional handcraft activity. Each enterprise has at least one machine and different hand tools that can use to carry out their minimum daily activities among which one enterprise have existed to be a good model workshop with highly organized machineries.

As the purpose of micro enterprises is to get profit to improve their livelihood, more than 90% produce demanded house and office furniture and only 10% of reported that produced agricultural development farm implements that is beehive, wheelbarrow, Treadle pump and BBM at least once in addition to usual product. Lack of suitable & safety working areas appropriate for marketing condition, material shortage for production activities, and inability to participate in local biding computation due to financial capacity are their main limitations.

#### Recommendation

1. The necessary linkages between micro enterprises with the financial institutions have to be made to improve their financial capacities.

2. Follow up And integrated trainings incorporating technical, managerial financial and marketing skill and knowledge has to be provided by concerned government bodies in the sector.
3. A sort of information channels between rural farmers and micro enterprises through extension workers has to be developed to provide feedback that minimizes the gap between supply and demand.

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## Assessment of Factors Affecting Adoption Of Modern beehive in Eastern wollega zone

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### Abstract

*This study was entitled Assessment of Factors affecting adoption Of Modern Beehive in East Wollega Zone. It was initiated with objective of the Major factors that determines the adoption of Modern beehive and quantifying the relative importance of the various factors associated with adoption modern beehive. The study was conducted in five districts of East wollega Zone; Gobu sayo, Diga, Guto jida, Gida ayana and Ebantu districts. The sample respondents were stratified into adopters and non-adopters of modern beehive, 38 adopters and 59 non-adopters and total of 97 rural beekeepers were interviewed. The data*

*were analyzed using descriptive statistics by Spss softwere. From the survey result, All of the respondents which is about 100% are male headed and female has not get a chance to included in sample. The major honeybees pests exist in the study area were identified and prioritized by the respondents, accordingly Ant, honey badger, birds, spider and wox moth problems were ranked respectively. Logistic Regression was run to determine factors affecting adoption. The model revels that total land area and extension service were positively and significantly influence adoption of MBH and Number of traditional beehive was negatively and significantly influence adoption. Age, Experience in beekeeping, TLU, participation in demonstration and participation in training and family size were insignificantly influencing adoption. Hence, it is recommended appropriate* interventions of honey bee pests control should be taken to reduce colony disturbance and *developing beehive technology from locally available material to reduce cost of the technology.*

**Key words**: *Adoption, Modern bee hive, Adopters, Non adopters*

## Introduction

Beekeeping is one of the major agricultural activities being upheld by the government programmes of poverty alleviation. It offers a great potential for income generation, poverty alleviation, sustainable use of forest resources and diversifying the export base. Beekeeping is a relatively low investment venture that can be undertaken by most people (women, youths, the disabled and the elderly). With beekeeping, there is no competition for resources used by other forms of agriculture but agricultural research has not given due emphasis to assessment and understanding of modern methods of bee farming especially in developing countries (Dr. U.K. Behera (2007).

As noted by(Gidey and mekonen) the direct contribution of beekeeping includes the value of the out puts produced such as honey, beeswax, queen and bee colonies and other product such as pollen royal jelly, bee venom and propels in cosmetic and medicine, it provide an employment opportunities.Eeven though it is not well known, it is estimated that around one million farm households are involved in beekeeping business using traditional, intermediate and modern beehive and thousands of households are engaged in Tej making in almost all urban areas.

Ethiopia is one of the four biggest wax exporter to the world market after China, Mexico and Turkey and with honey production our country ranks 10th on the world, the system of production commonly exercised were traditional ( from the total of about 4,601,806 hives exist in the country 95.5% 4.3%,and 0.2o% are traditional, transitional and modern bee hive respectively (Beyene and david 2007)

Beekeeping activities was the most essential for many poor house holds by using modern beehive to get income from natural resource of bees, without prevent of the rich from his farm lands but as indicated by (Gidey and mekonen) there is different constraints in bee keeping production such as inadequate availability of production technologies꞉limited beekeeping knowledge, limited availability of vegetation, limited training and technical assistances in beekeeping, lack of honey marketing facilities, insignificant research activities and other related factors, the rural beekeeping households have not sufficiently benefited from the honey subsectors. Even though extension of using modern bee hive technologies displayed to farmers over the last many years, the adoption of these technologies by small holder farmers is limited and according to annual report (2004) of eastern Wollega zone of agriculture, the population of traditional, transitional and modern bee hive were 98%, 1.8% and 0.2% respectively. So it is vital to be aware and there is a need to understand the contextual factors affecting the adoption of modern beehive technologies in order to generate and disseminate appropriate technologies to small scale farmer.

## Objective of the study

☐ To identify the factors that determines the adoption of modern beehive.
☐ To quantify the relative importance of the various factors associated with adoption of modern bee hive

## Research Methodology

### Description of the Study Area

The study was conducted in East wollega zone, western part of Oromia Regional State. Zone has 17 districts and well known by coffee production, it located about 331km from Addis Abeba. it bounded in the north by Horro guduruu wollega zone, in the south by Iluu Abba bora and Jimma zone, in the east by west shewa zone and in the west by West wollega zone.

The zone has a total land of about 1,384,973 Ha; from this, farming 63.3%, grazing 10.5%, forest 11.5% and other 14.7% and it contains about 3.7% of oromia land. Its agro-ecology 7.2% dega , 51.1%Weina dega and 41.7% kola with minimum and maximum temperature 23°c and36°c respectively, gain 800-2260mm rain fall in the year. According to the information from Zone livestock resource development Office (2007), East wollega zone has a total rural population of 1,199,444 of which male and female are 617,753  and 581,871, respectively.

**Beekeeping Activities in the Study area**

 In zone, there are 287 Farmer Training Centers; Each FTC includes beekeeping training as a major component. Currently, beekeeping extension in zone working with MBH, transitional and traditional hive. In this case traditional hive used for demonstrating colony multiplication. Honeybee colonies are increasing in the area due to colony multiplication, as honeybee colony is one of the income sources for the beekeepers. Honey yield is also increasing except in 2006 due to occurrence absconding of bee colony in that year (Figure 2)
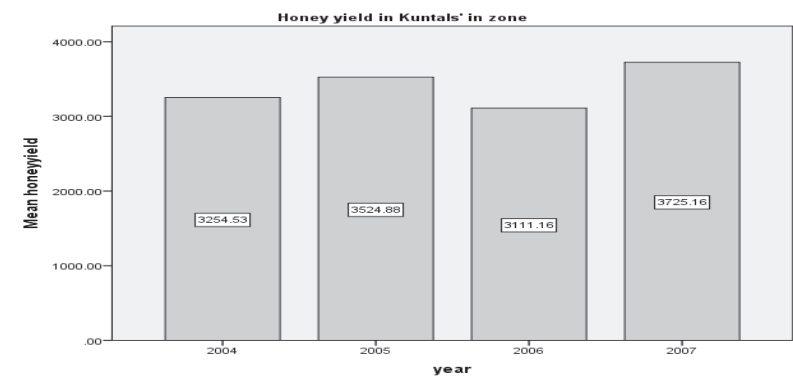


Figure 1: Honey production trends in the study area
Source: East wollega Zone livestock resource development (2015)
Table 1.Types of beehives in the study area

| No_ | Typeof hive | Zone | Diga | Ebantu | Gida ayyana | Guto gidda | Gobu sayo |
|---|---|---|---|---|---|---|---|
| 1 | Modern | 9418 | 1134 | 152 | 1359 | 1500 | 167 |
| 2 | Transitional | 30262 | 4046 | 790 | 966 | 2383 | 205 |
| 3 | Traditional | 15830 | 33178 | 67745 | 80000 | 19748 | 811239 |
| 4 | Others | | | | | | |

Source: East wollega Zone livestock resource development office (2015)

**Sampling Techniques**

East wollega zone purposively selected because high potential in beekeeping production.  Multi-stage purposive sampling techniques were employed where five districts were selected based on apiary potentials.
Accordingly, Gobu Sayo, Diga, Guto Jida,  Gida Ayana  and Ebantu were selected. Then based on beekeeping potential, two PAs were selected from each district and at the end total of 97 households were selected and interviewed.

**Data Types and Data Collection Methods**

Both qualitative and quantitative data was collected from primary and secondary sources. Qualitative data used to assess smallholders farmers attitude towards the use of modern beehive technology in study area. Preliminary survey was conducted to assess the potentials of each district in beekeeping and at the second stage formal survey was conducted by structured questionnaires. Focus group discussion was also conducted with beekeepers and district level beekeeping experts.

**Method of Data Analysis**

The tools for data analysis were descriptive statistics such as percentages, frequencies, mean and standard deviations; t-test employed by SPSS statistical software. Analytical model selected for this study is binary logit model, which significantly identifies the influences of determinants of modern bee hive adoption. However, as of Aldrich and Nelson, (1984), the outputs of Probit and logit models are usually similar. But logit model is easier to estimate.

**Model Specification**

Following Maddala (1983), Aldrich and Nelson (1984), Green (1991) and Gujarati (1995) the logistic distribution for the adoption decision of improved box hives can be specified as:

$pi = \frac{1}{1+e^{-zi}}$ If pi is the probability of adopting modern bee hive their 1-Pi represents the probability of not adopting the technology and expressed as

$1-pi = 1 - \frac{1}{1+e^{-zi}} = \frac{e^{-zi}}{1+e^{-zi}} = \frac{1}{1+e^{zi}}$

Then, the odd ratio as $\frac{pi}{1-pi} = \frac{1+e^{zi}}{1+e^{-zi}} = e^{zi}$, $\frac{pi}{1-pi}$ defines the probability of adoption of modern beehive to non adoption of the technology. Finally, the logit model is expressed as follows by taking the natural logarism of odd ratio

$Li = \ln\left(\frac{pi}{1-pi}\right) = \ln e^{po+\sum_{i=1}^{n} pixi} = zi = po + \sum_{i=1}^{n} pixi$

## Result and Discussion

### Demographic Condition of the Respondents

Adoption of modern beehives technology by farm households is measured in terms of modern bee hives technology users and non-users. 39.2 % respondents were adopter of modern hive and 60.8 % respondents were non adopters. From the survey result, All of the respondents which is about 100% , are male headed and female has not get a chance to included in sample.

Table 2 Sex of the household

| Variables | Non adopter n=59 | Adopter n=38 | Combined n=97 |
|---|---|---|---|
| **Sex** | | | |
| Male | 59(60.8) | 38(39.2) | 97(100) |
| Female | - | - | - |

Source own survey 2014 () percent

The mean age of the respondent was 39.26 years and ranged from 19 to 80 years. The mean age for adopters and non-adopters were 38.07 and 40.03 respectively with insignificant mean difference (t-value = 0.695 and sig. 0.388) at 5%.

The result shows that the beekeepers in the study areas getting older and more resources are in the hands of older farmers. Mean Educational level of the household was 6.75 and ranged from nil to 12 schooling and about 16.4% of respondent are illiterate. Similarly Mean education level of adopter and non adopter was 6.7 and 6.5 respectively with insignificant mean difference (t-value =0.819 and sig. 0.778) at 5%. Assumption of homogeneity of variance with respect to education was not violated. About 22.03 % of non adopter and 7.89 % adopter are illiterate. The average family size of sample respondents was 7.10 and ranged from 0 to 19 persons. Of which about 49% are economically active and it was 7.078 and 7.126 persons per household for adopters and non adopters).

73.2% of the respondent meet the food consumption requirement from own production but 25.8% doesn't met their food consumption because of shortage land for farming purpose.

Beekeeping experience is one of the variables that was considered. Mean Beekeeping experience of adopter and non adopter was 16.28 and 15.00 respectively. The result indicates that the mean years of beekeeping experience of both categories are nearly equal.

The mean comparison of MBH adopters and non-adopters shows that no statistically Significant difference is observed in terms of beekeeping experience. (t-value= 0.909, sig value= 0.36). Table (4)

Table 3 the Mean distribution of sample respondents by personal related variables

| variables | Non adopter n=59 | Adopter n=38 | Combined n=97 | t-value |
|---|---|---|---|---|
| | | Mean | | |
| Age | 40.03(14.41) | 38.07(11.98) | 39.26(13.48) | 0.695 |
| Education | 5.06 (3.85) | 6.71(3.61) | 5.71(3.82) | 2.1 |
| Family size | 6.88(3.57) | 7.07(3.43) | 6.92(3.50) | 0.280 |
| Less 10 yrs | 2.22(1.54) | 2.05(1.46) | 2.15(1.50) | |
| 10-14yrs | 1.11(1.05) | 1.10(1.15) | 1.11(1.08) | |
| Male15-65 yrs | 1.86(1.47) | 1.94(1.48) | 1.88(1.48) | |
| Female 15-65 | 1.47(1.29) | 1.71(1.79) | 1.58(1.49) | |
| Greater 65 yrs | 0.25(0.57) | 0.23(0.58) | 0.23(0.57) | |
| Tropical livestock unit | 4.83 (4.99) | 10.29 (7.20) | 8.91 (7.37) | 1.458 |
| Total land per HH | 2.22 (1.74) | 3.13(2.08) | 2.73(1.88) | 2.063* |
| Beekeeping Experience | 15 (8.78) | 16.28 (9.09) | 16.16 (11.49) | 0.909 |

*significant at 5% level of significance. Source own survey 2014 () standard deviation

## Socio-economics Characteristics of the Respondent

The size of land distribution between non adopters and adopters is on average 2.22 ha and 3.13 ha respectively (Table 4). The respondents have the land size which ranges from zero to ten hectare with the mean of 2.73 ha. The mean comparison of farm size of adopter and non adopter statistically significant ( t-value= 2.063, sig=0.042).
The major livestock reared in the study area are cattle (ox, cow, heifer, and calf), sheep, goat, poultry, horse and donkey. Accordingly, the total livestock holding of the respondents was 864.67 TLU, ranging from 0 to 34.67. The mean livestock holding for adopters and non-adopters was10.29 and 4.83 respectively (table 3).

Mean comparison was made between adopters and non-adopters using t-test (t-value=1.458, sig=0.148). It reveals that there is no significant mean difference in the wealth Status of both categories measured by livestock holding.

## Perception of Beekeepers about MBH

It was found important to identify perceived relative advantages/ problems of modern bee hives by comparing with local beehive so as to get the general perception of beekeepers of adopter (N=38) of MBH Table 4. Perception of respondents towards MBH

| Parameter about MBH | Very low | Low | Medium | High | Very high |
|---|---|---|---|---|---|
| Cost of hive | | - | 15.7 | 39.4** | 28.9 |
| Yield | | - | 21.1 | 13.2 | 65.8 * |
| Produce quality honey | | | 13.2 | 18.4 | 68.4* |
| Ease for inspection | 2.6 | | 15.8 | 21.1 | 60.5* |
| Needs high skill | 13.2 | 5.3 | 13.2 | 26.3 | 42.1** |
| Absconding | 28.9* | 28.9* | 21.1 | 15.8 | 5.3 |
| Pest &predators | 15.8 | 7.9 | 28.9 | 34.2** | 13.2 |
| Swarming(half absconding) | 31.6 | 15.8 | 34.2 | 7.9 | 2.6 |
| Disease | 23.7 | 36.8* | 36.8 | 2.6 | |
| Marketing problem | 36.9* | 39.5* | 21.1 | 2.6 | |
| lack of wax | 10.5 | 10.5 | 23.7 | 31.6** | 23.7 |
| Thief problem | 81.6 | 15.8 | 2.6 | | |

Source, survey result: 2014.

Number in the table shows % of respondents answered when the researchers asked relative problems and advantages of MBH
High yield, produce quality of honey, ease for inspection, low or very low Absconding , low disease, lack of honey market problem, lack of thief problem are the major relative advantages of modern beehive by comparing local hive which were identified by the majority of adopters of modern hive. On the other hand, high cost, need of high skill, pest and predators, Lack of wax are the main relative disadvantages of MBH. See table 5 (** sign).

## Honey bee Pest Problems

The existences of honeybee pests can create obstacle for adopting MBH as they attack honey bees and hive products. Hence, pest problem is a common problem in the study area for both categories.
The major honeybees` pests exist in the study area were identified and prioritized by the respondents based upon the damage cause on the honeybees and hive product by honey bee enemies.

Table 5. Ranks of honeybee enemies

| NO | Honeybee enemies | Frequency | % | N=97 Rank |
|---|---|---|---|---|
| 1 | Ant | 55 | 56.7 | 1st |
| 2 | Honey badger | 16 | 16.5 | 2nd |
| 3 | Birds | 13 | 13.4 | 3rd |
| 4 | Spider | 7 | 7.2 | 4th |
| 5 | Wax moth | 6 | 6.2 | 5th |

Source survey result 2014

According to the prioritization result, even though ant causes a serious problem, respondents were use improved ant protection method by DIDIT and traditional way by adding wood ash around hive and circulating by roof hive stand.

## Modern Bee hive Adoption

During the study period, the zone had 9,418 MBH. Among the respondents, 39% of them were adopting the technology. The respondents of adopter's category had the total number of 155-modern bee hives and 466 traditional bee hive. The average number of modern bee hive per adopter was 4.07, adoption MBH was very low. But, Beekeepers were understood advantage of MBH over traditional bee hive. However, the cost of the technology is too high according to their perception.

Table 6. Beehives adoption by district

| No | Districts | Response on using MBH | | Total |
|----|-----------|-----|-----|-------|
| | | Yes | NO | |
| 1 | Gobu sayo | 9 | 11 | 20 |
| 2 | Diga | 6 | 15 | 21 |
| 3 | Guto jida | 6 | 11 | 17 |
| 4 | Gida ayana | 11 | 12 | 23 |
| 5 | Ebantu | 6 | 10 | 16 |
| **Total** | | 38 | 59 | 97 |

Source, own survey result, 2014

The reason replied by most of respondent on why they are not adopting modern beehive was cash shortage and expensiveness of the technology.

Table 7 reason on not adopting MBH

| No | Reason of not adopting MBH | Frequency | Percent |
|----|----------------------------|-----------|---------|
| 1 | Did not try to get | 2 | 3.4 |
| 2 | Did not agree its advantages | 13 | 22 |
| 3 | Not available | 6 | 10.2 |
| 4 | Cash shortage | 19 | 32.2 |
| 5 | Too expensive | 19 | 32.2 |
| Total | | 59 | 100 |

Source, own survey result, 2014

Adopters was get modern bee hive from different source 47% MOA,11% BAMRC, 16%NGO, 21%Market and 5% others like by own making.

Table 8 Responses of respondents on source, availability of modern beehive

| T.L | Source of modern bee hive | Adopter n=38 | Available on time you need | | Can purchase amount you need | |
|-----|---------------------------|--------------|-----|-----|-----|-----|
| | | | yes | no | yes | No |
| 1 | MoA | 18 (47) | | | | |
| 2 | BAMRC | 4(11) | 6 (16) | 32(82) | 11 (30) | 27(70) |
| 3 | NGO | 6(16) | | | | |
| 4 | Market (IMX) | 8(21) | | | | |
| 5 | Others | 2(5) | | | | |

Source survey result 2014 ( ) indicates percentage

About 82% respondent replies that it is not available when they needed and 70% because of Expensiveness of hive and cash shortage of respondent they cannot purchases amount of they needed every year. Almost all about 90% of respondent have no honey extractor to protect honey quality when they honey processing. Respondent in study area assume their honey quality reduced when they are processed, it may affect price of honey.

## Determinants of Adoption of Modern bee hive

Explanatory variables that are selected for econometric model would be interpreted based upon the model output. Accordingly, as indicated in Table 18, 73 % of the total variation explained by logistic model. The explanatory variables that fit the model, Age, TLU, total land of household head, experience of beekeeping Extension service, Participation in training, Participation in demonstration, Educational level of the household, family size, number of traditional beehive. multicollinearity problem was checked by using VIF (Variable Inflation Factor) for continuous variables and CC (Contingency Coefficient) for nominal variables and there is no series problem. By rule of thumb, there is no problem of multicollinearity as CC was found to be less than 0.8 while VIF found was less than 10. According to Maddala (1992) and Gujarati (2004) VIF can be defined as: VIF (xi) $=\frac{1}{1-R^2}$, where, $R2$ is the squared multiple correlation coefficient between Xi and the other explanatory variables. Table 9 Results of multi co linearity test: Variance inflation factor for the continuous explanatory variables.

| Variabales | Co linearity Statistics | | |
|---|---|---|---|
| | Tolerance | VIF | $\dfrac{1}{VIF}$ |
| Age | .530 | 1.886 | 0.530 |
| Education | .834 | 1.199 | 0.834 |
| Familysize | .713 | 1.402 | 0.713 |
| TLU | .523 | 1.912 | 0.523 |
| Number of Traditional beeive | .854 | 1.171 | 0.853 |
| total land | .623 | 1.605 | 0.623 |
| Experiencebeekep | .602 | 1.662 | 0.601 |

Source, own survey result 2014

Table 10. Results of multi co linearity  test: contingency coefficient for the dummy variables

| | Extension service | Participation on demonstration | Participation on training |
|---|---|---|---|
| extension service | 1.0000 | | |
| Participation on demonstration | 0.3118 | 1.0000 | |
| Participation on training | 0.5172 | 0.4390 | 1.0000 |

Source, own survey result 2014

Table11  Logistic regression for factors influencing MBH adoption

| | B | S.E. | Wald | Sig. | Exp(B) |
|---|---|---|---|---|---|
| Agehh | -.012 | .030 | .171 | .680 | .988 |
| Education | .070 | .093 | .574 | .449 | 1.073 |
| TLU | -.029 | .048 | .383 | .536 | .971 |
| Total land of hh | .426 | .186 | 5.221 | .022* | 1.531 |
| NumberofTraditionalbeehive | -.056 | .031 | 3.279 | .070** | .946 |
| Experience beekeeping | .025 | .032 | .604 | .437 | 1.025 |
| Extension service | 1.038 | .618 | 2.816 | .093** | 2.823 |
| Participation in training | .923 | .675 | 1.873 | .171 | 2.518 |
| Familysize | -.029 | .088 | .108 | .743 | .971 |
| Participationindemonstration | -.862 | .667 | 1.670 | .196 | .422 |
| Constant | -1.158 | 1.410 | .674 | .412 | .314 |

.

-2 Log likelihood  104.123, Predicted adopter 60 %, Non-adopter 81.8%

Over all 73%

*, **, significant at $p<0.05$, $p<0.1$

From the results of the model, Total land area was positively related to the adoption and significant at 5%. The odds in favor of adopting MBH increased by a factor of 1.53 for beekeeper who have more farm land area in hectare. This shows that farmers who have more land area more interested beekeeping with MBH compared to the Farmers who have less farm land area.  Extension service positively related to the adoption and significant at 10%. The odds in favor of adopting MBH increased by a factor of 2.82 for beekeeper who have got extension  service, number traditional beehive influences adoption of MBH negatively and significantly at 10 %. The Odds in favor of adopting MBH decreased by a factor of 0.94 for beekeepers who had more traditional beehive.  Age, TLU, beekeeping experience, participation in training and demonstration, family size and education were not significantly influence adoption of modern beehive

## Conclusion and Recommendations

### Conclusion

The study was conducted in East wollega zone, western part of oromia. For this study multi-stage purposive sampling technique were used and Gobu sayo, Diga, Gida Ayana, Guto jida and Ebantu districts including two PAs from each districts were selected and interviewed depend on Apiary potentials. Accordingly, respondents were stratified into adopter and non adopter modern beehive technology. Total of 97 households (38 adopter and 59 non adopter) were taken for the study through random sampling method. The data were analyzed using descriptive statics by spss sofwere.

The mean age of the respondents was 39.26 years and ranging from 19 to 80 years. The mean age of adopter and non adopters were 38.07 and 40.03 years respectively with insignificant mean difference (t-value=0.695 and sig =0.388) at 5%. Similarly mean educational level of adopter and non adopter was 6.7 and 6.5 schooling respectively with insignificant mean difference (t-value =0.819 and sig=0.778) at 5%. Beekeeping is the major source of household's income in study area; beekeepers in zone uses traditional, transitional and modern beehive and have got 3725.16qu.of honey and worth 260.761,200 birr with 30.00birr/kg in 2015/16. But adoption of modern beehive was low. Comparison was made on perception of relative advantages and disadvantages of MBH.

High yield, produce quality of honey, ease for inspection, low absconding , low bee diseases, luck of thief problem are the major advantages of MBH by comparing local beehive which is identified by adopters of MBH. On other hand high cost, needs high skill, pest and predators, luck of wax are the main its disadvantages. The major honey a pest exists in study area were identified and prioritized by respondents based on the damages causes on honeybees. Ant, badgers, birds, spider and wax moth are the major honeybee enemies in study area.

To determine factors the affecting adoption, logistic model was run. The model revels that total land area was positively and significantly influence at adoption of MBH 5%. Extension service influence adoption positively at10%, where as the number of traditional beehive influence adoption negatively and significant at 10%, on other hand Age, TLU, Experience beekeeping, participation in demonstration and training, family size, education were not significant influencing adoption of MBH in study area. Due to expensiveness of technology and cash shortage, farmers cannot purchases mount of MBH needed from different sources.

### Recommendations

Based on the results of the study, the following recommendations are suggested.
☞ Researchers have to search other alternative, on modifications of the modern beehive to reduce the cost of the technology.
☞ Traditionally processing honey in study area, affect quality of honey, this turn reduce price of product. So AERC should give attention on adaptation of honey extractors
☞ Extension services was found to be significantly influencing adoption MBH hive, it should be strengthened down to the village level to inform farmers in order to increase the rate of adoption.
☞ Appropriate interventions of honey bee pests control should be strengthened to reduce colony disturbance

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# Assessment of Indigenous Agroforestry Practices in Eastern Hararghe Zone of Oromia Region, Ethiopia

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## Abstract

*The study was conducted in Eastern Hararghe Zone of Oromia Region, Ethiopia. The objectives of the study were to identify the various Agroforestry practices, highlight the potentials and constraints and the farmers' preference of tree species. For the intended purpose, both random and purposive sampling techniques were used for the study. A total of 180 farm households were selected for the intended purpose. Data were collected from 180 farm households using semi-structured questionnaire and checklist. Data generated were analyzed using descriptive statistics such as frequency distribution, tables and percentages. The result revealed that various agroforestry practices identified are in the area about 96% respondents were practiced homestead based agroforestry, 82% of the respondents were practiced agroforestry by planting trees on farmlands, scattered trees on the farm land, 75% and 46% of the respondents were practiced farm boundary and woodlot based agroforestry, respectively.  The result further revealed that the most preferred tree species by the large proportion of the farmers included Magnifera Indica (90%), Cordia Africana (88%), Gravilia robusta (72%), Acacia Albide(62%) and papaya (50%). Therefore, efforts made to introduce and promote improved agroforestry technologies in the area, should be considered the existing agroforestry practices, farmers' preferences and constraints identified through this assessment were crucial.*

**Keywords:** Assessment, Indigenous, Agroforestry, Practice

## Introduction

Agroforestry practice is a land-use system in which trees or shrubs are grown in association with agricultural crops, pastures or livestock. This integration of trees and shrubs in the land-use system can be either a spatial arrangement, e.g. trees growing in a field at the same time as the crop, or in a time sequence. Agroforestry systems often involve management of trees and shrubs and utilization of their products (Tengnas, 1994).

In Ethiopia, agroforestry has been an age-old practice in smallholder farming system. Cultivating trees, agricultural crops and pastures and/or animals in intimate combination with one another spatially or temporally is an old practice that farmers have used (Tolunay *et.al*. 2007). There are several types of indigenous agroforestry practices in different part of the country. In the context of this study, agroforestry practice is a specific land management operation on a farmland, and consists of arrangements of agroforestry components such as tree, crop and livestock in space and/ or time. The indigenous agroforestry practice is growing of various trees species such as fruit trees, coffee on farmlands, and around homestead with crops, is an indigenous agroforestry practice in the study area**.**

The indigenous agroforestry practices practiced by farmers includes coffee shade based, scattered trees on the farm land, home gardens, farm boundary practices, trees on grazing lands are some of the known examples of indigenous agroforestry practices (Tesfaye, 2005; Azene, 2007). The existence of these systems has a great potential for further development and the introduction of new agroforestry systems. In dry lands, trees are important mainly the water balance of plants and moisture content, erodability and other properties of the soil (Skoupy, 1991; Sheikh & Khalique, 1982). The removal of the vegetative cover from the soil results in increases in bulk density and reduction in infiltration rate (Nair, 1984). This ultimately will decrease the land productivity.

Eastern Hararghe zone is severely affected by deforestation and land degradation. Most parts of the arable land of the area is degraded because of soil erosion prevalence and since the topography of area is mostly hill slope and it has no vegetation cover the land is usually prone to soil erosion. Hence, one of the solutions could be plantation of a tree in degraded marginal lands to meet the multiple demands of trees, to reduce the pressure imposed on the remaining forest resource and restore land degradation. In addition, integration of trees in to the farm as an agroforestry, biological soil and water conservation and livelihood diversification to meet multiple demands of the farmer is vital.

The agroforestry practices and the existence of different trees on farmlands for ages indicates the successfulness of practicing indigenous agroforestry in the area, but the existing agroforestry practices and its constraints are not assessed and documented in systematic manner. Therefore, the main objective of this study was to assess the indigenous agroforestry practice in the study area and to highlight opportunities and constraints of the agroforestry practice for sustainable agricultural production in the study area.

## Methodology

### Description of the study area

The study was carried out in Babile, Kersa and Goro-gotu districts of East Hararghe zone. The Babile district has a population of 93,708. The altitude varies between 950 to 2000 masl. Land use of the district is 21.1% arable, 3.9% pasture, 3.7% forest, and the remaining 71.3% is degraded land. Livestock-crop mixed farming is the major livelihood activity. The main crops grown are *khat*, maize, sorghum and groundnut while cattle, sheep, goats, camels, chickens and donkeys are the major livestock species kept. Kersa district has a population of 170,816. The altitude of this district ranges from 1400 to 3200 masl. Land use of the district is about 28.5% arable, 2.3% pasture, 6.2% forest, and the remaining 56.3% is degraded. The main crops grown are maize, sorghum and barley while Khat, coffee and vegetables are important cash crops.   In addition, cattle, sheep, goats, and chickens are the major livestock species kept. Goro-Gotu district is one of targetd district and has a population of 143,931. The altitude of this district ranges from 1200 to 2660 masl. Land use of the district is about 20.3% is arable, 19.9% pasture and forest, and the remaining 59.8% is degraded land.  The main crops grown are maize, sorghum, wheat, beans, and barley while Khat, coffee, fruits and vegetables are important cash crops. In addition, cattle, sheep, goats, and chickens are the major livestock species kept.

### Sampling procedures and sample size

For this study, three districts Babile, Kersa and Goro-gutu districts were purposely selected based on their potential for agroforestry practices, having considerable diversity in terms of agro-ecology and their experiences of agroforestry practices. A random sampling technique was used to select sample *kebeles* and farmers from these districts. Accordingly, a total of nine representative *Kebeles* were randomly selected based on their potential in agroforestry practices.  A total of 180 farm households were randomly selected and used for the study. Primary data were collected from sampled farmers using semi-structured questionnaire and guide checklist.

### Data collection and method of data collection

Semi-structured interviews, focus group discussions and personal observations were employed to generate primary data pertaining to the existing agroforestry systems and practices in the study area. Household survey was employed to collect data on general socio - economic characteristics of sample households and to know facts about the household, their experience in agroforestry activities, reasons for their participation in agroforestry practices and constraints they faced. The major source was sample households.  In addition, focus group discussions were employed to get preliminary information about the agroforestry practices, prevailing opportunities and constraints in implementing agroforestry practices with key informants were carried out using checklist so as to explore information pertaining to agroforestry practices in the study area.

### Data analysis

According to the nature of study, objectives and the type of data, this study is basically descriptive in nature. Hence, the collected data were analyzed using descriptive statistics such as frequency; average and percentage were used for data analysis. The SPSS (statistical package for social science) version 20 was employed for data analysis.

### Results and discussion

### Socio-economic characteristics of the respondents

The respondents' age ranges from 23 to 66 with an average age of 45.5 years. This implies that the respondents are still within their active age and can engage in various income generating activities in the target area. The household provides a major source of labor for agricultural and non-agricultural activities. The labor available for work per household is directly proportional to

the family size. The family size of the respondents ranges from 3 to 12 with an average of 6.8 persons per household head as presented in Table1.

As shown in Table 2 the landholding of the respondents ranges from 0.25 to 0.63 hectare with an average landholding of 0.48 hectare. Thus, the landholding of the respondents is small and thereby determines the area allocated for agroforestry practices. The average livestock holding of the respondents ranges from 0 to 6.8 TLU with an average of 3.7 TLU.

Table 1. Socio-economic characteristics of sample farm households

| Socio-economic characteristics | Min. | Max. | Mean | Std. Deviation |
|---|---|---|---|---|
| Age of household heads (years) | 23 | 66 | 45.5 | 13.0 |
| Household family size ( number) | 3 | 12 | 6.8 | 2.7 |
| Land holding in hectare | 0.25 | 0.63 | 0.48 | 0.37 |
| Livestock holding in TLU | 0 | 6.8 | 3.7 | 2.92 |

Source: Field survey, 2013

As shown in Figure 1 from the total respondents, about 88% of the respondents were male while the rest 12% are female farmers were involved in the study.



Figure 1.Gender of the respondents
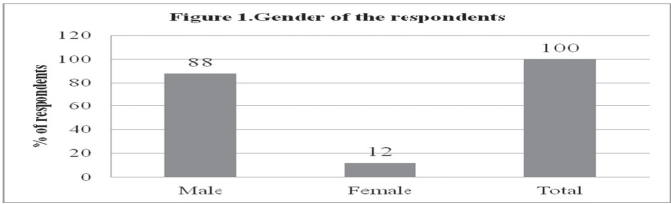
Education is a crucial factor for skill development and enhancing farmers' decision making in resource allocation for agricultural activities. Figure 2 shows that about 64% of the respondents are illiterate that means do not have formal education while about 36% of the respondents are literate.



Figure 2. Level of eduction of the respondent
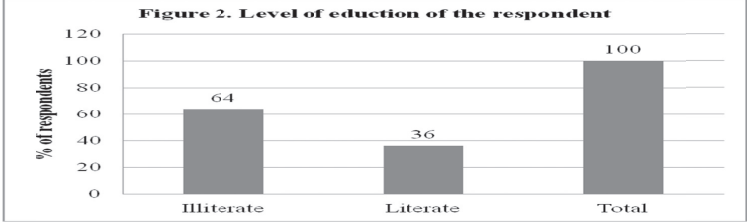
## Major Agroforestry practices in the study area

Smallholder farmers practiced various agroforestry practices by integrating crops, animals and trees on their farm land in the study area. Smallholder farmers in the area developed their own type of indigenous agroforestry practices that are suitable with the available resources and agricultural practices. In the study area, farmers have deliberately been grown different types of tree species together with crops and livestock on the same farm land. Particularly, sorghum, maize, haricot bean, wheat, barley, Khat, *Coffea arabica*, and fruits such as (*Mango*, *Mangifera indica*, *Carica papaya*) are the major type of crops integrated with the agroforestry tree species and livestock.

The result of the survey revealed that, all of the respondents (100%) were practiced agroforestry in their farm land. Growing of woody perennials and fruit trees on farmlands with cereals and perennial trees, planting of fruit and forage trees around homestead together with vegetable, and planting of multipurpose trees on farm boundary, are an indigenous agroforestry practices identified in the study area. As shown in Figure 3 about 82% of the respondents were practiced agroforestry by planting woody perennials, fruit trees and coffee on farmlands with cereal crops. According to these farmers, various trees species are grow to provide shade for crops such as coffee, livestock and human, firewood, source of income, supply of fodder for their livestock, supply fruits, timber, control soil erosion and soil fertility improvement on their farm land for various purposes.

Moreover, about 96% respondents were practiced agroforestry by planting of fruit and forage trees around homestead in the area. This shows that homestead based agroforestry practice has greater proportion and they grown different species of trees around their homestead in the area. In addition, about 75 and 46% of the respondents they involved in boundary planting and woodlot agroforestry practices, respectively.



Figure 3. Type of agroforestry practices
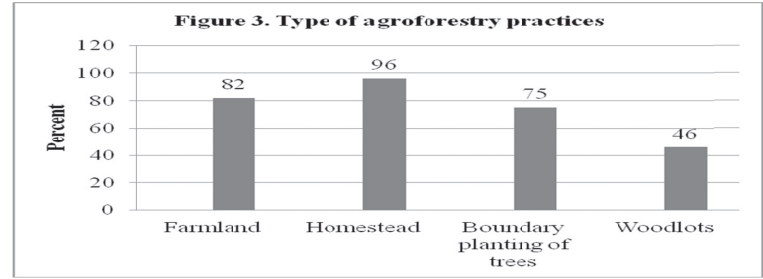
## Farmers' perception on agroforestry practices

Effort has been made to assess farmers' perception on agroforestry practices in the study area. Accordingly, the study results revealed that the farmers were asked to respond how they perceive agroforestry practices in the area. Farmers have positive attitude toward agroforestry practices in the area for its benefits, and all farmers were very interested to practice agroforestry on their farm land. As a result, farmers had a better understanding of benefits of agroforestry practices, its' role and contribution in natural resource management and livelihoods.

As a result, farmers were more willing to take up intensive agroforestry practices. Furthermore, many farmers noted that the most important benefit of agroforestry is soil erosion control and the provision of fodder for livestock. As a result, farmers have planned to continue to practice agroforestry practices and are very interested in growing more trees on their farm land. Farmers' opinions revealed that they are highly interested to plant fast-growing trees on their farm land. Reduce soil erosion and improve soil fertility. As shown in Table 2 source of fuel wood, of fodder for livestock and ability to reducing soil erosion and increase soil fertility are major attributes of trees on which the majority of the respondents responded positively.

Table 2. Farmers' perceptions on role of agroforestry practices in the study area

| Attributes | Percent of respondents | |
| --- | --- | --- |
| | Agree | Disagree |
| Reduce soil erosion and improve soil fertility | 92 | 8 |
| Source of fuel wood | 100 | 0 |
| Source of fodder for livestock | 95 | 5 |
| Source of cash income | 83 | 17 |
| Competition for land and labor | 28 | 72 |
| Attraction of birds, insects/ pests and diseases | 12 | 88 |

Source: Field survey, 2013

## Preferential agroforestry tree species among farmers

Smallholder farmers in the study area intentionally grow various tree/shrub species on their landholding for its multiple uses and purpose such as, providing shade, fuel wood, improving soil fertility, low competition for space, construction pole, generate income, fodder for animals, soil erosion control and fertility improvement. In the area, various trees planted on farm lands. This was found to be attributed to the many uses and benefits realized from tree species by the farmers. In the study area farmers were preferred the tree for its multiple uses, and economic value. The trees are planted by farmers on their farm land, homestead and woodlots for house construction, fuel wood, and income generation. As shown in Table 3 the most preferred tree species by the large proportion of the farmers in the study area includes *Magnifera Indica* (90%), *Cordia Africana* (88%), *Podocarpus falcatus(82%), Gravilia robusta* (72%), *Acacia Albide*(62%) and papaya (50%).

Table 3. Tree species preference among farmers in the study area

| Major tree/shrub species | Percent of the respondents |
|---|---|
| Cordia Africana | 88 |
| Podocarpus falcatus | 82 |
| Copress lustanica | 58 |
| Acacia Albide | 62 |
| Junipers procera | 48 |
| *Gravilia robusta* | 72 |
| *Olea Africana* | 53 |
| *Olea Africana* | 50 |
| Acacia absinica | 33 |
| Magnifera Indica | 90 |
| Papaya | 50 |
| Avocado | 37 |
| Apple | 48 |
| Psidium guajava | 40 |
| Susbania sasban | 30 |

Source: Survey result, 2013

## Major constraints of agroforestry practices

In the study area, the constraints in agroforestry practice were identified and prioritized in order of their importance by farmers in the study area. Table 4 indicates that the most serious constraints encountered the farmers in order of their importance were drought/water shortage (85%), shortage of land(82%), lack of seed/seedlings (75%), low survival rate of planted seedlings (67%), lack of awareness (63%) are major constraints to the prevalence of agroforestry practices in the area.

Table 4. Major constraints of Agroforestry in the study area

| Constraints | Percentage |
|---|---|
| Lack of seed/seedlings | 75 |
| Low survival rate of planted seedlings | 67 |
| Shortage of land for tree planting | 82 |
| Drought/water shortage | 85 |
| Labor shortage | 62 |
| Competition of tress with annual crops | 60 |
| Diseases/pest attack | 40 |
| Lack of awareness | 63 |
| Inadequate knowledge/skill | 50 |

Source: Survey result, 2013

## Conclusions and recommendations

The purpose of this study was to identify existing agro-forestry practices, tree species and farmers' preferences, and also to identify factors that influence practices in the study area. The results of the study revealed that various agro-forestry practices were adopted by farm households in the study area. The common agro-forestry practices that were identified in the study area includes planting trees on farm land, homestead, boundary planting of trees and woodlot with various tree species farmers maintained to meet the different needs for their livelihoods in the study area.

Furthermore, it can be seen that various agroforestry practices practiced by smallholder farmers in the study area but due to some constraints such as drought/water shortage, low survival rate of planted seedlings, lack of quality seed/seedlings, and shortage of land for tree planting significantly influence agro-forestry practices of the study area. Therefore, understanding the existing agro-forestry practices, tree species planted and farmers' preferences, the majority of the farmers are willing to plant and retain various tree species on their landholding. Therefore, it needs to the consideration and integration of indigenous knowledge, potentials for the introduction of fruit trees and multi-purpose trees which can grow in small area of land, the government should be encouraged the smallholder farmers to practice agroforestry. Smallholder farmers in the study area have different preferences, hence quality seedlings should be provided to the farmers based on their interest, providing of fruit trees and multipurpose tree species, fodder plants and incentives should be given to those willing to plant trees.

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## Assessment of Existing Irrigation Practices and Related Problems on Selected Irrigation Projects in Eastern Hararghe Zone, Oromia, Ethiopia

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### Abstract

*The assessment was conducted in Kersa, Meta and Goro-gutu districts of Eastern Hararghe zone of Oromia regional state of Ethiopia with objectives to assess existing irrigation practices, constraints and opportunities of irrigation schemes in the areas. Data collected through individual interview and key informant interviews using semi-structured questionnaire. The collected data analyzed using descriptive statistics. The results of the assessment revealed that the major water sources for irrigation scheme development include springs, seasonal rivers, streams, seasonal lakes, wells and ponds that can be used for irrigation and domestic uses in the study areas. Furrow irrigation was a common irrigation method used by farmers. The findings of the study also indicated that shortage of water and inefficient irrigation water management limit farmers to cultivate their land. Moreover, lack of water saving irrigation technologies, damaging of irrigation schemes and canals by flooding and landslides, and farmers' limited knowledge in irrigation water management were found to be a major threats to sustainability of the irrigation schemes. The overall effect leads to inadequacy of water for irrigation, and unable to intensify agricultural production in the area. Therefore, organizational structure of irrigation users and their capacity should be strengthened, and promotion of irrigation water saving technologies need attention. Moreover, due attention should be given to promotion of proper irrigation water management practices, and awareness creation for tackling challenges faced by farmers in the area.*

**Keywords**: Assessment, Irrigation practices, Irrigation, Problem

### Introduction

Irrigation development, particularly for smallholder farmers has significant importance to raise production and productivity to achieve food self-sufficiency, improved income and ensure food security. The irrigated agriculture can also play a vital role in supplying sufficient amount and the required quality of raw materials for domestic agro-industries and increase export earnings. Irrigation also improves the efficiency of other production inputs such as fertilizers and improved seeds. Hence, the low-input irrigated farming is often more productive than the high-input rainfed farming. Therefore, irrigated agriculture will be a dominating feature of future farming in order to be able to produce sufficient food for an ever-growing world population. In addition, the irrigation frees the farmers from the limitations of rainfed farming, enabling them to cultivate all the year round, grow a wider variety of crops, have higher

cropping intensity and do priority farming. Improved irrigation and agricultural practices coupled with enhanced participation of the farmers in the markets is the key to income generation (ICC, 2007).

Ethiopia has the potential for irrigation development both in terms of vast suitable land and availability of fresh water resources suitable for irrigation purpose, but not contributing its share to the growth of the agriculture sector accordingly. However, there are many constraints impeding rapid development of small-scale irrigation schemes such as predominantly primitive nature of the overall existing production systems, shortage of agricultural inputs, limited access to improved irrigation technologies, unstable institutional set up and inadequate extension services and limited availability of capital and other socio-cultural factors (MoA, 2011). Although, smallholder irrigation development in developing countries that it can be used as a key drought mitigation measure and as a vehicle for the long-term agricultural and macroeconomic development, and successful smallholder irrigation schemes can result in increased productivity, improved income and nutrition, employment creation and food security (FAO, 2000).

In Eastern Ethiopia, smallholder farmers largely depend on erratic and often insufficient rainfall, which is significantly reduced their production and productivity. In addition, other factors that have contributed to this are continuous land degradation, and deforestation. Therefore, to overcome the problems, and considering the importance of the irrigation, the government is giving special emphasis to enhance irrigated agriculture through development and promotion of irrigation practices for improving the livelihoods and food security of smallholder farmers in the area. Accordingly, the government and non-government organizations involved in the promotion of irrigation practice, for improving the livelihoods of smallholder farmers in the area (Awulachew, *et al.*, 2005). However, the existing irrigation practices do not exist without problems, and also no attempt was made to conduct a study to understand the problems they faced in the target area. The objectives of this study was, therefore, to assess existing irrigation practices, constraints and opportunities by emphasizing on small-scale irrigation schemes developed in the study area.

## Methodology

### Description of the study area

The study was carried out in Kersa, Meta, and Goro-Gutu districts of East Hararghe Zone of Oromia Region. The districts were selected purposively because of irrigation schemes have been promoted in the area by government and non-government organizations, for improving the livelihoods and food security of smallholder farmers. Apart from those, donors such as IFAD are also involved in irrigation schemes development and promotion in the selected area. The study was carried out in January and February, 2014.

Agriculture is the principal economic activity of that employed majority of smallholder farmers in the study areas. The majority of farmers rely on rain-fed agriculture, and few farmers that are privileged to use irrigation. The livelihood of the people is depending on both crop production and animal husbandry. The major crops produced in the area are maize, sorghum, wheat, barley and common bean. Vegetables such as potato, onion, head cabbage and carrot and fruits are also cultivated in the area using irrigation. Rivers, springs and ground water are the source of water for irrigation practice.

### Sampling procedure and sample size

The study was conducted in Kersa, Meta, and Goro-Gutu districts of East Hararghe Zone of Oromia Region. From each district, two Kebeles which was a total 6 Kebeles were selected purposively based on the promotion of small scale irrigation schemes for the intended purpose, and then, a total of 6 irrigation schemes were randomly selected to assess the existing irrigation practices, constraints and opportunities existed in the target irrigation schemes. Finally, a total of 160 irrigators were randomly selected using random sampling technique taking into account probability proportional to size of the irrigation user farmers in each of the selected irrigation scheme and participated as respondents in the household interview. In addition, group discussion was conducted with irrigators to prioritize constraints and opportunities existed in irrigation practice in the target area.

### Method of data collection

Data was collected from both primary and secondary sources. Primary data were collected using interview, key informant interviews, and focus group discussions held with irrigation user farmers using semi-structured questionnaire. Field observations were also made to assess the existing irrigation practices, constraints and management practices of the selected irrigation schemes. The secondary data were collected from district agricultural offices, and irrigation Authority offices.

### Method of data analysis

Descriptive statistics such as mean, frequency and percentage were used to analyze the collected data using statistical package for social sciences (SPSS). In addition, qualitative data was analyzed through ranking and discussed the result in descriptive way.

## Results and discussion

### Socioeconomic characteristics of the respondents

In terms of age composition of household members, about 40% of household members were within the ages of 21-65 years followed by 32%, which was bellow 15 years.  The study revealed that majority of household members (about 67%) is economically productive. This indicates the abundance of productive family labor force for agricultural and other related purposes. Hence, irrigators can be managed their irrigation farm fields using their labour (Table1). Regarding level of education, the majority of the households, 59% were illiterate followed by 23%, which was read and write. Majority of irrigators are illiterate (Table 1).

Table 1.  Socioeconomic characteristics of sample households in the study area

| Socioeconomic characteristics | Numbers | Percent |
|---|---|---|
| Household age structure (years of age) | | |
| Below 15 | 327 | 31.75 |
| 16-20 | 281 | 27.28 |
| 21-65 | 410 | 39.81 |
| Above 65 | 12 | 1.17 |
| Level of education of the household head | - | - |
| Illiterate | 94 | 58.75 |
| Read and write | 36 | 22.5 |
| Elementary school | 24 | 15 |
| High school complete | 6 | 3.75 |
| Sex of household head | - | - |
| Male | 149 | 93 |
| Female | 11 | 7 |
| Cooperative membership: Yes | 54 | 33.77 |
| No | 106 | 66.25 |

Source: Survey results, 2014

As shown in Table 1 the low levels of educational status mean that training would be required in extending irrigation farm technologies to the farmers as irrigation farming required intensive knowledge and skills (Table 1). Regarding marital status, about 94% of irrigators were married. In terms of sex, out of 160 irrigators interviewed in the 6 irrigation schemes, 93% were headed by males and only 7% were headed by females, and also most (66%) of the irrigators have not been a member of any cooperatives.

The average family size of the sample households in the study area was 5.45 persons, with minimum and maximum family size of 2 and 13, respectively. The average land holding size of the sample irrigators was 0.36 ha, and irrigated land holding of the sample households was 0.24 ha in the area (Table 2). Farmers mentioned that opportunities to expand irrigation land by accessing more land were quite difficult. Farmers mentioned that it would be difficult as plots near water sources have become relatively scarce getting more land for irrigation in the area.

Table 2.  Family size and land holding of sample households

| Socioeconomic indicators | N = 160 | | | |
|---|---|---|---|---|
| | Mean | Minimum | Maximum | S.D |
| Family size (number) | 6.55 | 2.00 | 13 | 2.73 |
| Total land holding (ha) | 0.36 | 0.125 | 0.44 | 0.32 |
| Irrigated land holding (ha) | 0.24 | 0.063 | 0.37 | 0.21 |

Source: Survey results, 2014        S.D= Standard deviation, ha=Hectare

### Water source and irrigation practices

The survey results revealed that the major water sources include seasonal and perennial springs, streams, private and communal wells, and ponds that can be used for irrigation and domestic purpose in the area. Sustainable water availability is essential to the success of any type of irrigation practices. In the study area, the most widely used water sources for small scale irrigation systems were perennial springs, streams, and wells for irrigation. Accordingly, 12 small scale irrigation schemes developed from seasonal

and perennial springs and streams water diversion, 1524 private wells, 24 community wells, and 15 community ponds are exist in the area which are used for irrigation and domestic purposes. With the help of these water sources, the farmers were able to produce crops twice a year from their farm land by diverting the streams and springs to their farm lands.

The result of the survey also revealed that different types of irrigation practices exist in the study area. These include irrigating farm lands by diversion of springs and streams, private walls and ponds. The farmers traditionally practice irrigated farming by diverting the available water resources such as springs, rivers, lakes and ground walls by traditional means. Before promotion of modern irrigation scheme, farmers in the area used to practice irrigation in their small plot of land by diverting springs, streams, rivers, lakes and ground walls using traditional means of irrigation. These farmers practice irrigation for the production of cash crops such as vegetable crops produced through irrigation for the purpose of market to generate household cash income.

Irrigation practices implemented in the study area are diverse, especially in terms of water sources, use, and structures developed. The small scale irrigation schemes developed from springs and streams, private and community wells, ponds and seasonal lake are exist in the area which are used for irrigation and domestic purposes. The sand dams and concrete canal springs and streams diversion common in the area. In addition, community based small-scale irrigation schemes developed by the involvement of the communities, government and non-government organizations are common in the study area.

In eastern Harargh Zone, irrigation schemes developed from diversion of springs, streams and seasonal rivers were among productive schemes observed in the study area that were developed by IFAD, CISP and ECC with the involvement of local communities. The schemes were developed by diversion of water from springs and used for vegetable production such as potato, pepper and head cabbage cultivation. Farmers participated in the development of the irrigation schemes by giving their land used to develop the schemes and canals.

In addition, some farmers had private walls in their farm fields developed by themselves used for irrigation during water scarcity in the study area. The irrigation water supply for crop farm was made available by pumping from the wells by installations of diesel pumps. Majority of farmers used motor pump to lift the water from the wells and irrigate their fields through flooding. Deep wells dug that have a depth from 8-30 meters are also main perennial water sources for farmers in the area. These deep wells are extensively used by farmers to irrigate small plots of land. The wells were developed in the farm fields of the irrigable farm land for ease of watering the irrigated crops. However, according to the perception of the farmers, owning of the water pumps, buying the fuel and maintenance of the motors were among the major challenges they faced. Moreover, some farmers use shallow walls dug for irrigation purpose using motor pumps, and commonly used for vegetable and Khat production in the study area.

Moreover, some farmers in the study areas, the major source of irrigation water is seasonal lake which is transported by motor pumps from lake by individual farmers. Those irrigation user households produced cash crops in dry periods using irrigation water. The main field crops grown using small-scale irrigation schemes in the study area are onion, tomato, potato and pepper. Generally, access to irrigation has been regarded as a powerful factor that provides a greater opportunity for cropping intensity, and crop diversification. This imply that a household who have access to irrigation scheme can cultivate twice or more in a year. Thus, irrigation increases the intensity of cropping and the most commonly produced irrigated vegetables are potato, cabbage, onion and carrot, and Khat in the study areas. In addition to water used for irrigation, local community collect water for human use and watering animals from irrigation schemes and canals are common in the study areas.

**Characteristics of the irrigation practices**

Most command area is below the springs point water is transported to irrigation field by gravity flow and irrigates their fields using furrow irrigation method. According to the, the overall potential of irrigable land using the available water of the area is 9,259 hectares of land, and 5,823 farmers have participated in the practice of irrigated agriculture in the area. The distribution and controlling of the irrigation water were undertaken by water distributor who is selected by the communities for serve them to get fair distribution of water and responsible for everyday operation of the scheme. In addition, in almost all study areas, the community used water sources for cooking, washing, and drinking.

**Irrigation methods**

Irrigation methods are the systems how to obtain water for irrigation purposes from its sources to the irrigation fields. Furrow irrigation method is dominant in the study area. The majority of the farmers are using furrow irrigation method to irrigate their crops using rotation principle, which is more labor-intensive. Farmers in study area mentioned that water levels in the dam and canal were too low during the dry season. This affects irrigation time and turns of irrigators, and they mentioned as problem. Even if farmers do not pay water fees, the extracted volumes of water from the scheme are restricted due to water

shortage and high irrigators, farmers cannot irrigate as much as they want. Farmers in mentioned that water levels in the schemes and canals were too low, particularly during the dry season.

### Farm input

The common features of irrigation practice in the study area are irrigable land scarcity and irrigation water shortage. Farmers were raised during focus group discussion shortage of water and irrigation land challenges faced irrigation user farmers. However, access to irrigable land through sharecropping and renting is a common practice in the area. Accordingly, landless farmers and those who own small plots access irrigation land through renting, sharecropping, and labor exchange. The result shows that the majority of farmers in the area have own irrigable land (74%) which inherited from their families. In addition, sharecropping (11%), renting (6%) and labor exchange (9%) are the most important source of irrigable land through which non-plot holders gained access to land in the area. Land allocation, on average 0.24 hectare of land were allocated for vegetable and other crops by irrigation users. The result shows that relatively more land allocated for vegetable crops by the irrigation users. Thus, access to irrigation facility may causes difference in land allocation for vegetable crops in the study area.

Farmers perceived that access to improved agricultural inputs such as quality seeds, fertilizer, and pesticides are vital. Awareness of the importance of using quality seeds and fertilizer appeared to be quite high among all farmers.  But, farmers in considered farm inputs such as seeds, fertilizers, and pesticides to be expensive and in the majority of cases not readily available at a time particularly seeds. The result revealed the majority of farmers responded that high price of fertilizer (42 %) is main constraint followed by shortage of improved seeds (30.5%) and lack of awareness on availability and usage of pesticides (27.5%).

### Cultivated crop products

In the study area, farmers use irrigation water for the production of cash crops than for the production of food grain crops. By using the irrigation water, vegetables crops such as potato, carrot, onion, cabbage, pepper, tomato and peppers are widely produced through irrigation for the purpose of market to increase household cash income in the study area, with maximum cash crop production intensity is two in a year in the study area. However, potato takes the lion's share in terms of number of farmers' involved and area coverage followed by head cabbage in the area.  This also results the negative aspects of such high degree of production concentration on one crop/lack of product diversification create competition among producers for market, which in most cases excess production supply during irrigation seasons as well as main seasons results in price decline. During group discussions the participants pointed out that potato production is most preferred by irrigation user farmers in the area. This is due to fast growing crop, it withstands short time moisture stress and diseases as compared to other vegetable crops, productivity, and market demands are reasons why the production of potato is most preferred. Farmers favor potato, carrot and cabbage due to high demand for these products, ability to sell year-round, better prices, higher profits and income.

Moreover, some farmers are also use irrigation water for Khat fields through intercropping with vegetable crops mainly potato and others also irrigate sole Khat fields for the purpose of cash income. Therefore, this indicated that small-scale irrigation development encourages farmers to produce cash crops because it directly influences the cash source. Moreover, farmers mentioned that implemented irrigation practice was increased diversification of crop production and intensification of land use practices in the area. In the area, farmers grow twice to three in a year.

### Irrigation water management practices

A field survey was conducted to identify major constraints related to access and utilization of irrigation water and management issues of irrigation schemes through group discussion, field observation and key informant interviews in the study areas. The result of the study revealed that irrigation schemes developed by government and non government organizations through community participation have been challenged by a number of problems such as land with access to water is scarce, water shortage, non-durability of the physical structure of irrigation schemes, poor sustainability of irrigation schemes due to maintenance problem, flooding, land slide, and institutional related problems. Irrigation user farmers pointed out that the major limitation to use irrigation water for crop production was the scarcity of irrigation water in the study area. Moreover, some farmers do not cultivate their all irrigable plots by using irrigation water due to shortage of irrigation water, and waiting for long days to get their turn for watering of planted crops.

The survey result indicates that out of the sampled irrigation user farmers, 96% responded that we didn't get enough water to irrigate the crop as required, and as a result they irrigate the planted crops twice per month and this significantly affected the crop yield. Accordingly, the survey results revealed that water

scarcity was the first most important reason for not obtaining the required quantity of water to irrigate the irrigable plots.

During group discussion, irrigation user farmers pointed out that the major limitation to use irrigation water for crop production was the scarcity of water in the study area. Farmers do not cultivate their all irrigable plots by using irrigation water due to shortage of water, and waiting for long days to get their turn for watering. The participant farmers are also identified and ranked major causes of water scarcity in the study area (Table 3). The participant farmers ranked increasing number of irrigation users ranked first followed by poor scheduling of distribution, diversion of water by traditional irrigators, loss of water due to seepage problem, declining of water from  source and inadequate coordination of water distribution are the main problems in small-scale irrigation systems in the study area. In addition, most of the irrigation user farmers complained about the scarcity of water in the scheme and short durability of the constructed schemes due to poor management of schemes and irrigation canals.

Table 3.  Pair-wise ranking of causes for irrigation water scarcity in the study area

| Causes for water scarcity | DW | IN | PS | SL | DI | PC | Score | Rank |
|---|---|---|---|---|---|---|---|---|
| Diversion of water by upper (DW) | | IN | PS | SL | DW | DW | 2 | 3 |
| Increasing number of users(IN) | | | IN | IN | IN | IN | 5 | 1 |
| Poor scheduling of distribution(PS) | | | | PS | PS | PS | 4 | 2 |
| Seepage loss(SL) | | | | | SL | PC | 2 | 3 |
| Declining of irrigation water (DI) | | | | | | DI | 1 | 4 |
| Poor        coordination    of    water distribution (PC) | | | | | | | 0 | 5 |

 Source: Field survey, 2014

On the other hand, limited knowledge of irrigation water management (irrigation scheduling, water saving irrigation technologies) makes irrigators inefficient in irrigation water use in the study area. All sample respondents of irrigation users (100%) said that irrigators have limited knowledge in irrigation water management and proper water saving irrigation technologies as a result farmers faced water shortage due to water loss. In addition, irrigation user households participated on group discussion also mentioned that traditional way of irrigation method is common to irrigate irrigable plots, and results loss of water and failing to meet plants' water needs. There are also water losses due to technical problems such as seepage affects the sustainability of irrigation schemes in the study area.

Moreover, flood, land slide and silt problems, are problematic and affects the sustainability of some irrigation schemes in the study area, which result in irrigation structures are damaged by floods (irrigation and canal filled by silt and /or washed out, water delivery of canal is decreased, and irrigation water scarcity existed).

**Handling and maintenance of the irrigation schemes in the area**

In the study area, handling operation and maintenance problems are found to be a major challenge to sustainability of the irrigation schemes. As shown in the Figure 1 the majority of the respondents (47.6%) said that handling and maintenance of irrigation schemes and canals was poorly managed followed by well managed (28.5%) and medium managed (23.9%), The sample irrigation user farmers also mentioned that maintenance problems of the irrigation schemes caused by lack of interest of the beneficiaries, lack of cleaning irrigation canals frequently, poor coordination of maintenance, flooding and damage by animals.
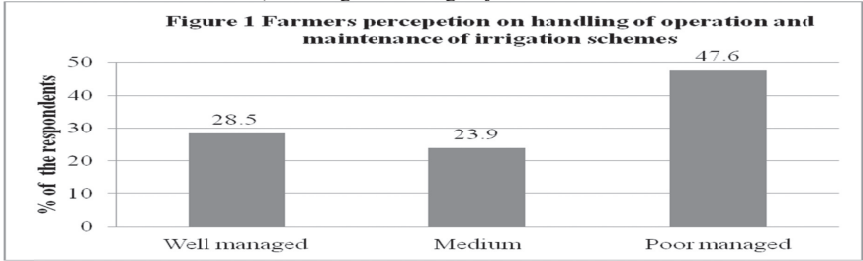


Source: Field survey, 2014

The study was also made an effort to identify existing opportunities for irrigation scheme development in the study area. Accordingly, existing opportunities for irrigation practices were identified through individual interview and group discussion. The participant irrigation user farmers were mentioned that

existing watershed management activity, good marketing opportunity for irrigated crops both at local and export markets, and farmers' indigenous knowledge in traditional irrigation practices were identified as major opportunities to develop and promote irrigation schemes for sustainable crop production in the study area.

## Conclusions and Recommendations

The study was conducted in East Hararghe Zone of Oromia Regional state with the objectives to assess existing situation of irrigation practices, constraints and opportunities of small-scale irrigation schemes constructed in the study area. The primary data were collected from 160 randomly selected irrigation user households using semi-structured questionnaire. The collected data analyzed using descriptive statistics. The results of the assessment revealed that the major water sources for irrigation scheme development include seasonal and perennial springs, streams, and wells that can be used for irrigation and domestic uses in the study areas. Furrow irrigation was a common irrigation method used by farmers to irrigate their farm fields with a significant water loss. The findings of the study also indicated that shortage of water and inefficient irrigation water management limit the cultivated land by applying irrigation water.

Moreover, increasing number of irrigation users, poor sustainability of irrigation schemes and canals due to flooding, land slide, and livestock damaged and limited knowledge in irrigation water management were found to be a major threats to sustainability of the irrigation systems in the area. On the other hand, limited knowledge of irrigation water management makes irrigators inefficient in irrigation water use in the study area. Irrigation users have limited knowledge in irrigation water management, and lacks of proper water saving irrigation technologies as a result farmers faced water shortage to irrigate their fields, and results loss of water and failing to meet plants' water needs. This is due to shortage of water as well as inefficient of irrigation water management were affect the sustainability of irrigation schemes in the study area.

In conclusion, strengthening of organizational structure of irrigation user farmers and their capacity, and promotion of irrigation water saving technologies should be given due emphasis to enhance irrigation water use efficiency in the area. Moreover, any effort in promoting small scale irrigation schemes, due attention should be given to promotion of proper irrigation water management practices, and awareness creation for tackling challenges faced by farmers in the area.

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# Analysis of Gender Participation in Production and Marketing of Bee Products in Ejere and Ada-Berga Districts of Oromia

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## Abstract

The study was conducted in Ejere and AdaBerga districts of West Shewa Zone, Oromia.  The objectives were assessing and analyzing the level and situation of gender participation in production and marketing of bee products. To carry out the study, purposive and simple random sampling procedures were employed to select village administrations and sample households respectively. Accordingly, 7 village administration and 116 respondents (8 women and 108 men) were selected. The primary data were collected through individual interview and group discussion using semi structured interview schedule and check lists. The collected data mainly consist the socio-economic profile of respondents, level of participation as well as constraints and opportunities of gender participation in production and marketing of bee products. The result obtained from the study revealed that the proportion of gender participation is inequitable as it is higher among the males than that of females. The level of female participation was low (27%), which mainly limited to a few activities (helping hive construction, colony feeding ant protection, honey storing and transporting to market and honey selling); while, otherwise they can participate in more

activities. According to obtained information, the main reasons for low participation of females can be categorized in to socio – cultural, socio – economic, personal (inter family issues) and biological. The socio – cultural factors were the construction of family structure (Cultural trend of family division of labor), low skill, un awareness of females regard to beekeeping, low access of females to beekeeping extension service delivery and information, influence of social taboos, and fear for bee sting. Socio – economic factors include, lack of working time due to home care responsibilities. Insignificantly, Personal (inter family issues) such as lack of interest and influence of male family heads are also the contributing factors. Biological factors such as maternity problem and unfitness of physical condition are also insignificantly contributing to the low participation of women. On the other hand, despite these constraining factors, there exist different opportunities towards enhancing the participation; amongst which the current concern of Ethiopian government and NGOs with respect to gender and development; existence of DAs in each site villages; the concern of HBRC in both districts are the majors. Hence it can be concluded that the factors which constraint the gender participation in production and marketing of bee products are not fundamental. It can also be recommended that recognizing women's role and enhancing efficient utilization of workforce of agricultural and/or apicultural family members (both male and female), ensuring sustainable development of women farmers' through accessing them to awareness, skill and knowledge of beekeeping practices through need based practical training, adoption of drudgery reducing technologies, promoting establishment of rural women self help groups might improve the situation.

## Introduction

In Ethiopia, prospects and policies regarding role, responsibilities and participation of women and men in agricultural practices have evolved significantly over recent years. Moreover, the realization of the development goals of the country requires the effective participation of population (both female and male citizens) through intensive gender participation in agricultural practices, of which apiculture is the one.

Apiculture is an agro – based industry and occupies an important position in Ethiopian economy owing to its development, production and marketing of bee products. Its manufacture comprising of bee colonies management, protection, production, post harvest handling and marketing of bee products. It also encompasses the development of bee forages, which in turn contributes to natural resource conservation. In addition, apiculture is relatively high employment potential as it can absorb wide range of agricultural house hold family members towards age, sex, educational level and available assets. Encouragement and enhancement of wide range age and gender participation is essential to efficiently utilize and to exploit the potential of the sector.

Gender among its broad term refers to social and cultural attributes that governs the performance of an individual roles, responsibilities and decision making abilities (Yeshi and Tewodros, 2009). Since a society is a construct of both women and men, they together have a share in the production of goods and .services. Amongst various activities of production of goods and services apicultural practice is the one which play essential role in agricultural sub sector.
But, according to UNDP 2002, gender roles and responsibilities affect food security and house hold welfare which are critical indicators of human development. But significant gender inequalities have been observed in access to key productive assets and services.

Different statistics indicate that in developing countries where gender inequalities in access to and control over resources are persistent, there is an imbalance in the work load and benefits sharing among women and men. This is true in Ethiopia in general and the study areas in particular, regarding apicultural sub sector of agriculture.
In recognition of these prospects, even though the districts of central high land Shewa in general and Ejere and AdaBerga districts in particular are known for the joint participation of male and female family members in agricultural activities, the proportion of gender participation in production and marketing of bee products is being observed inequitable as that the participation higher among the males than that of females.

To investigate the situation, extent and level of gender participation and to identify the degree and factors that constraint the fair participation of gender, the analysis of gender participation in production and marketing of bee products might be crucial and timely.
Hence, this study was under taken to analyze the gender participation scale in production and marketing of bee products in Ejere and Ada Berga districts of west shewa zone, Oromia.
## Objectives

### General Objectives

To assess the level and situation of gender participation in production and marketing of bee products in order to identify constraints and recommend possible ways for improvement

### Specific Objectives

☐ To identify gender role in beekeeping activities.
☐ To provide and secure benchmark data for further research towards development of the gender participation in apicultural sector productivity.

## Methodology

### Description of the Study Area

### Location

Ejere and Ada Berga districts are located 41 Km and 64 Km west of Addis Ababa respectively. Both districts share similar agro - ecology (mid altitude), other than Ada Berga has about 20% low altitude (kola) in mugher valley.

### Population:

According to statistical abstract of Ethiopian CSA, 2010, the total population of Ejere district was 97,635 of which 47658(48.8%) were females and 49,977 (51.2%) were males. The total land area of the district is 581.04 km2 and crude population density is estimated at 118 persons per km2 .The total population of Ada Berga district was 131,588 of which 65,729(49.9%) were females and 65,859 (50.01%) were males. The total land area of Ada Berga is 581.04 km2 and crude population density is estimated at 103 persons per km2.

### Agriculture and Land Utilization

As an average, for both districts, the proportion of arable land was 60.2%, pasture 20%, forest (including bushes and shrubs) 9.3%, while the rest 10.5% accounted for degraded, built-up and other areas.

### Apiculture

According to office of agriculture and rural  development of both districts the estimated numbers of bee hives with colonies in Ejere district were about 580 colonies with traditional , 504 colonies with transitional and 141 colonies with modern box hives. In Ada Berga, there were about 670 colonies with traditional, 532 colonies with transitional and 120 colonies with modern box hives.

### Sampling Techniques and Data collection

### Sampling Techniques

Different sampling procedure was employed to select study sites and sample households.  In the first stage, among 11 districts of west Shewa, two districts (Ejere and AdaBerga) were selected using purposive sampling techniques. In the second stage, 8 Village administrations (3 from Ejere and 5 from AdaBerga)) were selected based on population size of each district and using simple random sampling technique. Sample respondents were selected using systematic random sampling method. The total sample size was 116 households of which 108(93%) were male and 8 (7%) were females.

### Data Collection Techniques

Data collection was undertaken using a semi-structured interview schedule. Besides, individual interview, participatory group discussion was conducted to have in depth understanding of certain cross-cutting issues. Secondary information was also collected from respective district office of agriculture, rural development and CSA.

### Types and Sources of Data

The primary data sources were beekeepers from both sexes. Whereas the secondary data was collected from published and unpublished sources, departments of district agriculture.

### Collected Data

The collected data and information consist of different dependent and independent variables which might indicate the scale and situation as well as the constraints and opportunities of gender participation in production and marketing of bee product in the study areas.

### The majors were:

☐ The socio-economic profile of respondents,
☐ Level of gender participation in production and marketing of bee Products.
☐ Access to and control over income obtained from beekeeping
☐ Reasons, constraints and opportunities of gender participation in production and marketing of bee products.

## Methods of Data Analyses

The obtained study data were analyzed and presented using different statistical tools. The differences of qualitative responses were tested through pair wise ranking matrix and rank correlation analysis.

## Result and Discussion

### Socio-Economic Profile of Population

In this section, summary table 1 presents the size of agricultural population and apicultural holding size. The populations of both districts were 229,223 of which 113,706(49.60%) were females and 115,517(50.39%) were males. Of the total population of agricultural households, 1428 people (39 females and 1389 males) keep bees. This indicates that amongst total beekeepers of both districts, the rate of female beekeepers is 2.8%, and of male beekeepers is 97.2%.

*Table 1: Size of population regard to agricultural and apicultural holdings*

| No | District | Sex | Total agricultural population | | Beekeepers | | Total holding of bee colony | | |
|----|----------|-----|--------|------|------|--------|-------------|--------------|--------|
| | | | No | % | No | % | Traditional | Transitional | Modern |
| 1 | Ejere | Both sex | 97635 | 100 | 665 | 0.681 | 586 | 508 | 133 |
| | | Female | 47977 | 48.8 | 14 | 0.0291 | 6 | 4 | 5 |
| | | Male | 49658 | 51.2 | 651 | 1.310 | 580 | 504 | 128 |
| 2 | AdaBerga | Both sex | 131588 | 100 | 763 | 0.579 | 690 | 499 | 99 |
| | | Female | 65729 | 49.95 | 25 | 0.038 | 25 | 15 | 4 |
| | | Male | 65859 | 50.01 | 738 | 1.120 | 665 | 484 | 95 |
| Total | | Both sex | 229223 | 100 | 1428 | 0.622 | 1276 | 1007 | 232 |
| | | Female | 113706 | 49.6 | 39 | 0.034 | 31 | 19 | 9 |
| | | Male | 115517 | 50.39 | 1389 | 1.202 | 1245 | 988 | 223 |

*Source: statistical abstract of Ethiopian CSA, 2010 and survey result*

### Distribution of Sample Village Administration and Respondents with their respective Districts

Amongst eleven districts of west shewa zone, two districts (Ejere and Ada Berga) were selected. and 3 Village administration from Ejere (Kimoye, Kusaye and Chiri); five Village administration from AdaBerga (Gatira, Chane, Haro Boro, Reji Mekoda and Sambero Sago ) were selected. Accordingly, 60 sample respondents (58 male and 2 female beekeepers) and 58 sample respondents (50 male and 6 female beekeepers) were selected from Ejere and Ada Berga respectively.

Here, it is clearly seen that the number and proportion of female respondents is few. This is because of that the number of women beekeeper family heads was relatively few in both districts. Despite, since the interview schedule was designed as it can participate both sexes to express the situation of level of their participation as well it did not affect the process and objectives of the intended study. This is due to the response gotten from un selected women.

Table 2 *Distribution of Sample Village administration and Respondents with their Respective Districts*

| District | PA | Number of Respondents | | | % | |
|----------|-----|------|--------|-------|------|-------|
| | | Male | Female | Total | M | F |
| Ejere | Cirrii | 19 | 1 | 20 | 95 | 5 |
| | Kimoye | 19 | 1 | 20 | 95 | 5 |
| | Kusaye | 20 | 0 | 20 | 100 | 0 |
| | **Ejere Tota L** | **58** | **2** | **60** | **96.6** | **3.3** |
| Adaberga | Gatira | 16 | 4 | 20 | 80 | 20 |
| | Chane Birate | 15 | 1 | 16 | 93.7 | 6.25 |
| | Haroo Boroo | 4 | 0 | 4 | 100 | 0 |
| | Rejjii Mekoda | 5 | 1 | 6 | 83.3 | 16.6 |
| | Sanbaro Sago | 10 | 0 | 10 | 100 | 0 |
| | Adaberga Total | 50 | 6 | 56 | 89.2 | 10.71 |
| Grand Total | | **108** | **8** | **116** | **93.1** | **6.9** |

**Sample Respondents by Age, Sex, Apicultural Holding Size and Year of Experience**

Summary table 3 below shows the profile of sample respondents. According to the study result, among 116 respondents of both districts, 8 (7%) were female beekeepers with 33, 13 and 11 traditional, transitional and modern bee hives with bee colonies respectively. There were also, 108(93%) male beekeepers with 317, 75 and 145 traditional, transitional and modern bee hives with bee colonies respectively.

**Table 3** *Sample Respondents by age, sex, apicultural holding size and year of experience.*
*Source: Survey result*

| District | Sex | Age | | | | Beehives with colony | | | Experience year of beekeeping | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -20 | 21-40 | 41-60 | 60+ | Tradit ional | Trans itiona l | Moder n | NO | 1-10 | 10-20 | 20-30 |
| Ejere | F | 0 | 0 | 1 | 1 | 4 | 0 | 0 | 0 | 1 | 1 | 0 |
| | M | 0 | 33 | 22 | 3 | 56 | 44 | 78 | 1 | 32 | 15 | 10 |
| AdaBerga | F | 1 | 2 | 3 | 0 | 29 | 13 | 11 | 0 | 4 | 2 | 0 |
| | M | 0 | 12 | 23 | 15 | 146 | 31 | 0 | o | 18 | 7 | 25 |
| G/Total | F | 1 | 2 | 4 | 1 | 33 | 13 | 11 | 0 | 5 | 3 | 0 |
| | M | 0 | 45 | 45 | 18 | 202 | 75 | 145 | 19 | 39 | 40 | 10 |
| | Total | 1 | 47 | 49 | 19 | 235 | 88 | 156 | 19 | 44 | 43 | 10 |

The above summary result indicates that the female to male percentage ratio of holding traditional, transitional and modern bee hives with colony was 14:86, and 15:85 and 7:93 respectively. This result also indicates that the age of female beekeepers who actively participate in beekeeping activities range -20 to 6o where as that of male beekeepers range 21 to 60+ years of age.
On the other hand, the maximum years of beekeeping experience of female and male beekeepers was 14 and 50 and minimum was 2and 1 respectively.

**Marital Status and Level of Education of Sample Households**
*Table 4 .Marital Status and Level of Education Of Sample Households*

| Distri ct | Sex | Marital status | | | | | Educational level | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Not Mar ried | Marrie d | Divo rced | Wido wd | Total | Illi ter ate | Functional literate | Primary school ( 1 - 8) | Above primary (> 8) | Total |
| Ejere | F | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 2 |
| | M | 11 | 47 | 0 | 0 | 58 | 16 | 37 | 5 | 0 | 58 |
| | | 11 | 47 | 0 | 2 | 60 | 0 | 0 | 0 | 0 | 0 |
| AdaB erga | F | 1 | 4 | 0 | 1 | 6 | 3 | 2 | 1 | 0 | 6 |
| | M | 6 | 46 | 0 | 0 | 52 | 22 | 20 | 8 | 0 | 50 |
| | | 7 | 50 | 0 | 1 | 58 | 0 | 0 | 0 | 0 | 0 |
| Total | F | 1 | 4 | 0 | 3 | 8 | 5 | 2 | 1 | 0 | 8 |
| | M | 17 | 93 | 0 | 0 | 108 | 38 | 57 | 13 | 0 | 108 |
| | | **18** | **97** | **0** | **3** | **116** | **43** | **59** | **14** | **0** | **116** |

*Source: Survey Result*

Generally, marriage is basic to family formation and educational level also another social characteristic and both may possibly affect the participation scale of individuals in agricultural activities in general and apiculture in particular.
Hence, in both study areas, information was collected on both dependent variables to investigate their influence on the scale of participation with respect to gender. Accordingly amongst the contacted sample female beekeeper respondents 50% were husbanded and 50% were single due to different reasons. Generally since relative number of women with young and middle age are husbanded in most society, the above an equal ratio may indicate that relatively husbandless women tend to keep bees to maintain and hold up their familys' livelihood .
Regarding men, those who are married keep bees and this may possibly due to main responsibility and trend of community division of labour.  On the other hand, for both sex, education level has no significant effect to keep bees. The level of education has insignificant influence towards level of participation.
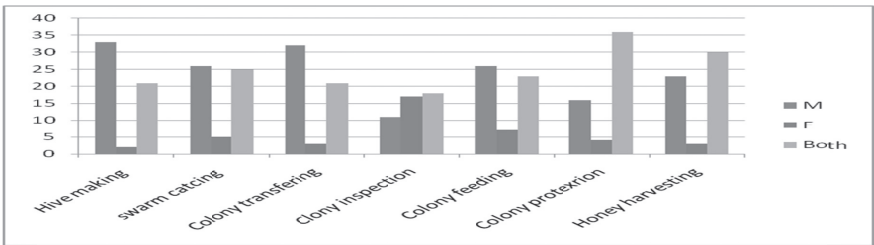**Gender Participation Status in Production and Marketing of Bee Products**
**Gender Participation Status in Production of Bee Products**

All respondent farmer beekeepers (both male and female) in both study districts were interviewed regarding their participation in the production of bee products. Even though there exist various activities of production of bee products, for this study, seven, main activities (hive making, swarm catching, colony transferring, colony feeding, colony inspection, colony protection and bee product harvesting) were selected and the degree of gender participation in the selected activities was also analyzed for each study districts separately and for both districts together and presented in the following tables and figures.

*Fig 1. Proportion of Gender Participation Status in Production of Bee Products in Ejere district.*
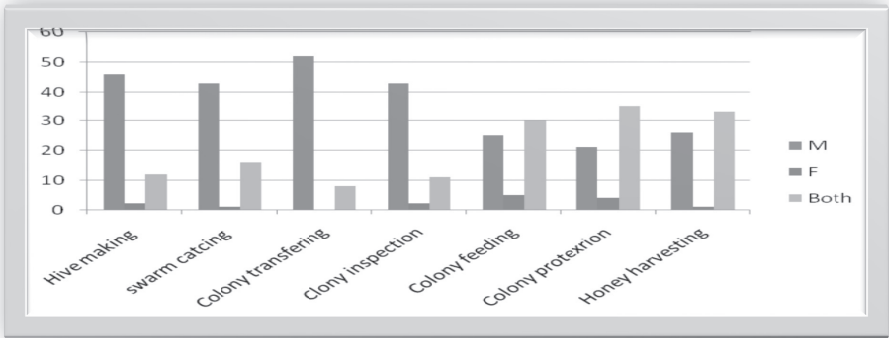


*Fig 2. Proportion (%) of Gender Participation Status in Production of Bee Products in AdaBerga district.*



*Fig 3. Proportion of Gender Participation Status in Production of Bee Products in both districts*
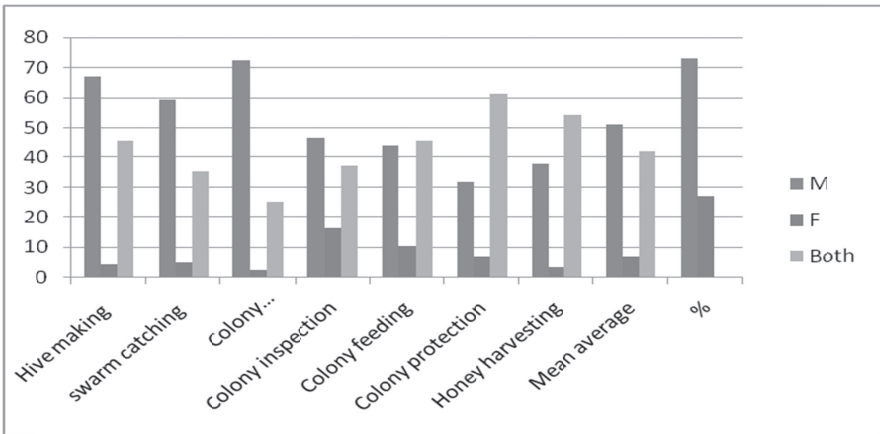


According to the result of the study, proportion of participation of men in production of bee products is higher (73%) than that of women (27%), more or less by three fold. The participation of women is limited to few activities and low in all activities of production. All sample respondents (both sex) were informed the status of gender participation not only with respect to their personal sex category, but also taking in to account of the participation of their family members (both male and female), and so, the obtained data could validate the participation of both sex in both districts.

According to the result of the study, the proportion of participation of men in production of bee Products is higher (73%) than that of women (27%) by more or less three fold. Men participate in all most all activities of producing bee products while participation of women mainly limited to a few activities (helping hive construction, colony feeding ant protection, honey storing and transporting to market).

**Gender Participation Status in Marketing of Bee Products**

All respondent farmer beekeepers (both male and female) in both study districts were interviewed regarding their participation in the marketing of bee products. Even though there exist various activities of marketing of bee products, for this study, six main activities (honey storing, honey transporting, honey selling and control over income of honey sell) were selected. The degree of gender participation in the selected activities was also analyzed for both districts together and presented in the following tables and figures.

*Fig 4: Proportion of Gender Participation Status in Marketing of Bee Products in both districts*
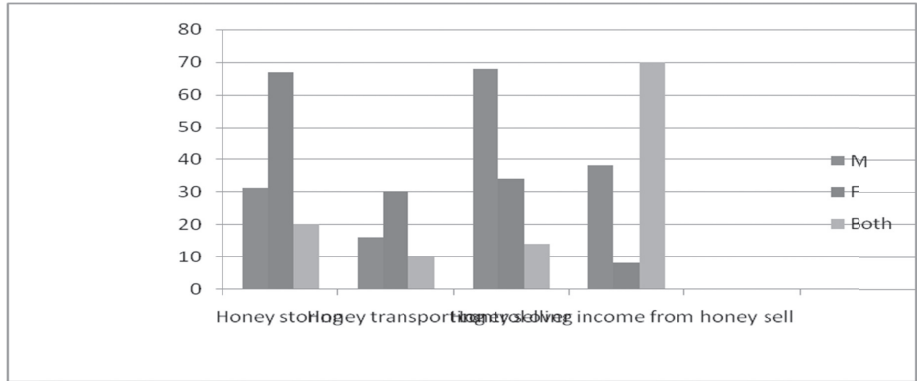


The proportion of participation of men in marketing of bee products is 51.73 whereas that of women is 48.26.The participation of women is high than men in two activities (honey storing and honey transporting to market) and low in honey selling and control over income from honey sell. Weighing gender participation status in production of bee Products against marketing activities, the level of participation is fair in marketing activities than production activities.(See table 10 and figure 7 below )

**Group Discussion on Gender Participation Status in Production and**

**Marketing of Bee Products**

During the study time, further than analyzing the degree of gender participation in production and marketing of bee products through individual interview, group discussions were also held to expand the reliability of information.

Accordingly, group discussions were held in two selected Village administrations from both districts (Kimoye of Ejere district and Sambero sego of Ada Berga district). The participants of the discussion were men and women key informants, development agents, and local leaders of both Village administrations at their local village. The participants were invited to forward different information regarding gender participation in production and marketing of bee products at their respective areas. The mainly focused issue was the level of gender participation in production and marketing of bee products and they rank as presented in table 7 and 8 respectively.

The result of group discussion revealed that the level of participation of females in production of bee products in Ejere district is 29% fair,57%low,and 14% no participation. But in AdaBerga district, the level of participation of females in production of bee products 43% fair and 57% low

*Table 10 Weight of gender participation status in production of bee Products against marketing*

| District | Sex | Activities and participation level(%) | |
|---|---|---|---|
| | | Bee product proion P | Bee product  Marketing |
| Both | Female | 27 | 48.27 |
| | Male | 73 | 51.73 |

Regards to the level of participation of females in marketing of bee products, the result of group discussion revealed that in Ejere district is 29% fair,57%low,and 14% no participation. But in AdaBerga district, the level of participation of females in production of bee products 43% fair and 57% low. Here it can be suggested that the level of participation of females in marketing of bee products, is fair than in

production activities and also the level of participation of females of AdaBerga district is relatively superior than that of Ejere in marketing of bee products,

**Figure 7** *Proportional Weight of gender participation status in production of bee Product against marketing*
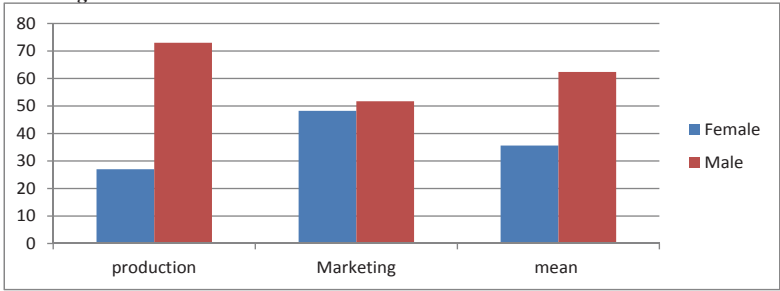


Based on the result of the information obtained from the group discussion that reveal the low participation of women in production of bee products, the participants of both districts were invited to list the possible reasons for low participation. Accordingly, the listed possible reasons were summarized and analyzed using pair wise ranking and presented below.

**Possible Reasons**
1. Lack of awareness
2. Lack of knowledge and skill of beekeeping practices
3. Lack of interest of women
4. Biological factors (Maternity)
5. Lack of beekeeping extension service
6. Fear of sting and hard ship
7. Influence of male family head
8. Trend of inter family division of labor and influence of social taboos
9. Lack of physical fitness due to low experience

According to rank correlation analysis of the listed possible reasons were summarized and analyzed using pair wise ranking and presented below.

**Rank correlation analysis between the study districts**

| No | Possible reasons | Rank | | Di | Di2 |
|----|------------------|------|--|-----|------|
| | | Ejere | Ada Berga | | |
| 1 | Lack of awareness | 9 | 9 | 0 | 0 |
| 2 | Lack of knowledge and skill of beekeeping practices | 1 | 2 | -1 | 1 |
| 3 | Lack of interest of women | 6 | 5 | 1 | 1 |
| 4 | Biological factors | 4 | 3 | 1 | 1 |
| 5 | Lack of beekeeping extension service | 3 | 4 | -1 | 1 |
| 6 | Fear of sting and hard ship | 7 | 7 | 0 | 0 |
| 7 | Influence of male family head | 8 | 6 | 2 | 4 |
| 8 | Inter family trend of division of labor and influence of social taboos | 2 | 1 | 1 | 1 |
| 9 | Lack of physical fitness due to low or no experience | 5 | 8 | -3 | 9 |
| | | | | | 18 |

**Rank correlation analysis between the study districts**

r' = 1 – 6($\sum$Di22)/n(n2 – 1 )
     = 1 – [6(18)/9(80 )]
     = 1 – [108/720]
      = 1 – 0.15
      = 0.85

The rank correlation analysis between two study sites show that the relation of causes of 85% and this can be an evidence for sensible similarity of constraints of fair gender participation in production and marketing bee products in the study areas.

Amongst the analyzed reasons the four important were also and substantiated as follows through categorizing in to socio – cultural, socio – economic, personal (inter family issues) and biological.
 Socio – cultural factors

☐ Cultural trend of family division of labor

☐ Influence of social taboos which guesstimate as that female have no and cannot undertake beekeeping practices

☐ Female's low access to, beekeeping extension service delivery, lack of skill.

**Socio – economic factors**

☐ Lack of working time due to home care responsibilities

**Personal Factors**

☐ Insignificantly, Personal (inter family issues) such as lack of interest and Influence of male family heads are also the contributing factors.

**Biological factors**

On the other hand, biological such maternity problems and insignificantly unfitness of physical condition (especially through lack of regular exercise) are also contributing factors.

**Conclusion**

Gender participation in production and marketing of bee products in the study areas is inequitable as that the participation higher among the men than that of women. Clearly, gender inequities in rural agricultural in general and apicultural practices in particular lie at the root of food insecurity and this may crucially inviting issue to be addressed very initially through some recommendation of this study and ultimately through further research and policy reform.

The findings of the study show that the proportion of gender participation in production and marketing of bee products is inequitable as that the participation is higher among the men (73%) than that of women (27%) by more than two fold. The participation of women mainly limited to a few activities (helping hive construction, ant protection, and colony inspection and feeding.

On the other hand, regarding participation in marketing activities, the participation of women is fair (43%) against that of men (57%).

According to obtained information, the main reasons for low participation of females can be categorized in to socio – cultural, socio – economic, personal (inter family issues) and biological factors. The socio – cultural factors were the construction of family structure (Cultural trend of family division of labor), low skill, un awareness of females regard to beekeeping, low access of females to beekeeping extension service delivery and information, influence of social taboos, fear of bee sting.

Socio – economic factors include, lack of working time due to home care responsibilities. Biological factors such as maternity problems, unfitness of physical condition (especially through lack of regular exercise) also insignificantly contribute to the low participation of women. Personal (inter family issues) such as lack of interest and influence of male family heads are also insignificantly contributing factors..

In addition to the above factors, amongst rural society of the study areas, the division of labor in beekeeping practices is complex and not well defined. Women do not have as many opportunities as men for access to beekeeping information, training, extension services and they lag behind men in terms of participating in community mobilization beekeeping extension service delivery and they have little control on resources or income released from sales of bee products. As a result the participation women could have a little impact for the development of the sector towards additional family income generation, household food security and poverty alleviation. Hence, it is indispensable to recommend some principal ways of improving the situation.

**Recommendations**

Currently, the initiatives by Ethiopian government provide the much needed to women access to back yard off- farm economy, of which beekeeping practice is the one. But the participation of women in the production and marketing of bee products is not reasonable and acceptable. According to different studies and information, some main points can be recommended to improve gender participation in production and marketing of bee products.

The possible recommendations that could be given on the basis of this study, so as to be considered in the future intervention strategies which are aimed at the promotion of gender as well as development of women participation in production and marketing of bee products might be the followings.

1. Recognizing gender's role and enhancing efficient utilization of workforce of agricultural and/or apicultural family members (both male and female).
2. Agricultural households, policy makers and development workers should have a clear understanding of the relative and shifting roles and responsibilities of women and men in production and marketing of bee products.
3. Improving social and intra – family trend of traditional knowledge and practices that disregard the role of female members of rural apicultural families.

4. This can be possible through augmented and sustainable consideration and efforts of agricultural households, policy makers and development workers to create awareness towards development of intra – family division of labor and decision making opportunities.
5. Ensuring sustainable development of women farmers' through accessing them to awareness, skill and knowledge beekeeping practices through training.
6. There should be need based practical training on transitional and modern beekeeping activities which ought to be a mandatory component of all agricultural training.
7. Providing rural women easy access to extension service delivery uniformly with men as much as possible.
8. It is necessary to include beekeeping extension service in the entire agricultural extension delivery system, so that women's and men's needs and priorities become part of policies of mainstreaming gender in apicultural practices. In addition, the beekeeping extension ought to comprises a lesson of transforming traditional attitude that challenge participation of women in apicultural activities to enhanced social and intra – family outlook that promote the participation.
9. Emphasis on adoption of drudgery reducing technologies.
10. This might be valuable to save working time and unnecessary energy to improve the efficiency and physical input of women.
11. Empowering rural women through promoting establishment of rural women self help groups, so that they can be better accessed to beekeeping extension services, practical trainings and information.
12. Finally, it is strongly suggested that it is necessary to conduct further research within different agro - ecologies to generate more concrete and detailed data that would be more effective and practical from development point of view.

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## Apiculture Socio-Economic Survey in Selected Zones of Oromia and Sub Cities of Addis Ababa

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**Abstract**

The study was conducted to assess the potential of improved honey bee production in addressing food security and poverty challenges at household level within some selected regions of Ethiopia (Oromia and Addis Ababa). Socio-economic interviews, field surveys and participant observations were used to collect required information from the study area. The survey was under taken with the major objective of assessing and identifying potentials, major production constraints, opportunities and socio–economic circumstances of apiculture in Oromia and A.A. The study was conducted in three sub – Cities of Addis Ababa ( Yeka, Lafto, and Qirqos) and in 12 districts of 6 zones of Oromia region (E/Shewa, Bale, Guji, S/W/ Shewa, Jimma and H/G/Wollega) using semi – structured questioner for individual interview and check lists for group discussion. Accordingly, primary data was collected from beekeepers and non beekeepers from both sex (210 participants through group discussion, and 62 participants through individual interview). The data also gathered from 71 respondents (bee experts of zonal and district level, honey processors, honey traders, bee equipment producers and/or suppliers, consumers using semi - structured questionnaire. The interim result of the survey revealed that, among the common constraints of beekeeping, low skill of beekeeping practice, low quality and high price of bee equipments, unavailability of modern equipments, careless and unwise practice of agro – chemicals application, shortage of bee colony swarm, absconding of bees, bee pests and diseases particularly birds, shortage of bee forage plants. On the other hand the available opportunities are suitable climatic of the region, current attention of government and NGos towards bee culture development, involvement of bee research centre.
**Key words:** Potentials, Constraints, Opportunities,

## Introduction

In recent decades, many communities within rural areas of developing countries have faced crises of poverty and food security (Foster1992). These are the result of complex interactions between environmental and socio-economic factors which have directly affected lives of millions of people. Agriculture is the main activity which has employed most of rural households for food production and generating their income (FAO 2004).

According to Ellis (1988), communities in developing countries are more vulnerable to climate change impacts due to their high exposure to natural hazards, their direct dependence on climate sensitive resources such as plants, trees, animals, water and land, and their limited capacity to adapt to and cope with climate change impacts. Building the resilience of affected people so they can respond positively to these changes requires helping people to cope with current change, adapt their livelihoods, and improve governance systems and ecosystem health so they are better able to avoid problems in the future (DFID 2002). This means that vulnerable people need to be helped in various ways such as getting access to support programs and adaptive practices. As observed by Koirala and Thapa (1997), food security is not possible without income security.

Clearly, it is likely possible to maintain substitiyute for means of livelihood. Beekeeping is one of best practices that have been recognized to improve livelihood of poor farming communities without much investment cost (Baptist and Punchihewa1983). Apart from being consumed as food, bee products, especially honey, propolis and bee pollens, have long been used in traditional medicine. Based on these concepts these study is proposed to asses and identify potentials, major production constraints and opportunities of apiculture in Oromia region and Addis Ababa city.

According to CSA, (2005), in the Ethiopia, number of bee colonies, weigh against to other live stock population is 4.01%, 5.45%, 0.3% for the country, Oromia and Addis Ababa respectively. From this above information, it can be noticeably seen that there exists dearth of small and /or large scale investment on apiculture.

Even though beekeeping is one of the important and the oldest farming activities in Ethiopia, its' production constraints and productivity opportunities are not well assessed, identified and documented.

In fact, there are some common survey works in Oromia and Addis Ababa. But the works were pay attention on particular issues of honey production system of a few zones in Oromia and pest and disease survey in Oromia and AA.

However, there is a gap regarding over all apiculture socio- economic circumstance in the country in general and in Oromia and Addis Ababa in particular. Currently production system and productivity of apiculture are not well identified; there is a dearth of investment on apiculture, there exist little or no literatures concerning apiculture socio economics.

The possible challenge for apicultural researchers might be the unavailability of basic information about socio–economic aspect of apiculture. This may make the prioritization of apicultural research area difficult. For these and other cases Oromia regional state and A.A city administration are not exceptional.

Moreover, Oromia with high potential of bee culture has not been benefited from the sector and Addis Ababa city administration also shares the gaps.

Hence, this study was proposed to study Apiculture Socio – Economic situation in Selected Zones of Oromia and Sub Cities of Addis Ababa. Clearly, there were no deep study of apiculture socio – Economics and therefore there were difficulties of receiving information easily.

Even though there was no deep study of apiculture socio – Economics in the country this study was believed to initiate deep study of the subject matter with the following objectives.

## Objectives

### General Objective

‣ To asses and identify potentials, major production constraints and opportunities of apiculture in Oromia region and Addis Ababa city

### Specific Objectives

‣ To asses and characterize potentials, constraints and opportunities of beekeeping Production, productivity and bee product marketing.

‣ To generate information on constraints and opportunities of beekeeping production

## Methodology

## Location of the Study

The study was conducted in three sub – Cities of Addis Ababa (*Yeka, Lafto, and Qirqos*) and twelve districts of six zones of Oromia region (*E/Shewa, Bale, Guji, South West Shewa, Jimma and Horro Guduruu Wollega*).

## Sampling Techniques

Different sampling procedure was employed to select study sites and sample households.  In the first stage, among sub cities of Addis Ababa (Yeka, Lafto, and Qirqos) sub cities and among    zones of Oromia, six zones(E/Shewa, Bale, Guji, South West Shewa, Jimma and Horro Guduruu Wollega)   were selected using purposive sampling techniques. In the second stage,two district/ one sub city of Addis Ababa, two districts/ zone and two Village administrations/ district of Oromia were selected  using simple random sampling technique.

## Methods of Data collection

Primary data was collected from beekeepers and non beekeepers participants from both sex, (207 male and 17 female) through group discussion, and 66 respondents (60 male and 6 female through individual interview).
The data also gathered down from 58 relevant respondents (bee experts of zonal and district level, honey processors, honey traders, bee equipment producers and suppliers, consumers,honey brokers)  using  semi - structured questionnaire.
Secondary data were obtained from published and unpublished sources, population and housing census reports, federal and regional respective organizations   using semi – structured questioner for individual interview and check lists for group discussion.
Data collection was undertaken using a semi-structured interview schedule. Besides, individual interview, participatory group discussion was also conducted to have in-depth understanding of certain cross-cutting issues. Secondary information was also collected from respective district office of agriculture, rural development and CSA.

## Types and Sources of Data

The primary data sources were beekeepers from both sexes. Whereas the secondary data was collected from published and unpublished sources, departments of district agriculture.

## Collected Data

The collected data and information consist of different dependent and independent variables which might indicate the scale and situation as well as the constraints and opportunities of gender participation in production and marketing of bee product in the study areas.

## The majors were:

- ☐  The socio-economic profile of respondents, and the study area
- ☐  Constraints and opportunities of beekeeping
- ☐  Access to and control over income obtained from beekeeping
- ☐  Potentials, constraints and opportunities of gender participation in production and marketing of bee products

## Methods of Data Analyses

The obtained study data were analyzed and presented using different statistical tools. The differences of qualitative responses were tested through pair wise ranking matrix and rank correlation analysis.

## Result and Discussion

This section presents the descriptive and qualitative analysis part of the survey. The descriptive part explains the general characteristics of sampled respondents while the qualitative analysis describes the potential, constraints and opportunities of apiculture in Oromia region and Addis Ababa city administration. The collected primary and secondary data and the revealed result of the study is presented partitioned by different category of participant respondents as follows.

1. Beekeepers
2. Non beekeepers
3. Bee experts and Development Agents
4. Honey and Wax Processors
5. Bee Equipment Producers and Suppliers

6. Honey and Wax Traders
7. "Tej" Makers
8. Honey and Wax Brokers
9. Consumers

**Participants Distribution of the Survey by Zones And Sub -Cities**

**Addis Ababa**

In three sub-cities of Addis Ababa *(Yeka, Qirqos,Nifas Silk Lafto )*, individual interview was held with beekeepers (6 male and 2 females) and also group discussion was held with (13 male and 2 females) totally 19 male and 4 female beekeepers and 2 male non beekeepers were participated in group discussion and individual interview

**Oromia**

Regarding Oromia, Primary data was collected from farmer beekeepers and non beekeepers, bee experts of district level, honey processors, investors, honey traders, bee equipment producer and final consumers. Totally the survey was held in 12 districts of 6 zones of Oromia (*East Shewa, Bale, Gujii, South West Shewa, Jima, Horro-Guduruu Wallega*).
Individual interview was held with beekeepers (60 male and 4 females) and also group discussion was held with (195 male and 15 female) totally 273 male and 23 female beekeepers were participated in group discussion and individual interview. *(See table 1 and 2 below)*

*Table 1 Participants of group discussion and individual interview in Addis Ababa Sub cities*

| NO | LOCATION/Region and Zone | Beekeepers | | | | Non Beekeepers | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | Group Discussion | | Individual Interviewees | | | | | |
| | | M | F | M | F | M | F | M | F |
| 1 | **Addis Ababa** | | | | | | | | |
| 1.1. | Yeka Sub city | | | 2 | 0 | 1 | 0 | 2 | 0 |
| 1.2. | Qirqos Sub city | | | 1 | 1 | | 0 | 1 | 1 |
| 1.3. | Nifas silk Lafto sub city | | | 1 | 1 | 1 | 0 | 1 | 1 |
| 1.5. | A.A.        Beekeepers Association | 13 | 2 | 1 | 0 | 0 | 0 | 13 | 2 |
| | **Addis Ababa total** | **13** | **2** | **6** | **2** | **2** | **0** | **21** | **4** |

*Table2: Participants of group discussion and individual interview in Oromia*

| 2 | Zones of Oromia | Group Discussion | | Individual Interview | | Non beekeepers | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | M | F |
| 2.1. | East Shewa Zone | 32 | 5 | 10 | 2 | 2 | 0 | 44 | 7 |
| 2.2. | Bale Zone | 39 | 4 | 10 | 0 | 2 | 0 | 49 | 4 |
| 2.3. | Guji Zone | 26 | 5 | 10 | 2 | 1 | 0 | 36 | 7 |
| 2.4. | South West Shewa Zone | 34 | 1 | 10 | 0 | 1 | 0 | 44 | 1 |
| 2.5. | Jimmaa Zone | 29 | 0 | 10 | 0 | 0 | 0 | 39 | 0 |
| 2.6. | Horro Guduruu W. | 35 | 0 | 10 | 0 | 0 | 0 | 45 | 0 |
| | Oromia Total | 195 | 15 | 60 | 4 | 6 | 0 | 257 | 19 |

*Table3: Participants of group discussion and individual interview (both regions)*

| No | Region | Group Discussion | | Individual Interview | | Non beekeepers | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | M | F |
| 1 | Addis Ababa | 13 | 2 | 6 | 2 | 2 | 0 | 21 | 4 |
| 2 | Oromia | 195 | 15 | 60 | 4 | 6 | 0 | 257 | 19 |
| | T0tal | 208 | 17 | 66 | 6 | 8 | 0 | 278 | 23 |

*Tble4: Summary of Relevant Participant respondents of both study regions*

| Region | M | F | Total |
|---|---|---|---|
| Addis Ababa | 15 | 6 | 21 |
| Oromia | 25 | 12 | 37 |
| Total | 40 | 18 | 58 |

## Socio-Economic Characteristics of the Sample Households

### Family Size

Family size is one of the household characteristics that describe the population. There was variation among study districts as well as households in average family size. However, the survey result indicated that, the average family number of sample households in both study areas has to be **5.9** persons.

### Education Status of Sample Households

Education status of the people in a given area is considered because education is one of the important inputs for development. At the same time, education is also an indicator for level of development of a given society particularly the social aspect of development.  In the study areas, the majority (36%) were illiterate, (45%) those are learnt secondary and elementary level of education, (17%) can read and write only.

### Distribution of Sample Respondents by Sex and Age

Amongst total respondents, 23 were female beekeepers and 276 were male and 2 were female non beekeepers. The minimum age of participated respondents was 21 and the maximum was 68 where as the majority were between 40-60 years old.

### Land Holding of Respondents

In Addis Ababa sub – cities, almost all beekeepers have no land for beekeeping site. They keep their bees at their homestead of living site. Some of them observed with crowded number of bee hives at their back yard. This may created by over stocking, which might be result in easily disease and pest transmission and other managmental problems.
On the other hand, the beekeeper respondents of Oromia region have relatively fair land holding except few youth dependent on their family for their livelihood. Generally, the average plot site for beekeeping was 20m$^2$ in Addis Ababa and 300m$^2$ in Oromia.

### Experience in Beekeeping

The study result showed that the experience of beekeeping of beekeepers differ from area to area and from farmer to farmer based up on their experiences and exposure in beekeeping activities. The extent of practical experience of beekeeping was measured by the experience that an individual was continuously engaged in beekeeping activities.
Majority (53%) of respondents had about 1-10 years of experience while 30% had an experience of 10-20 years and the rest 17% have more than 20 years of beekeeping experience.

### Potentials, Production Constraints and Opportunities of Beekeeping in Oromia and Sub – Cities of Addis Ababa

### Potentials

Both study areas (***Oromia and Addis Ababa***) have similar potentials of beekeeping, i.e. abundance of natural resources. There is a rich variety of indigenous honey bee population more or less free of major bee disease and parasites. Moreover, Addis Ababa city is blessed with different ever year flowering plants in the abode of dwellers of the city which bees can visit and forage throughout the year.
This availability of bee forage also followed by good result of honey production (about 35 kg from one modern hive per one season) in Addis Ababa city
In addition, Oromia has also fair bee forage distribution except some extreme areas. Hence it can be suggested that both regions have fair potential for apiculture.

### Constraints

Regarding beekeepers the information obtained through observation, group discussion and collected data reveals that there exist many constraints of beekeeping in Oromia and Addis Ababa. Common constraints were identified through interview and group discussion with different categories of respondents. The identified major and bottle neck ones were the following.

## A. Beekeepers

1. Lack of awareness of apicultural resource and beekeeping practices.
2. Lack of knowledge and skill of beekeeping practices
3. Un – availability, low quality and high cost of modern bee equipments
4. Unwise application of agro chemicals, not safe for bees
5. Bee enemies particularly birds
6. Low participation of gender in beekeeping practice
7. Insufficient extension service delivery and information of beekeeping
8. Lack of Products' Marketing Cooperatives and other marketing facilities.
9. Lack of organized honey market
10. Absconding of bees due to different reasons
11. Scarcity and high cost of honey processing equipments
12. Insufficient credit service for beekeeping activity
13. Adulteration of honey to increase volume for market

## B. Non Beekeepers

The participants of the study were not only beekeeper farmers but also non- beekeepers. Non beekeepers refer to those farmers who not tend to keep bees due to either lack of interest or another reason.

During the study time the issue was included in questioner schedule of non beekeepers revealed the answer for why they tend not to keep bees as follows.

1. Low awareness of beekeeping practices and its advantages
2. No trend and experience of beekeeping from previous family
3. No encouraging and inviting situation from beekeepers of their surrounding against constraints.
4. Fright of sting and have an aversion to hardship

### C. Bee experts and Development Agents

During the survey, it was complex to get the appropriate person who assigned for apiculture expert position, so that the duty is undertaken by delegation of other (live stock, forage, animal health, agronomist, etc experts). The delegation of experts out of their field of study and profession make them confused on beekeeping practices and this result with discouragement.

Nevertheless, it was tried to discuss with them at zonal, district and village levels experts about constraints of beekeeping in their area and most of them respond as follows.
- Lack of capacity building of experts and farmers beekeepers through beekeeping training
- The day and night work of beekeeping is tedious and no incentive for such work.

### D. Bee Equipment producers and Suppliers.

- Bee equipment producers and suppliers refer are those make bee equipments such as box hive, honey extractors, foundation sheet maker(casting mould), smokers, queen excluders, gloves, bee veil, chisels …etc.
- Even though beekeepers complain them for low quality and high price of their products, they also complain for the following constraints of production and supplying bee equipments.
  ➢ Unavailability of raw materials for making the intended bee equipments
    ☞ High cost of importing raw and readymade materials from abroad.
    ☞ High labor cost and storage cost of making and storing the materials.
    ☞ There is shortage of raw materials to meet their plants' capacity particularly in rainy seasons and pick in rainy seasons and this makes the plants to stay idle mostly.
    ☞ The crude products (raw materials) supplied for their plants are less quality careless harvesting poor storage and poor transportation method,

### E. Honey and Wax Traders

☐ Honey and wax traders are those collect the product from local markets, door – to –door honey collectors and the surrounding local small markets.

☐ These groups are mostly who have no legal license and honey shops. They under take their business in shops of other consumable commodities (soaps, perfumes, oil, fuel products…etc) which can contaminate bee products sequentially.

☐ Nonetheless, they also complaints for different constraints of honey and wax trading such as less supply of quality honey, adulteration problem, destination and price abuse of illegal honey brokers.

### F. *"Tej"* Makers

☐ According to many reports of bee product utilization, among total crude honey produced in Ethiopia, more than 85% is utilized for making local beverage*" tej"."Tej"* makers are those who process local beverage from crude honey and other materials. In the country and the study areas they dominate huge share of purchasing at markets of crude honey.

☐ Based on the information revealed from " *tej makers* "they are complaining constraints as follows:

☐ Even though they can get crude honey at any season, the quality of the honey is very inferior and much of it is exposed to waste before making *"tej".*

☐ They were complaining that most of the time they face highly adulterated crude honey with unintended materials such as crude wax, yellow corn and others.

### G. Honey Brokers

☐ In Addis Ababa city and zonal towns of the study areas, there exist honey brokers who facilitate a supply of honey and wax for different business organizations and charge their service fee.

☐ Most of these honey brokers are not legally licensed and those who certified are not for honey and wax but also for other agricultural and horticultural products.

☐ The great problems with these brokers are that they have no adequate amount of proper knowledge of quality of bee products and they are much careless about the maintenance of bee products quality.

## H. Local Consumers

☐ Final local consumers referred to the members of community of urban and rural who buy bee products (honey) from different sources for their home consumption.

☐ These include civil servants, urban and rural dwellers, and different category of community. They purchase bee products for diverse purposes such as food, gift, medicine and other purpose. Consumers of both study regions obtain honey from local market, shops, door –to-door suppliers honey verandas and super markets.

☐ Honey consumers also have much complaints regarding of bee products particularly honey. The main are adulteration of honey with different materials, cheating  the capacity of weighing balance material. Price abuse  by mid sellers, door to door honey collectors and any others honey sellers.

## The major constraints they raised were:

a. The absence of organized market of bee products.
b. The price and quality abuse of door- to – door honey suppliers.
c. Supply of adulterated honey
d. High price of honey at super markets

## Opportunities

In the study regions, particularly Oromia following the rainy seasons, majority of honey plants in different agro-ecological zones noted to flower from September – November and April – June. Generally, in the study regions, following the flowering seasons of honey plants, honey flow is expected two times a year i.e. from mid October-December and May-June.

Moreover, the participants of the study pointed out a number of opportunities towards keeping bees as follows.

1- There is still good potential (local honeybee races and forages) to increase honey production and to improve the livelihood of the farmer beekeepers.

2 - The Government has recently put in its development agenda the need to develop apiculture as one of the strategies to reduce poverty and to diversify national exports.

3- Due to the concern of law base of beekeeping resource since recently, there was the proclamation development of beekeeping resources utilization, and the users of improved hives and appropriate beekeeping equipment and accessories are increasing;

4 - The presence of micro finance institutes at grass-root level;

5 - Some NGOs are also giving more attention to the sub sector than ever before as an important intervention areas to support the poor and particularly the women. This will give farmers the opportunity to access improved technologies and capacity building.

6 - The establishment of bee products development and marketing cooperatives and unions.

7 - These institutional changes provide good opportunity to create increasing demand and competitive market for organic honey. This will in turn result in endogenous technological change and overall development in the sub sector.

8 -Climatic condition of the country is suitable for beekeeping

9 - The effort of government and bee research centers to eradicate constraints of beekeeping such as lack of technical skills, shortage of materials of beekeeping.

10 – Current fair price of honey and wax on market

11- Climatic condition of the regions suitable for beekeeping

12 - The effort of government and bee research centers to eradicate constraints of beekeeping such as lack of technical skills, shortage of materials of beekeeping.

## Conclusion

According to different literatures, in developing countries, including Ethiopia, it can be appreciated that the level and weight of constrains of beekeeping is being bottle neck of production and productivity of apiculture and utilization of bee products.

These constraints are further aggravated by inadequate beekeeping extension coverage, lack of special skills and research undertaking in the beekeeping sector. Because of these and other related factors, the urban and the rural beekeeping households have not sufficiently benefited from the beekeeping sub sector.

The major constraints of beekeeping practices in both study areas were:- Lack of awareness towards availability and utilization of apicultural resources, lack of knowledge and skill of beekeeping practices, un - availability and low quality of modern bee equipments, unwise application of agro chemicals not safe for bees are the majors while, shortage of bee forage, Pesticides poisoning, lack of skilled manpower and training institutions, low level of technology used, honeybee pest and diseases, marketing problems … and others an other extra constraints in the study regions.

On the other hand the obtained available opportunities were, the effort of Ethiopian government and bee research center particularly Holata Bee Research Center to eradicate constraints of beekeeping such as technical skills, information of beekeeping materials. On this base, it can be concluded that in both study regions the aspect of constraints of beekeeping much go beyond than its opportunities. Yet, an effort to alleviate the constraints and exploit the already available opportunities should be valid. On this base, it can be concluded that in both study regions the aspect of constraints of beekeeping much go beyond than its opportunities. Yet, an effort to alleviate the constraints and exploit the already available opportunities should be valid.

## Recommendations

The field investigation for this study showed clearly that the major constraints of honey beekeeping in Addis Ababa and Oromia regions are more or less similar. To alleviate these constraints of apiculture and to exploit available opportunities, a number of points might be relevant to be recommended.

a. Awareness creation towards the environmental, social, economical benefit of apiculture among urban and rural community (both beekeepers and non beekeepers and also other group of society).
b. Rendering both theoretical and practical training of beekeeping and relevant information for farmer beekeepers and non beekeepers, development agents and experts so that they empowered to undertake the activity and exploit benefit.
c. Delivering sufficient Extension Service Delivery and Information of Beekeeping.
d. Awareness creation towards availability and utilization of apicultural Resources
e. Mitigation of skill of beekeeping practices amongst farmers' beekeepers, bee products producers, traders and others participants of production and marketing participants.
f. Facilitate availability and quality of modern bee equipments ,
g. Improving unwise and careless application of agro chemicals, not safe for bees.
h. Eliminate bee enemies particularly birds, ants, and rodents.

The identified constraints and opportunities of apiculture that should get focus and attention were registered in this study with the following supplementary recommendation.

☐ Rendering sustainable awareness, knowledge, and skill of beekeeping for entire society members who are interested in apicultural development.

☐ Detail study on over all regions of the country regarding production character of bee production, marketing and utilization.

☐ Recognizing women's role and enhancing efficient utilization of workforce of apicultural family members (both male and female) through attitudinal change of inter family division of labor.

Finally, it is important and have been recommended to pay attention on the following points of bee products marketing issues.

## A. Quality Honey for Market and Quality Control

The honey traders and consumers were primarily concerned about quality aspect of bee products especially honey. A good honey may be spoiled by poor handling, storage and in appropriate transport methods. Most markets prefer fresh, pure (unadulterated), unspoiled and lighter honey. Honey producers should take this preference in to consideration if they are able to produce, store and transport such honey. To supply quality honey for the market, special attention should be paid to the following points:

♦Honey producers (farmer bee keepers) must be trained on pre and post harvest    handling, processing, storing, transporting and marketing of honey and also they have to be motivated to produce quality honey.

♦Rules and regulations must be made to control adulteration and abuse of honey quality.

## B. Organized Market Channels

Many producers and consumers were faced with the problem of deciding which market channel to choose, where to sale and purchase honey. In addition both are in fear for adulteration of honey with water, sugar and others un appropriate materials.  Therefore: Organized market channel should be developed through establishing collecting centers equipped with necessary facilities and market information.

## C. Co-operation with Development and Research organizations

Agricultural development officers, honey producers, traders and consumers should be aware that the center described below is the only bee research center in the country and concern itself with improvement of beekeeping sector and afford long and short term training regarding modern beekeeping, honey product processing, handling, and marketing; on station and on spot. It also afford payment free advisory service for organizations and individuals.

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# Analysis of Honey and Bees Wax Marketing Value - Chain in Ethiopia

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### *Abstract*

*The objectives of the study were: to characterize the production and marketing systems of honey and beeswax, as well as to document the market chain of honey and beeswax along the different market levels and actors, and to identify major constraints and opportunities in the sector.*

*From four regions of the country, (Amhara, Oromia, SNNP, and Tigray), eight districts were selected. From each district, consumers, honey traders, farmer beekeepers, tej makers and honey brokers were contacted.*

*The honey and bees wax marketing channel in the study areas consists of multi layer and influenced by traditional honey market segment and also dominated by fragmented domestic honey markets. Generally, the identified major honey marketing channel in the study areas were, honey producers, door – to – door honey collectors, district town honey traders, district town and local /tej/ makers and consumers. The identified constraints of honey and wax marketing were: lack of organized honey market, low quality of honey and adulteration problems, low supply of honey, scarcity and high cost of honey processing equipments and honey containers, low quality of honey processing equipments, limited knowledge and skill of honey processing and handling, lack of appropriate market information, limited knowledge of preference of target market, cheating on honey weight and price information by honey collectors, lack of market encouragement and facilities. On the other hand the available opportunities were, growing market demand for honey and bees wax, encouraging intervention of GOs and NGOs to improve beekeeping and honey marketing sector of the country. emerging of honey marketing cooperatives and unions, encouraging start of credit facilities for running the business, high market demand for honey and bees wax, and the fair price of honey, emerging of honey marketing cooperatives and unions; effort of Holeta Bee Research Center to maintain the decreasing number of bee colonies through training and disseminating of improved bee flora seeds and seedlings to maintain shortage of bee forage are the opportunities for the improvement of honey and bees wax production and marketing in Ethiopia.*

## Introduction

The large amount of produced honey in Ethiopia is a great resource for the country.   The total honey production of Ethiopia is estimated up to 53,000 metric tons annually.    But a small amount of this product is marketed through poor marketing conditions.

The large amount of produced honey in Ethiopia is a great resource for the country. The total honey production of Ethiopia is estimated up to 53,000 metric tons annually.  But a small amount of this product is marketed through poor marketing conditions. Moreover About 80 - 85% of the total Ethiopian honey production goes to local beverage /tej/ making which consumed as national drink in large quantities, (Harmann, 2004). This might makes the benefits that the country gained and the existing income generating capacity of honey is still insignificant.

The motives that might constrain production and   marketing system of honey in the country includes  low price of local market, lack of facilities to access the product to market, knowledge of pre and post harvest handling of honey, complex and multi-Layer market channels (Nuru 2006).

In addition there is a little or no adequate studies conducted to identify marketing situations, market channel, constraints and opportunities of honeybee products marketing in the country.

Thus, it is important to study and document the value chain of honey and beeswax in the country taking into consideration the agro-ecological diversity and production systems as well as the major constraints and opportunities of the sector.

Bee products marketing system and value chain study is very important to get information on the market channel circumstance, constraints and opportunities of the system. Hence, this study was undertaken to identify the aforementioned issues of bee product marketing value chain.

## Objectives

### *The objectives of the study were:*

- ☐ To analyze the characteristics of marketing systems of major bee products /  honey and beeswax/in the country.
- ☐ To document market value chain of honey and beeswax along the different market levels and actors.
- ☐ To identify constraints and opportunities of the sector and recommend possible solutions of alleviating the problems and to forward options towards exploiting the available opportunities in the in the country.

## Methodology

### Description of the Study Area

In general, the potential areas for honey and beeswax production in the country include Southwestern, Western and Northwestern parts of the country Gezahegn, (2001).
 In the country, five regions (*Oromia, Amahara, Tigray , SNNP and Addis Ababa*) were selected based on the relevancy towards the study. With the collaboration of zonal and districts relevant stake holders, the final target organizations and individuals were selected.

### Sampling procedure

The participants of the study were includes, farmer beekeepers (honey producers), district and zone level honey traders( whole sellers and retailers), door – to – door honey collectors (*tej)* makers, consumers and honey brokers,  … etc were contacted. Besides, development agents, bee experts, key informants of the relevant areas also participated.

*Table 1: Distribution of sample Respondents by sex*

| Sex | Region | | | | | |
|---|---|---|---|---|---|---|
| | Oromia | Amahara | Tigray | SNNP | Addis Ababa | Total |
| Female | 4 | 4 | 2 | 2 | 3 | 15 |
| Male | 40 | 36 | 38 | 20 | 11 | 145 |
| Total | 44 | 40 | 40 | 22 | 14 | 160 |

## Methods of data collection

The collected data were both primary and secondary data and the applied data collection systems were**:** *key informant interview, individual respondent interview, group discussion and observation.*

## Method of data analysis

The obtained study data were analyzed using different statistical and econometrical tools. The differences of qualitative responses were tested through pair wise ranking matrix and rank correlation analysis.

## Result and discussion

### Beekeeping in Ethiopia

Beekeeping in Ethiopia plays an important role in income generation for beekeeper farmers. Clearly the apiary industry has an economic impact via direct effects (the gross value of production), indirect effects (demand stimulated in linked sectors) and crop pollination effects. An average of Ethiopian birr (ETB) 420 million is obtained annually from the sale of honey, both in local and world markets (Workneh, et al, 2008).
The country produces about 53,000 tone of honey and 5000 tone of beeswax annually (HBRC 2004). Beekeeping is practiced as additional source of income to cover household expenditure.  But due to low productivity and other challenges beekeeping is not highly important as compared to other source of agricultural incomes in the study areas.

### Beekeeping practice/ Honey production

Honey production in Ethiopia is mainly through traditional means made from locally available materials. Men, women and youth are involved in various beekeeping activities such as
- Feeding bees
- Beehives construction
- Watering
- Harvesting honey
- Storing
- Marketing
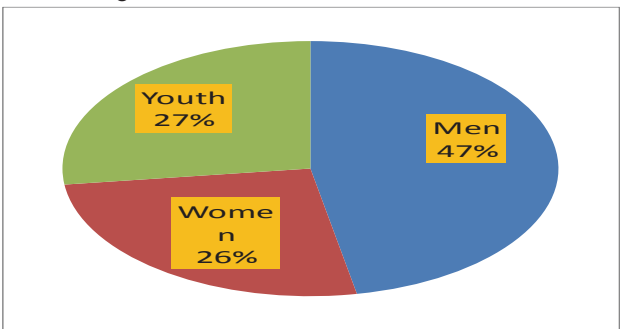
## Productivity of Different Bee Hives

The decreasing productivity of beekeeping might be due to changes in vegetation/deforestation, honeybee diseases among bees, poor management of bees, inappropriate pesticide and herbicides application for field crops.

Even though the productivity of beekeeping was in declining state the aggregate product as well as supply of honey for market was in increasing state.

## Bee Products Marketing

### Demand

In the study areas, it was observed that honey is highly regarded product and the demand for it is also high. Even though the price of honey is rising from year to year, buyers especially/*tej*/ makers (for crude honey), and home consumers (for extracted honey) are willing to pay for supplied honey.

Moreover, during the study time, it was insight that there is full market absorption for supplied both crude and extracted honey at any type of market.

### Supply

The trend of honey utilization of the respondents were for market, home consumption and insignificantly (below 1%) for medicinal value.

| Types of hives | Average prod (Kg/season) | Seasons /year | Optimal production (Kg/one hive) | Amount supplied for market in % |
|---|---|---|---|---|
| Traditional | 5 | 2 | 10 | 75 |
| Transitional | 12 | 2 | 24 | 75 |
| Modern | 24 | 2 | 48 | 95 |

*Table 2: An average demand and supply of honey for market*

**Price** The price of honey and beeswax varies and different regions of the study areas it varies from 30 - 55 ETB and 50 - 110ETB for crude and extracted honey respectively among regions.

**Average Price of honey and wax ETB/1kg  (2013)**

   1-  ***Honey*** Average Price by Regions(ETB) /Kg Average Price by Regions(ETB) /Kg

| Type of Honey | Price of Honey by Regions(ETB)/Kg | | | | |
|---|---|---|---|---|---|
| | Amahara | Oromia | Tigray | SNNP | Addis Ababa |
| Crude | 30 | 40 | 90 | 30 | 90 |
| Extracted | 60 | 90 | 150 | 50 | 120 |

*2-Wax* Average Price by Regions(ETB) /Kg

| Type of wax | Amahara | Oromia | Tigray | SNNP | Addis Ababa |
|---|---|---|---|---|---|
| Crude | 40 | 45 | 80 | 30 | 80 |
| Extracted | 60 | 50 | 180 | 50 | 190 |

**Honey Marketing Channel of the Study Areas**

The honey and bees wax marketing channel in the study areas consists of multi layer and influenced by traditional honey market segment and also dominated by fragmented domestic honey and bees wax markets.

Generally, the identified major honey marketing channel in the study areas were, beekeepers (honey producers), door – to -door honey collectors, district town honey traders/retailers, honey marketing cooperatives, large honey varandas district/zonzal town and local /tej/ makers and consumers , etc… *(Fig below)*

**Honey Marketing Channel of the Study Regions**
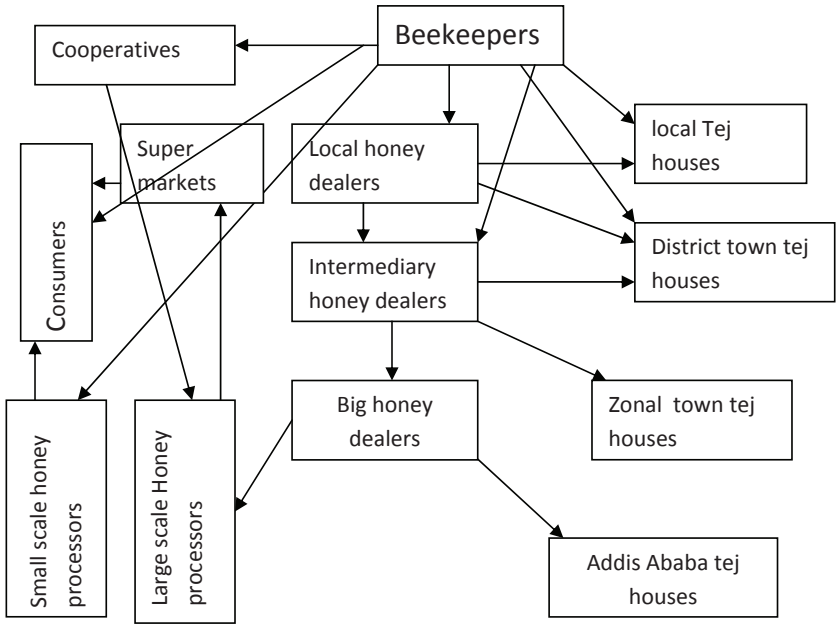


As observed during the study, the bees wax marketing has no well defined channel and even the honey marketing channel is fragmented and not uniform for different regions.

This might be due to the lack of appropriate market research suitable for bees products marketing and followed by low knowledge of marketing system, corruption on quality of products, abusing price of products.

**Constraints and Opportunities of the Sector**

**Constraint**

**The identified constraints of honey and wax marketing were:**

- ➢ Lack of organized bee products market,
- ➢ Low quality and adulteration of market honey and bees wax
- ➢ Low supply of honey and bees wax for market
- ➢ Scarcity and high cost of honey and bees wax Processing equipments and honey Containers
- ➢ Low quality of honey processing equipments,
- ➢ Limited knowledge of bee products processing.
- ➢ Lack of skill of honey processing and handling,
- ➢ Lack of appropriate market information,
- ➢ Limited knowledge of preference of target market,
- ➢ Cheating on honey weight and price information by honey collectors,
- ➢ Lack of market encouragement and facilities.

**Marketing Problems according to Honey Traders**

- ☞ Supply of low quality and adulterated honey
- ☞ Competition with unlicensed/ honey collectors and traders.
- ☞ Shortage of finance
- ☞ Tax
- ☞ Highly irregular demand for honey

**Opportunities**

On the other hand the available opportunities identified were,

- ➢ Growing market demand for honey and bees wax
- ➢ Encouraging intervention of GOs and NGOs to improve beekeeping and honey marketing sector.
- ➢ Emerging of honey marketing cooperatives and unions
- ➢ Encouraging start of credit facilities for running the business
- ➢ Increasing market demand for honeyand bees wax
- ➢ Fair price of honey and bees wax
- ➢ Effort of Bee Research Centers to maintain the decreasing number of bee colonies through training and disseminating of improved bee flora seeds and seedlings to maintain shortage of bee forage are the opportunities for the improvement of honey and bees wax production and marketing in Ethiopia.

**Conclusion**

The honey marketing system in the study regions have many problems. Moreover, the system is not well considered by agricultural development officers and policy makers.

These responsible bodies are particularly focused on supplying bee hives without relevant accessories, skill, market facilities and market information.

As a result, due to lack of these packages and because of beekeepers limited knowledge of bee products handling, processing,    and preference of their target market, they do not try to make changes in the quality of their honey.

Even though those genuine beekeepers were not involved in corrupting their honey quality through adulteration, they got the ultimate blame and lose credibility.

Generally, both group (honey producers, honey traders and consumers) complain more about the lesser quality of honey and its low and irregular supply than its rising price.

Thus it can be concluded that the declining quality and insufficient supply of honey are the major constraints of honey marketing in the study areas.

Most honey come to market is crude (unstrained) and poorly managed. Poorly managed and improperly handled honey is often crystallized and ferments quickly.

Unfortunately, adulterations of honey have been practiced by few honey producers and honey traders in local market.

As a result many consumers suspect as it had been adulterated. People who buy honey do not want adulterated honey.

**Recommendation**

The field investigation for this study showed clearly that the major constraints of honey marketing in the study areas are low quantity  and quality of honey and bees wax on market, low and irregular supply of honey, lack of equipments and skill of processing honey.

To alleviate these constraints of bee products marketing and to exploit available opportunities, a number of points seem to be of general and relevance are recommended.

*A.  Quality Honey for Market and Quality Control*

The honey traders and consumers were primarily concerned about quality aspect.

A good honey may be spoiled by poor handling, storage and transport methods. Most markets prefer fresh, pure (unadulterated), unspoiled and lighter honey.

Honey producers should take this preference in to consideration if they are able to produce, store and transport such honey. To supply quality honey for the market, special attention should be paid to the following points:

Honey producers (farmer bee keepers) must be trained on pre and post harvest    handling, processing, storing, transporting and marketing of honey and also they have to be motivated to produce quality honey.

*B.  Organized Market of bee products*

Many producers and consumers were faced with the problem of deciding which market channel to choose where to sale and purchase honey.

In addition both are in fear for adulteration of honey with water, sugar and others.  Therefore: Organized market channel should be developed through establishing collecting centers equipped with necessary facilities and market information

### C. Co-operation with Development and Research organizations

Agricultural development officers, honey producers, traders and consumers in the zone should be awared that the center described below is the only bee research center in the
country and concern itself with improvement of beekeeping sector and afford long and short term training regarding modern beekeeping, honey product processing, handling, and marketing; on station and on spot. It also affords payment free advisory service for organizations and individuals.
  ➢ Rules and regulations must be made to control adulteration of honey
  ➢ Perception of financial institutions to beekeeping production and marketing business.
  ➢ Encouraging the development of a saving culture

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