INDIRA GANDHI NATIONAL OPEN UNIVERSITY

Determinants for the Adoption of Coffee Production Technologies;

The Case of Small Holder Farmers in Mesela Woreda, Oromia National Regional State, Ethiopia.

A Thesis Submitted to Indira Gandhi National Open University, the Department of Rural Development, in Partial Fulfillment of the Requirements for the Award of M.A in Rural Development.

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DECLARATION

I hereby declare that the dissertation entitled "**Determinants for the Adoption of Coffee Production Technologies; the Case of Small Holder Farmers in Mesela Woreda, Oromia National Regional State, Ethiopia",** Submitted by me for the Partial fulfillment of the M.A. in Rural Development to Indira Gandhi National Open University, (IGNOU) New Dehli is my own original work and has not been submitted earlier to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

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ACRONYMS

AEP	Agricultural Extension Program
CBD	Coffee Berry Disease
CIP	Coffee Improvement Project
CIPA	Coffee Improvement Project Area
CSA	Central Statistical Authority
CTA	Coffee and Tea Authority
DA	Development Agents
EARO	Ethiopian Agricultural Research Organization
ECX	Ethiopia Commodity Exchange
GM	Genetically Modified
IAR	Institute of Agricultural Research
ICO	International Coffee Organization
IMF	International Monitory Fund
MDG	Millennium Development Goal
NCRC	National Coffee Research Center
PA	Peasant Association
OBOA	Oromia Bureau of Agriculture
WB	World Bank

ABSTRACT

Coffee is the main cash and export crop in Ethiopia. The country's export earnings from this crop exceed all other agricultural products. Low production and productivity, which are mainly associated with poor adoption of recommended coffee technologies, were among the major problems. Adoption of improved technologies is one of the most promising ways to increase productivity and production in Ethiopia. However, the adoption and dissemination of these technologies is constrained by various factors. To this end, the aim of this study was to empirically examine determinant factors affecting adoption of coffee production technology in the study area. Three stage sampling procedure was followed to select rural kebeles and households for the study. First, 8 coffee grower PAs were selected purposively from 25 PAs. Second, the 8 PAs were stratified based on their geographical location. Finally, proportional to size 150 coffee grower households were selected randomly using probability proportional to size sampling. Questionnaires and interview schedule were developed, pre-tested and used for collecting the essential data for the study from the sampled households and concerned government officials, respectively. In addition, secondary data were collected from relevant sources such as the district office of Agriculture and others. The result of the study had indicated that the majority of coffee farmers in the study area were reluctant to accept recommended coffee production technology to address problems of low productivity. Instead of the coffee technology, they preferred to stick with their traditional cultivation system that left them with limited production. Results of the study signifies that the determining factors underlying adoption of coffee production technologies of the district were social, economical and institutional factors which manifest in various manner were important variables which had positively and significantly influenced the adoption. The overall findings of the study underline the importance of technical and institutional support system in the area that involve budding new cultivars resistance to CBD and resolve the risk of bi-annualtiy of coffee bearing fruit. Well trained extension agents must be deployed, especially for creating awareness and to reverse the decline of coffee production. Therefore, policy and development interventions should be given emphasis to improve the technical and institutional support system so as to achieve wider adoption of the recommended coffee technologies.

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

Being the origin of Coffee Arabica L., Ethiopia is the source of germplasm on which the world coffee industry relies. Coffee is an important export commodity for Ethiopia, contributing 41% of the country's foreign exchange earnings and about 10% of the gross domestic product (IMF, 2006). Over 25% of the population of Ethiopia, representing 15 million people is dependent on coffee for their livelihood (East Africa Trade Hub, 2010). The existence of coffee in agriculture is also the means of agricultural diversification and it has mitigation potential of 0.51-0.88 tone of CO2 /ha/year (World Bank, 2009). In addition, the country is currently the top African coffee producer and ranked fifth in the global coffee production sharing 40.6% and 4.5% of the region's and world's coffee production, respectively (ICO, 2013).

Oromia, one of the largest coffee producing regions accounting for about 70% of total coffee production and export volume, is believed to be the primary origin and center of diversity of Arabica coffee. Moreover, Coffee is an important crop in a social and economic wellbeing of Oromia farmers. Currently, 265 districts of the region 178 weredas are producing coffee at different levels. West Hararge is among the potentially major coffee producing zones in the region (Oromia BoA, 2010/11).

Different coffee varieties were recognized in West Hararghe. The commonly known ones include 'Abadiro' 'kubania' 'shumbure' and 'buna kela' (Tessema, 1997). 'Abadiro' and 'kubania' are well known for their high quality, whereas 'shimbure' is widely adaptable to low land areas where the intensity of CBD is less (Melaku and Samuel, 2000).

Paulos (1994) mentioned Habro, Mesela and Garamuleta as the major coffee producers in Hararghe. He included chercher, Harar zuria and Gursum as relatively less producers. But currently, if we consider only western Hararghe zone, the main coffee producing woredas are Mesela, Habro, Oda Bultum, Boke and Daro Lebu.

Even though, coffee production system varies in different parts of the region, from garden to forest, in West Haraghe, garden coffee production system is the commonly adopted intensive traditional management practices. For instance, the good land preparation method known as 'katara' is the vital in conserving moisture in drier areas .The other practice, named as 'riga', is used to cover soil cracks to reduce evaporation (Melaku and Samuel, 2000). There are also other good practices, which are traditionally undertaken by farmers in some areas within the Woreda, though the techniques are not yet scientifically identified and recognized. This implies the existence of valuable indigenous knowledge among the local farmers. Therefore, setting valuable strategies so as to utilize the opportunities and tackle the challenges with the adoption of various alternative coffee production technologies is inevitable.

The main strategy that has been used by the government to introduce coffee production technologis was through CIP. This project was launched in the main coffee producing areas of Oromia. But in some areas, including west Hararghe, the coffee board was undertaking the extension works by means of its developement agents (DAs) by the past regimes (Birhanu, 2003).

Recently, as the coffee sub-sector is merged with the regional agricultural bureaus, the task of introducing technologies to farmers is being undertaken by the woreda DAs. In this case a DA performs every department´s activities to be performed in one PA. Obviously, this can limit the efficiency of extension workers to some extent as compared to the size of PAs.

Hence, in one hand coffee is the major cash crop in the region including West Hararge, that has favorable weather conditions for its production, and on the other hand, there is inadequate and less adoption of integrated technologies in such a way that improve coffee production and productivity.

Accordingly, for the coffee sector to play its role in a sustainable way, it is necessary to take corrective measures and indicate major directions that can possibly improve the

efficiency of the sector in general. Cognizant of these facts, the current study has been undertaken in one of major coffee growing district of West Hararge Zone, Mesela Woreda.

Thus, this study focuses on assessing the basic constraints and determinants for the adoption of coffee production technologies by small holder farmers of Mesela Woreda, so as to develop alternative strategies that can enhance the production and productivity of coffee plantation that in turn improves the livelihoods of the small-scale farmers.

1.2 Statement of the Problem

The adoption of agricultural technologies in developing countries like Ethiopia attracts considerable attention because it can provide the basis for increasing production and income. Small-scale farmers' decisions to adopt or reject agricultural technologies depend on their objectives and constraints, as well as cost and benefit accruing to it (Million and Belay, 2004).

Oromia region has a huge potential for coffee production with more than 3 million hectares suitable for coffee production (Oromia Development corridor land use survey, 2008). But, only less than 25% of the total potential lands are currently under coffee production. This implies that the farmers, both in the region and the country as a whole, had not benefited because of market related and different production problems.

In spite being a strategic crop in terms of economic, social and cultural importance in West Hararghe Zone, particularly Mesela Woreda, currently, there are several constraints that make it low-input and low-output crop. This is mainly due to limited scaling up efforts made for adoption of coffee technologies to improve productivity and efficiency to small-scale farmers. The problem, which has manifold characters, is aggravated by factors such as inadequate input supply, the use of disease susceptible coffee cultivars, drought or rainfall uncertainty, poor agronomic management, limited concern for quality (Ashri, 1996). Moreover, the decline in the price of coffee, as compared to the increase in the price of 'Khat', is another pertinent problem inhabiting the expansion of coffee plantation in the district.

On the other hand, farmers are required to share 90% of seedling production and the remaining 10% has been covered by government as per the policy directive of the region. Due to weak extension service and supervision, seedlings produced by the farmers have adverse effect on yield and coffee quality. As a result, low seedling adaptation capacity is prevailing indicating that there is low adoption of the recommended technologies to abate such problem.

According to Oromia BoA; 2010/11), it is believed that about 60% of the total coffee area was covered by old coffee trees in major coffee production Zones of the region like West Hararghe. But, maintenance pruning of coffee trees was less practiced with in the districts of the region. This was attributed to financial constraints and absence of responsible agents to supply farm tools and technical support.

West Hararghe Zone, including the district under the study, is where rainfall is uncertain and drought is a major constraint for coffee production. Lack knowledge on appropriate moisture conservation methods, such as mulching and cover crop, the soil is exposed to sunlight in most coffee farms. In addition, insufficient construction of water conservation structures, as well as, the use of organic fertilizer is has not been properly applied both in amount and quality in most parts. Hence, the challenge is to determine factors that positively or negatively affect the adoption of recommended technologies in the study area.

Consequently, the adverse effects of coffee production constraints are low yield and poor quality, both of which require due attention. Therefore, in order to sustain the production and maintain the economic, social and cultural importance of coffee plantation in West Hararghe, particularly, Mesela Woreda, enhancing coffee development activities through adoption of the recommended technologies is inevitable.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Conceptual Framework of the Study

Most technologies are designed to improve the lives of their intended users. However, the truth is that the tool provides no benefit if the target users fail to use it. One might even define success of a technology as the product of its potential benefit and its likelihood of being adopted.

Ashri (1996) points out the adoption decisions of different technologies across space and time are influenced by different factors and their associations. Factors such as personal, socioeconomic, institutional and psychological factors determine the probability of adoption and intensity of technologies, such as, old coffee stumping technology. It is obvious that different studies have been conducted to look into the direction and magnitude of the influence of different factors on farmers' adoption decision of agricultural technologies.

A factor, which is found to enhance adoption of a particular technology in one locality at one time, was found to hinder it or to be irrelevant to adoption of the same technology in another locality. Although some known determinants tend to have general applicability; it is difficult to develop a universal model of the process of technology adoption with defined determinants and hypotheses that hold to everywhere. The dynamic nature of the determinants and the distinctive nature of the areas make it difficult to generalize what factors influence which technology adoption.

2.2 Commonly used Mechanism of Coffee Adoption Technologies

The knowledge of what types of technology are there in the study area and the corresponding scientific recommendation helps an investigator to differentiate adopters and non adopters, because it is essential that the interview should be supported by eye witness, where necessary. Thus, the following recommended technologies are expected to be practiced (CTA, 1997).

a. **Spacing**: for practical purposes spacing is recommended differently for different coffee types and localities.
b. **Preparation of planting hole**: Holing is expected to be done six months to three months ahead of the anticipated planting date .The size of the hole should be 40 centimeter in diameter in light loose soils and 60 centimeter in heavy more compact soils. Early digging of planting hole is beneficial for soil weathering in the hole.

c. After care of seedlings

For the purpose of escaping the problems related to poor establishment of coffee trees, subsequent maintenance practices must be done. These include; control of grass weed, the use of mulches, the development of shades and the adoption of annual pruning techniques. Some of the weed controlling mechanisms includes: plowing, hoeing, slashing, mulching, shading and chemical control.

d. Fertilizers application

With the current sky rocketing price of inorganic fertilizers farmers are recommended to use only to some farm fields. These constitute; young nursery grown trees, stumped coffee, and well managed mature trees in weed free conditions. On the other hand, it is not recommended to use fertilizer in coffee: suffering from neglect; growing without shade; infested with weed; old, tall, unpruned garden coffee; and forest coffee.

e. Pruning

Pruning techniques are highly recommended for the enhancement of coffee production both in quality and quantity. The common types of pruning are: formative pruning, maintenance pruning, and rehabilitation pruning, which constitutes, stumping, side pruning and topping. Stumping by itself can be of partial or cyclical type.

f. Composting

This is the application of organic fertilizer or green and farm yard manure. Though it is somewhat traditional, the modern ways of applications are also there to be adopted by farmers.

2.3 Impact of coffee adoption technology

As it is already explained above, the need for technology is crucial issue. IAR (1996) indicated that if the right varieties of coffee are planted, with the right agronomic practices in favorable environment the present yield per unit area is believed to double.

For example, the study of five different pruning techniques in Mana PA in Gomaworeda of Jima zone by Kasahun (1998) showed a significant improvement in yield. The least yield increment was 69 percent while the highest was 153 percent over the existing coffee. Practices like shade regulations, pruning including stumping and desuccerization, and population adjustment are believed to minimize the yield loss due to CBD (Workafes and Kassu, 2000)

On the other hand, some technologies, which benefit the minority while harming the majority, may be developed. For instance, the GM coffee, which was developed by a hawai-based company called Integrated Coffee Technology, inc., is found to adversely affect smallholder farmers while benefiting large-scale farmers.

This technology allows mechanized harvesting as it makes the whole farm berries to ripe simultaneously. Action aid representative said that the impact of GM coffee on smallholder coffee farmers who are suffering from low and volatile coffee prices is the devastating one. This is specially a great problem for millions of growers throughout the developing countries (Michael, 2001).

Thus, it is important to develop geographically specific technologies that can be able to harmonize the existing locality with suitable technology for the gain full application. Besides, we have to screen out the imported ones, so that we could select the beneficial technology which has desirable outcomes.

2.4 Coffee Technology Adoption and Related Constraints

i. Fungicide spray against CBD

One of the strategies for controlling CBD is fungicide spraying. But the adoption of this technology is very low throughout the country. In Sidama and Gedeo zones, only 33.3 percent of the sample farmers adopted the technology (Birhanu, 2003). In Gimbi , 78 farmers did not tried the technology, out of 105 coffee farmers (Getachew , et al, 1995).

Melaku and Samuel (2000) reported the reasons for not applying this chemicals as: high cost of fungicide; low price of coffee , low yield per hectare, lack of alternative chemical, lack of coffee management practices, lack of on farm trials and the absence of credit facilities for purchases of inputs. This was the result obtained for Oromia region as a whole. But the area specific study in Gimbi shows reasons related with input supply. Getachew et al (1995) pointed out lack of spray tools, labor shortage, chemical shortage, inconvenience of coffee trees, lack of knowledge and awareness as a bottle-neck for the adoption process.

ii. Stumping

Adoption of stumping techniques in Jimma area was mainly affected by farmers risk attitude, access to technological information, labor availability and presence or absence of exhausted coffee (NCRC, 1997). Similarly Getachew, et al (1995) found out the reasons for not stumping coffee trees to be: fear of income reduction, absence of relevant coffee, negative perception about the benefit and shortage of saw. For the same reasons some of the farmers were also reported to discontinue the practice. Other farmers were also there who totally rejected the practice. The farmers who have reasonable means of subsistence were found to be better adopter. In Gimbi, 40.4 percent of the farmers have adopted these technologies.

Studies in Manna and Gomma woredas asserted that stumping or any alternative methods of renewing old coffee were not practiced. This arises from the fear of yield loss during conversion period. In this case the special thing was farmers knew the

benefit of stumping. But they set the security in food supply as a precondition to stump the trees, during conversion period (Birhanu, 2003).

iii. Pruning technology

Pruning technology was also reported to be highly affected by risk averse behavior of farmers. The farmers were found to calculate yield loss and their risk effect rationally in making choice. The source of risk was found to be with variability of yield as a result of the problem of bi-annual coffee fruit bearing on one hand and the year-to-year variability of cash flows on the other. Even if pruning was believed to solve the problem of yield loss, it substantially increases the cost of production and change the labor use. This technique was also affected by the shortage of pruning tools (Birhanu, 2003).

But the results from similar study in Gimbi CIPA came out with slightly different farmer's behavior. Getachew et al (1995) showed that, some of the farmers were unaware about how and when to prune their coffee. The others provided lack of inputs as their reason like the above ones. Some other groups were also observed who had not heard anything about the technique. The proportion of farmers who adopt the technology was very insignificant. Among 105 farmers, 97 of them did not practice this technology.

iv. Land preparation and spacing

The proper land preparation procedures are usually observed under the intensive coffee production system. Birhanu (2003) described the confirmation from surveys that smallholder coffees have usually unpatterned spacing. Moreover, they have free growth, and dense population, which are over 6000 trees per hectare. This was observed in Manna and Gomma Woredas.

As it has been described earlier, some technologies are adopted independently (Getachew et al,1995). Farmers who had planted new cultivars have applied the recommended land preparation and spacing. In this regard, he has revealed the possibility of suggesting that the response to this technology depends up on the

condition of the farm and character of the technology. In this specific study area, 52 farmers adopted this technology out of 72 who planted new cultivars.

iv. In organic fertilizer application

In coffee culture, fertilizer application is necessary especially along with the pruning techniques. IAR (1987) reported that in Agaro, the two-stem pruning followed by the single stem, the fertilized plot gave 180 kg per hectare of clean coffee over the non-fertilized plot. But there are a lot of constraints for its application.

Study in Gimbi by Getachew et al (1995) clarified that, all users have abandoned using fertilizer after the first trial. This was caused by the financial constraints the farmers had and/or the farmers were not convinced by the return.

Empirical studies in east Africa had indicated the most common constraints in adopting improved technologies. In most of the cases farmers were not aware about the technologies and /or the benefit they could get out of it. In some cases the technologies had been found not to be profitable; on the other hand, the required technologies may not be available. Even if it is available, the use of improved technologies may also increase production risk; the other most important constraint was found to be related with institutional factors. These factors include; the policy environment that affect the availability of inputs and the markets for credit and outputs. In general, farmers were very hesitant to adopt improved technologies (Feder et al, 2003).

2.5 Empirical Studies on the Adoption and Diffusion of Agricultural Technologies

According to Van den Ban and Hawkins (1988), an important approach to investigate and find answers for the adoption and diffusion of innovations is to run an empirical study by using the following set of questions; (i) what decision making pathways do individuals follow when considering whether or not to adopt an innovation? Which sources of information are important? (ii) What are the differences among people who adopt innovations quickly or slowly? (iii) How do the characteristics of innovations affect the rate of adoption? (iv) How do potential users communicate among themselves about these

innovations? Who plays the important role in this communication process? And (v) how does an innovation diffuse through a society over time? Because of these, a number of empirical studies have been conducted by different scholars.

Until 1980, more than 3000 publications have appeared, of which, over 2000 represent results of empirical research on adoption of innovations and detailed analyses of differences between adopter categories with respect to a host of personal, social and cultural characteristics (Rogers, 1983). Views and findings are not, however, consistent with respect to the role of these factors on adoption behavior of farmers and the subject is of considerable controversy around the globe. No single conclusion has been drawn with respect to the key factors which favor or impede adoption decision at a given time and place and becomes less important or even induce an impediment on the adoption behaviors of farmers at another time and /or place.

However, the studies were mainly conducted around major cereals, and studies conducted in the area of coffee in particular; and perennial crops in general are scanty. The review mainly focuses studies conducted mainly on cereals, particularly maize and wheat, with very few related horticultural crops. For ease of grouping, the variables so far identified as having relationship with adoption are categorized as household personal and demographic variables, socio-economic factors, technology related factors, intervening (psychological) variables and institutional factors.

a) Psychological related variables

Behavioral change process involves decision-making, which implies cognitive engagement in deciding whether to adopt or reject a given innovation (Duvel, 1991). In addition, psychological related factors which he distinguished as needs, perception and knowledge are the most important determinants of farmers' adoption behavior. Many of the studies which have considered these variables reported their significant relationship with adoption behavior.

b) Institutional factors

Farmers make decisions within a broader environment or context. Institutional factors are part of such broader environment which affects farmers' adoption decision of agricultural technologies. Institutional factors in the context of this study include support provided by various institutions and organizations to enhance the use of improved technologies such as extension and credit services and other inputs. Extension provides farmers with information related to agricultural technologies. In collaboration with other organizations or alone, it can also channel credits and other incentives to the farming community to enable them improve production and productivity.

c) Household's economic variables

Economic factors influence household's adoption decision of agricultural technologies. According to Semgalawe (1998), economic factors such as household's resource ownership and economic objectives play a great role in determining the willingness and ability to invest in the adoption of agricultural technologies. In rural context, livestock holding is an important indicator of household's wealth position.

Livestock holdings are also an important income sources which enables farmers to invest on the adoption of improved agricultural technologies. No doubt that in most cases, livestock holding has positive contribution to household's adoption of agricultural technologies. This is evident from many of the past adoption studies which have reported positive effect of livestock holding on adoption.

d) Farm characteristics

Farm related variables such as farm size and other farm characteristics influence farmers' adoption behavior as farm is an important unit where agricultural activities take place. Concerning farm size, different studies reported its effect differently. On one side a study indicated positive relationship between farm size and adoption. Contrary to this, a study conducted on the adoption of intensive mono-crop horticulture reported the negative relation of farm size with adoption.

2.6 The Status of coffee production in Developing Countries

Coffee production is at its advanced level in different countries in the world .The previous technologies used for coffee production are currently being substituted by the modern and further improved ones. Countries, which are using these technologies, are at the position to control the world market for coffee.

Despite the existing potential, Ethiopia's coffee production remained low both in quality and quantity. The repeatedly proposed reasons are CBD and traditional way of cultivation. According to Workafes and Kassu (2000), there is poor productivity throughout the country. They described the nations' coffee yield to be only about 472 kg per hectare on average. This figure is very far lower than 1500 to 2000 kg per hectare, which was recorded by other countries. This indicates how much we are expected to do for the improvement of the situation.

Thus, to tackle with the challenge fostering the need of producers' incentive, competitiveness, cooperativeness, comparative advantage generation, dissemination of new technologies, expanded extension service, investment in infrastructure and different related policies is crucial. Further, he explained the case of declining world market in terms price of coffee to be a discouraging factor.

2.7 Objectives and Research Questions of the Study

2.7.1 Objectives

The main objective of this study is to assess the basic constraints and determinants of the adoption of coffee production technologies by small holder farmers of Mesela Woreda, West Hararge Zone, Oromia Region, so as to develop alternative strategies that can improve the livelihood of the small-scale coffee farmers.

The specific objectives of the study include the following points:

1. To determine the effectiveness and existing level of adoption of each recommended technologies on coffee plantation of the district;

2. To identify the challenges that can hinder the small-scale farmers in applying and adopting recommended technologies that will scale up the coffee production;

3. To examine the impact of adoption of recommended technologies on the farmers' livelihood;

4. To forward viable recommendations based on the findings of the current study.

2.7.2 Research Questions

i. What was the contribution of adoption of coffee technologies in enhancing the production of the district's small holding farmers?
ii. What were the factors affecting the adoption of coffee production technologies in the current study area?
iii. What were the challenges in the process of adopting coffee production technologies?

2.8 Definitions of Terms/Concepts

Exhausted coffee: a coffee tree, which gives less yield or totally ceased producing fruits.

Old coffee: Coffee tree, which has been giving product for long period of time and finally exhausted.

Rejuvenation (Stumping): Renewal of the old coffee tree by cutting to the height above the soil 25-30 cm at 45^{o} in the east west direction.

Pruning: cutting disordered branches and stems of coffee tree by pruning scissors.

Capping: cutting the shoot of young upcoming seedling or sucker until it reaches 1.8 m above the ground for strengthening the wood.

Seedling: the young newly growing coffee usually with its age below one year

Cherry: Red ripe fruits of coffee trees.

Berry: the green fruits of coffee

Cultural practice: hoeing, slashing of weeds, cultivation and the like practices.

Adoption: the level to which a farmer accepts and uses a given innovation.

Diffusion: the process and transferring of the technologies from the original adopter to others.

Small holders: Farmers who have less than 5 hectare of farm land.

Mulching: covering the seed bed with grasses or other dry plant materials which is also applied under newly established farms to conserve moisture.

Seed viability: the germination capacity of seeds.

Site preparation: the process of cleaning and cultivating of the land for coffee plantation.

Composting: applying green or farmyard manure to the farm.

Conversion period: the period between the time of stumping coffee tree and time at which the newly grown suckers start to give yield.

Spacing: Adjusting the distance between individual plants and between rows of coffee trees.

Biannual bearing: the condition in which coffee trees give yield once within two years due to tree exhaustion.

Coffee culture: the habit of growing of coffee

Local leadership: Being the member of any rural kebele or woreda committee or social and cultural associations.

Manpower availability: The quantity of family labor involved in agricultural practices regardless of sex and quality.

Technologies: The types and quality of inputs including recommended way of application used in coffee production.

Coffee farmers/coffee growers: Farmers who are engaged in coffee plantation culture.

Coffee plot: A small marked piece of land used for coffee production.

Perennials: Plants living for more than two years and giving yield constantly once established.

Income: The benefit from crops or other job received in terms of money or cash.

Coffee drying: The practice of spreading ripped coffee fruits or cherries on the sun light for the purpose of dry processing.

Modern composting: the application of composts prepared in excavated pit or any favorable containers at an optimal level of decomposition.

Literate: A person who has got formal education that include who can read and write.

Illiterate: A person who cannot read and write

Household head: Any responsible person in the household's decision making. In this thesis the word 'a farmer' also represents the household head.

Sample Household: Any coffee farmers who are randomly selected as representative of the target population and respond to the proposed questionnaire.

2.9 Study Variables

To examine the determinants for adoption of coffee technology, it is reasonable to use indicators, which measure how well the recommended technology intended to improve production and productivity is affected by different internal and external factors.

Dependent variables: Adoption of recommended Coffee Production Technologies (Adopters and non-Adopters).

Independent variables – are variables chosen to measure the adoption level of coffee technology –factors including

- **Social factors**: Age of potential adopter, membership to organizations, education level, household size, and farming experience;
- **Economic/Market forces:** availability of labor, technology resource requirements, farm size, level of expected benefits, the capacity to borrow and level of effort required to implement the technology;
- **Institutional/technology delivery mechanisms:** information access, extension services, and prior participation in, and training in pest control practices.

2.10 Limitations of the Study

The study might be constrained by a number of factors including:

- This type of study may affect the results; respondents may not recall dates, number of innervations of coffee technology, months of first visit, etc.
- The other limitation is that we cannot be certain that the observed improvement in coffee production and productivity is due to factors other than the recommended coffee technology.

CHAPTER THREE

3. METHODOLOGY

3.1 Study Area

Mesela District is located in West Hararghe Zone of Oromia regional state of Ethiopia. The district constitutes 25 rural kebeles (PAs) and one small town. Altitude of the area ranges from 1200m to 2900m a.s.l in most parts of the district. The area gets most of its rainfall amounting from 700mm to 1100mm annually, which is of high intensity, between the months of May to September; December to March is the driest season. Out of the total 25 PAs in the districts, almost all are main coffee producers. In the districts, out of the 32,690 ha total area, 20,142 ha is allotted for perennial crop of which 12,576 ha has been used for coffee production.

According to the last population and housing census, from the total population of 159,319; 81,078 male and 78,241 female reside in the district. As in other parts of the country, the majority of the population resides in rural areas. The major cash crop for the rural dwellers is ‘khat’ and coffee production, where coffee plantation is their dominant economic activity in which most of the population generates income for their day to day livelihood.

Mesela District is one of the districts where various coffee technology adoption programs, such as, selected planting material, improved planting methods, farm tools, agricultural chemicals and harvesting and processing methods were adopted and implemented. This had created a conducive environment to explore the constraints and determinants of adoption of coffee production technologies (Mesela Woreda Office of Agricultural Development, 2013).

3.2 Study Design

Descriptive method was used to provide a summary statistics related to variables of interest and identify variables between adopters and non-adopter of the exciting coffee production technology. The community based cross-sectional study had employed both quantitative and qualitative data. The target population was coffee farmer who had at least exposure to adoption of coffee scaling up techniques at the time of the study. The main field work, i.e., data collection, was carried out during the month of December, 2013. Thus, most retrospective information obtained from respondents about determinants for adoption of coffee plantation technology refers to the period from February 2009 to the date of interview.

3.3 Data Collection

3.3.1 Measurement tools

A questionnaire having three sections was prepared for interviewing eligible coffee farmer. The first section of the questionnaires was designed to capture information on socio-economic feature such as personal and household characteristics as well as farm and resource aspect of the coffee farmers. The second section dealt mainly with the sample household technical factors such as knowledge, attitude, and accessibility to basic adoption tools (inputs) and impact of coffee plantation technologies in enhancing production. The third section was proposed to capture information on quality of institutional and extension services that were intended to provide the recommended coffee technologies. Moreover, the questionnaire was translated from English to Afan Oromo language.

3.3.2 Field work

The field work was carried out by six interviewers and two supervisors having extensive experiences in data collection of similar surveys. The researcher provided theoretical training for one day and the practical session for the purpose of pre-testing the questionnaire and familiarize with the data collection tool after the practical session, discussion were made on the findings of the pre-test and based on the result minor revision was made. Orientation was given to the supervisor on how to organize and supervise the

data collection and on the techniques of detecting errors and correcting them on spot. The orientation was also focused on how to minimize non-response rate through a system of revisiting and ensuring the availability of quality data through observation of the interviewing, editing and re-interviewing the sample coffee farmer.

3.4 Ethical Consideration

Before undertaking the data collection, permission was assured from the Oromia Regional Agriculture Bureau, West Hararge Zone Agriculture Development Office, Mesela district Agriculture Development Office, Kebele administrative officials and local community leaders. Interviewers provided information on the purpose of the study and explained the objectives to the selected small holding coffee farmers. They also assured the confidentiality that any information concerning them will never be passed to the third person or institute without their consent. On the questionnaire there was no part that specified the name of the respondent. All selected coffee farmers were approached only when they agree to participate in the study. In addition, interview schedule were used to collect data from the district's government officials and councilors.

3.5 Sampling

A multi-stage sampling technique were employed to select the unit of analysis–coffee farmers or/ and households-who had adopted the technologies during the study period. The sampling design would combine stratified, simple random and systematic random sampling methods. The homogeneity stratification was based on the number of years of technology adoption program implemented. The first stage sampling units were kebeles and the second stage units were enumeration area/zone. In the last stage the household who had an exposure to the technologies during the study period were selected.

The sampling frames for each stratum shall be prepared using the list of PAs of kebeles, which was obtained from the central statistical agency (CSA) based on the 2007 National Population and Housing Census and the district agriculture office records. Peasant association within the Kebeles to be included on the study were identified and selected based on their geographical location.

3.5.1 Sample Selection Procedure

Standardized sampling formula for random sampling technique was used to obtain a target sample size and resulted in a sample size of 150 coffee households. This sample is allocated among the enumeration area (for this study enumeration area refers to the local classification /categorization of kebeles into zones) using probability proportional to size– PPS methods.

The selection of coffee farmers' households had involved two stages;

1st stage: Selection of peasant association within the kebeles.

First, the kebeles were stratified according to their geographical location. The list of kebeles and their geographical location were obtained from Mesela District Agricuture office. Based on the list of the PAs within the kebeles, the 25 peasant associations were grouped into three strata geographically and a total of eight PAs was considered in this study. Listing of all households was undertaken in selected zones.

2nd stage: Selection of Coffee farmer households

The target population mentioned above was selected from a sampling frame (listing form) which was prepared in each geographically selected stratum. The number of coffee farmer households used in each stratum was determined on the basis of probability proportional to size. The allocated sample of coffee farmers was selected from each stratum by using systematic random sampling method.

3.6 Data Analysis

Quantitative data: during data collection, data quality checking was made on spot and the data was entered to the computer after manual editing and coding was completed. For the analysis SPSS version 1.5 was used.

Qualitative data: For qualitative data collection, interview with some sample households and government councilors and officials was achieved by marking the core ideas related to the objective of the study. The respondents were identified and their responses to the key questions were noted and categories were developed. Then data were sorted out and comparisons made and relation investigated. These data was indexed, mapped and interpreted.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1 Response Rate

Members of Peasant Associations had cooperated in providing information on the influence of personal, socio-economic, technical and institutional factors that can determine the adoption decision process of coffee technology. Almost all the questionnaires were appropriately filled and recollected. Thus, the response rate was 99 percent.

4.2 Factors determining Coffee Adoption Technologies of the district

Several factors have been found to affect adoption of coffee technology. It appears that only three categories of these broad items were emphasized in these studies that are believed to have direct relation to coffee technology adoption. These involves Social factors: age of potential adopter, membership to organizations, education level, household size, and farming experience; Economic factors/Market forces: availability of labor, technology resource requirements, farm size, level of expected benefits, the capacity to borrow and level of effort required to implement the technology; Institutional factors /technology delivery mechanisms: information access, extension services, and prior participation in, and training in pest control practices.

4.2.1 Socio-Demographic Characteristics of Respondents

Social factors as a category focuses on age of potential adopter, social status of farmers, education level, household size, and farming experience whether it positively or negatively affect the adoption process. The responses of the sample households on each determinant factor are illustrated below.

Age Group of the Sample Households

From among the total 150 households 8% were between 22-30 years, 39% were between 31-38 years, 34% were from 39-46 years old and the remaining 19% were between 47-55 years old age group (Fig.4.1).

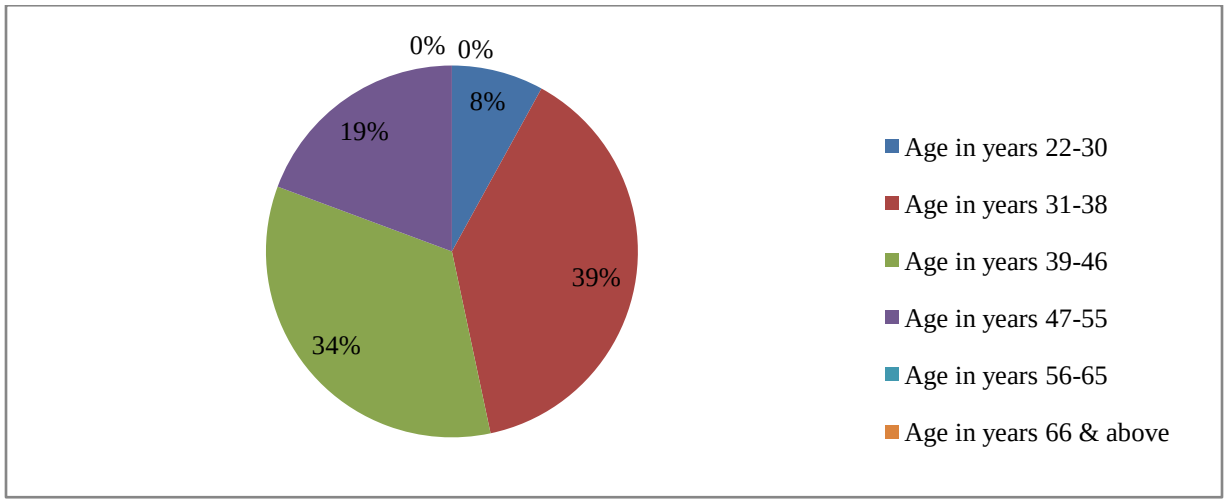

Fig. 4.1 Age group of sample households

Source: Field Survey, 2014

Farming Experiences

With regard to the responses on their experiences in coffee plantation, 17% had experiences between 1-7 years, 28% had experience between 8-14 years, 32% had between 15-21 years, 16% between 22-28 years and the remaining 7% had experience between 29-35 years. The maximum year of experience in coffee production was 35 years while the minimum was 2 years (Fig. 4.2).

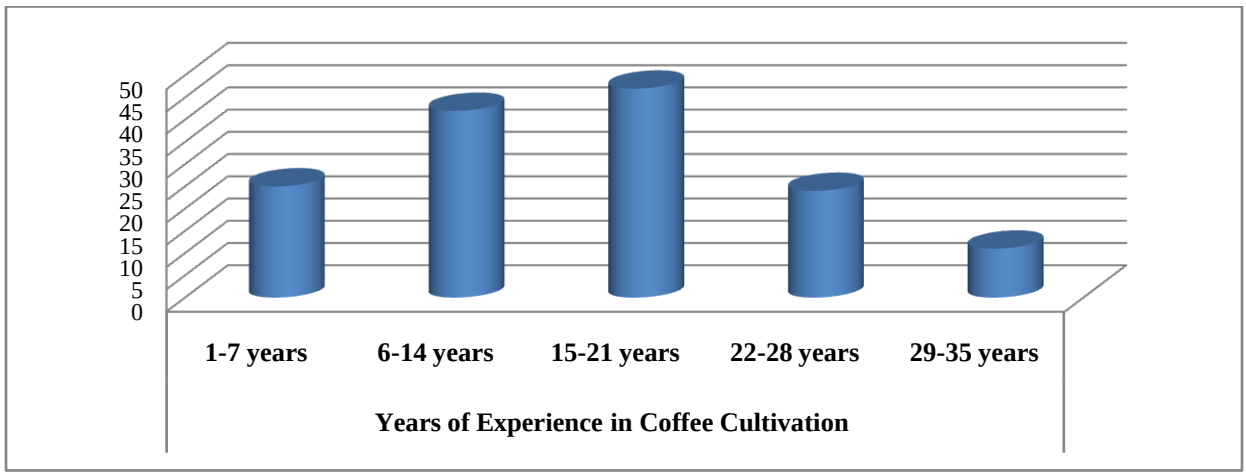

Fig.4. 2 Household responses on farming experiences in coffee plantation

Source: Field Survey, 2014

Most coffee farmers of the district have accumulated a good knowledge and experience of coffee farming obtained from years of observation and experimenting with various technologies, since most of their age fall within interval of 31-46 years. In addition, adoption pay-offs occur over a long period of time, while costs occur in the earlier phases, age (time) of the farmer can have a profound effect on technology adoption.

The response rate of coffee farmers about the educational level and its importance on adoption process, in most cases, related to years of formal schooling. The response rate were as follows; When it comes to educational status of coffee farmers, 23 % of them were illiterate, 24 % of the respondents were able to read and write, 27% had attained schooling from 1-5th grade and 23 % had reached 6-9 grade level and very few (3%) of them had attained 10 & above grade level (Fig. 4.3).

The field survey had shown that only 23% of the coffee household heads were illiterate while the remaining (77%) were literate, that is, they can at least write and read.

This can create a favorable condition for the acceptance of new practices, especially information-intensive and management-intensive practices. Furthermore, farmers' knowledge about improper practices may be enhanced by understanding through reading the safe application procedure regarding a given control strategy especially where chemicals are involved. Increased education is, thus, expected to improve coffee technology adoption.

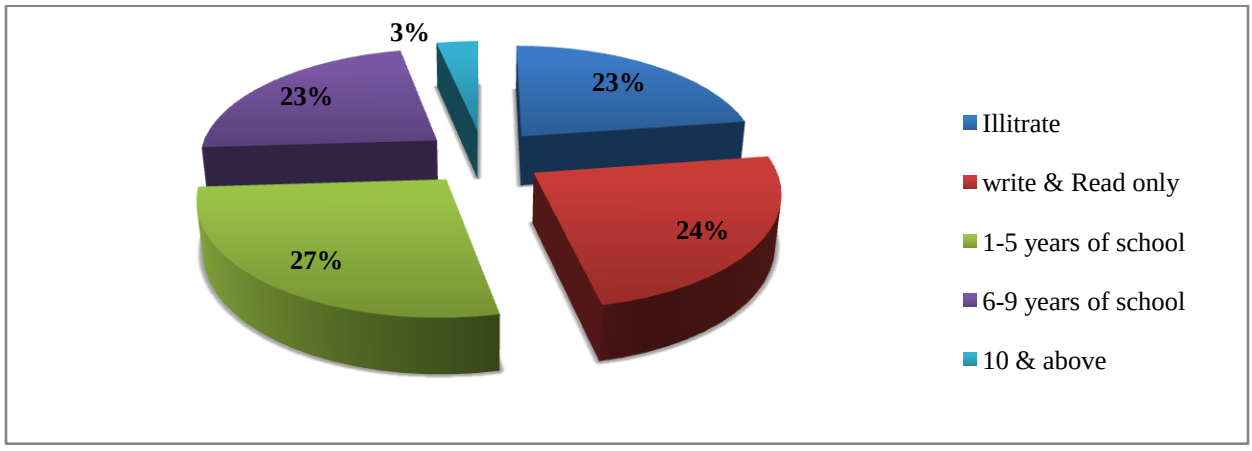

Figure 4.3 Educational Level of the Target Group

Source: Field Survey, 2014

4.2.2 Economic Factors Affecting Adoption of Coffee Technology

Adoption can be dependent on the cost of a technology and on whether farmers possess the required resources. Technologies that are capital-intensive are only affordable by wealthier farmers and hence, the adoption of such technologies is limited to larger farmers who have the ability to invest the required capital. However, for the sake of this study, this variable is limited to market forces such as: availability of labor, technology resource requirements, farm size, level of expected benefits, and level of effort required to implement the recommended coffee technology. Some the variables was analyzed and emphasized based on the response of the sample farmers.

4.2.2.1 Farm and Resource Characteristics

Farm related variables such as farm size and other farm characteristics influence farmers' adoption behavior as farm is an important unit where agricultural activities take place. Farm size can affect and in turn be affected by the other factors influencing adoption. Therefore, farm size affects adoption costs, risk perceptions, human capital, credit constraints, labor requirements, tenure arrangements and more.

Both the total farm size, and in particular the total coffee plot size is highly significant in influencing adoption behavior of the households. The total size of land covered by coffee within the district is 12,576 ha. On average, adopters have owned larger holdings than non-adopters. But, it is clear that the technologies are divisible and neutral to the scale.

Though the land size holdings vary from farm to farm, the majority (63%) of the respondents had owned 0.25-0.55 hectare of land. The minimum size of land owned by the sample farmers was 0.25 ha, while the maximum was 2 ha (Fig. 4.4).

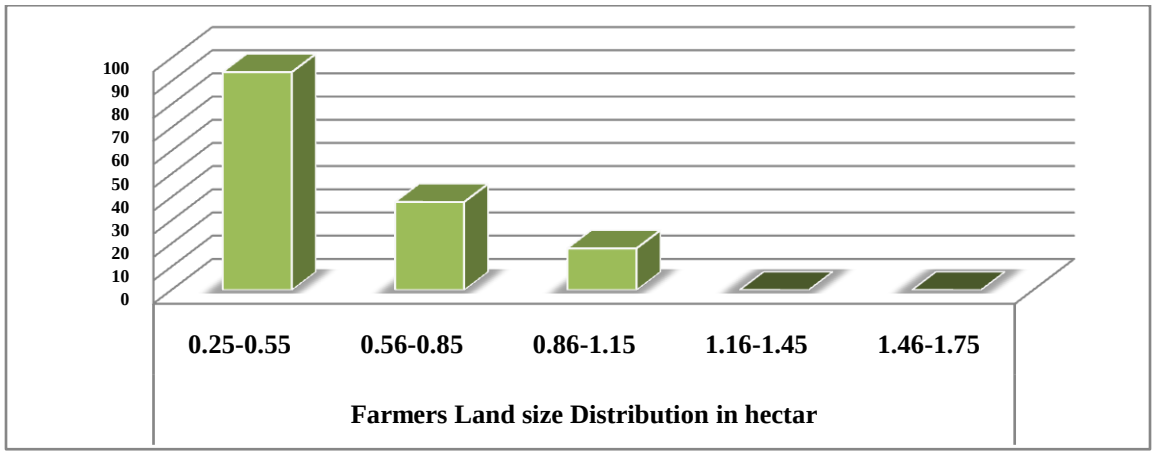

Fig. 4.4 Farmers' land Size distribution in hectare in the study area

Source: Field Survey, 2014

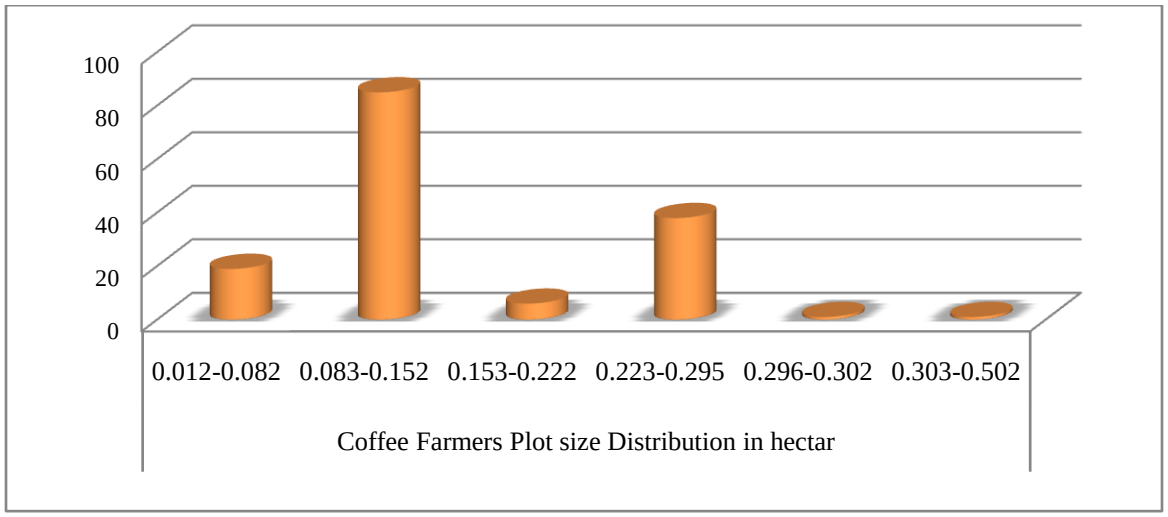

Figure 4.5 Distribution of land allotted for Coffee in Hectare

Source: Field Survey, 2014

It is also worth noting that around 69 percent of sample farmers had coffee plots less than 0.152 hectare. According to information from the districts' Office of Agricultural Development, almost all coffee production system practiced in the locality was attributed to garden coffee, which is under intensive management practices.

However, almost half of the sample farmers were not acquainted with modern coffee management practices which can be verified by the percentage ratio of adopters to non-

adopters of the technology. Thus, out of the total coffee farmers in the study area 57.14 percent were acquainted with the technologies.

4.3 Comparison of Adopters to Non-Adopters in Coffee Plantation Technology

All the component practices considered in this study were found to be practiced by adopters of coffee technology, but there was variation among the adopter households in the level of adoption or use of these practices. On the other hand, for various reasons farmers' practices were found to deviate from the rate and practices recommended by the research. As mentioned by sample respondents the reasons for deviation ranges from labor shortage and knowledge and to other household, personal, technological and institutional related factors. Thus, Variation in adoption among the sample households was assessed in view of various factors theoretically known to influence farmers' adoption behavior of new technologies.

Generally, 42% of the sample households were adopters of the technology. The non-adopters constitute large number of the respondents (Fig. 4.6; Table 4.1). This implies that more than half of the sample coffee farmers were not willing to accept the recommended techniques in their coffee farming practices.

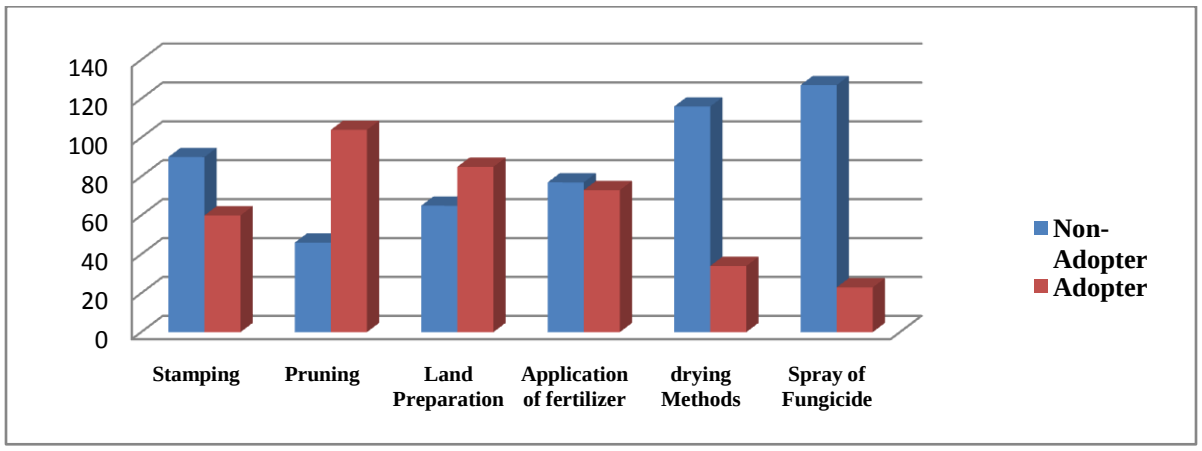

Figure 4.6 Comparisons of Adopters to Non-Adopters in the adoption of Coffee Production Technology

Source: Field Survey, 2014

Table 4.1 Comparison of Adopters to Non-Adopters in the adoption of Coffee production Techniques

s/no.	Type of Technology	Coffee Farmers responses to Adoption category		% age for each technique	
		Non-Adopter	Adopter	Non-Adopter	Adopter
1	Stamping	90	60	60	40
2	Pruning	46	104	30.67	69.33
3	Land Preparation	65	85	43.33	56.67
4	Application of fertilizer	77	73	51.33	48.67
5	Drying Methods	116	34	77.33	22.67
6	Spray of Fungicide	127	23	84.67	15.33
N.B total Number of respondents for each category is 150 farmers					

Source: Field Survey, 2014

Local names given to coffee types by native farmers in Mesela Woreda were similar to typically known in Hararghe areas. The names known to the sample farmers were : 'Fandisha', 'Guracha', 'Muyra', 'Hariro', 'Charchero', 'Adi', 'Hifato', 'Bula', 'shumbure' and 'Abadiro'. 'Abadiro' is a known variety for its quality and is typical to this woreda (Mesela Woreda Office of Agriculture, 2013).

Most farmers prefer to grow 'Abadiro' among the cultivars for coffee plantation. However, this cultivar has low resistance and very susceptible to CBD. The best option for CBD control is planting CBD resistant cultivars/seedlings. Though CBD is more pronounced in the area, planting CBD resistant cultivars was not successful mainly because of adaptability problems **(**Oromia BoA, 2008**).**

High susceptibility of local cultivars to CBD had caused significant yield and quality loss. High income from khat (another stimulant crop) per unit area resulted in uprooting of

coffee trees by some farmers for substituting it with khat (Mesela Woreda Office of Agriculture, 2013).

4.4 Basic Reasons of Non-Adopters for not accepting the Recommended Coffee Production Technology

Sample coffee farmers were asked the reason for not adopting recommended and existing coffee production techniques that will have significant contribution to increased coffee yield and quality.

Fungicides have been used widely to control Coffee Berry Disease (CBD) when it threatens coffee production at different coffee growing regions.

Table 4.2 Reasons for not Adopting Fungicide Spray

S/n.	Respondents reason for not adopting fungicide spray Technique	Response Rate	% age From total
1	Not economical	23	18.11
2	Financial constraint	3	2.36
3	Lack of access to the chemical	61	48.03
4	Lack of sprayer & Chemical	0	0
5	No information	7	5.51
6	No need	33	25.98
7	Total Number of Respondent	127	

Source: Field Survey, 2014

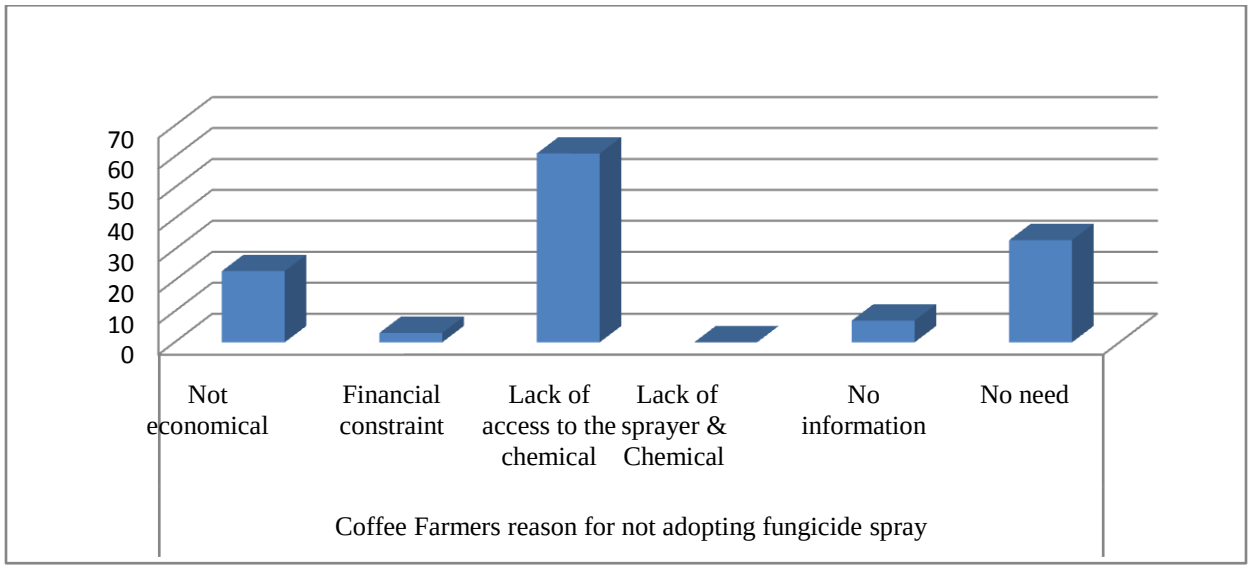

Figure 4.7 Reasons of sample households for not Adopting Fungicide Spray

Source: Field Survey, 2014

With regard to the reason for not adopting Fungicide spray, out of the six factors mentioned, most, 48%, mentioned inaccessibility of the chemical to control CBD, Others had given reasons, such as, high cost of the chemical, financial constraint, unavailability of sprayers, awareness problem, and the problem being considered insignificant (Table 4.2; Fig. 4.7).

4.4.2 Reasons of Respondents for not Adopting Pruning

In order to avoid poor establishment of coffee trees, frequent maintenance practices, such as pruning must be undertaken. Pruning technique is highly recommended for the enhancement of coffee production, both in quality and quantity.

With regard to the response given for the reason in not adopting pruning practices, 60% of the respondents had claimed lack of pruning tools. Others stated shortage of manpower, lack of skills, not convinced of its usefulness, and lack of information (Table 4.3; Fig. 4.8).

Table 4.3 Reasons of coffee farmers for not Adopting Pruning

S/n	Coffee Farmers reason for not adopting Pruning Techniques	Response Rate	% age From total
1	No information	5	12
2	Do not know how to do it	0	0
3	Lack of the tools	25	60
4	Lack of skills & Material	3	7
5	It has no effect on yield	2	5
6	Shortage of manpower	7	17
7	Carelessness due to the Market Price	0	0

Source: Field Survey, 2014

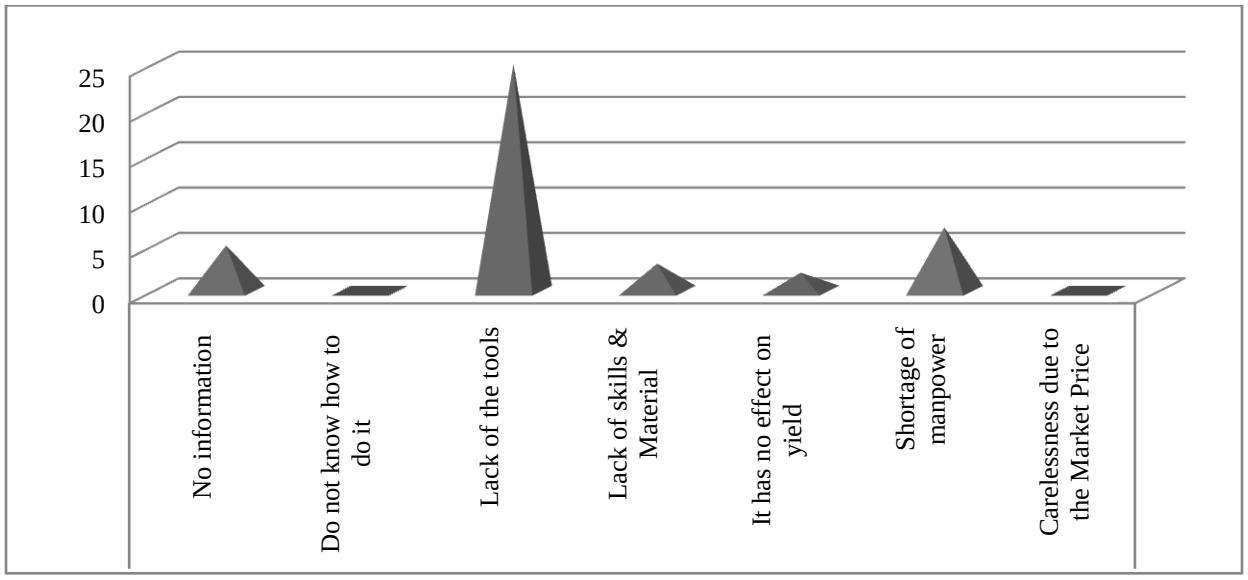

Figure 4.8 Reasons for not Adopting Pruning practices

Source: Field Survey, 2014

Based on this analysis, we can infer that most of the sample households have shortage of tools, even if the cost of the pruning tools is minimal as compared to what coffee fetches in the market. It only indicates the reluctance of farmers to accept the technique. Further, as

per the information obtained from the respondents, the source of risk to adopt the technique was found to be with variability of yield as a result of the problem of bi-annuality in coffee fruit bearing on the one hand and the year-to-year variability of cash flows on the other.

4.4.3 Reasons of Respondents for not Adopting Drying Technique

One of the important technologies in coffee production is the cherry drying technology. It is important to maintain the natural flavor of coffee. For this purpose, it is recommended that a wooden bed be constructed about one meter high from the ground. The main reasons given by the sample household heads for not adopting Coffee Drying method were categorized into six parts. However, most (60%) had claimed shortage or unavailability of the required raw materials for constructing of coffee drying bed. Others have mentioned financial constraints, not being convinced of its usefulness, volume of the product is low, shortage of manpower for not adopting the technology (Table 4.4; Fig.4.9).

Coffee farmers who dry their coffee based on the proper way had claimed that they do not fetch a higher price than those who dry even on the bare ground. Thus, coffee farmers find no reason of worrying about the technology.

Table 4.4 Reasons for not Adopting Drying Technique

S/no	Coffee Farmers reason for not adopting drying Technique	Response Rate	% age From total
1	No Significant Product	22	19
2	Not Beneficial to me	9	8
3	Shortage of the required Materials	70	60
4	Lack of Information	0	0
5	Shortage of manpower	2	2
6	Financial Constraint	13	11

Source: Field Survey, 2014

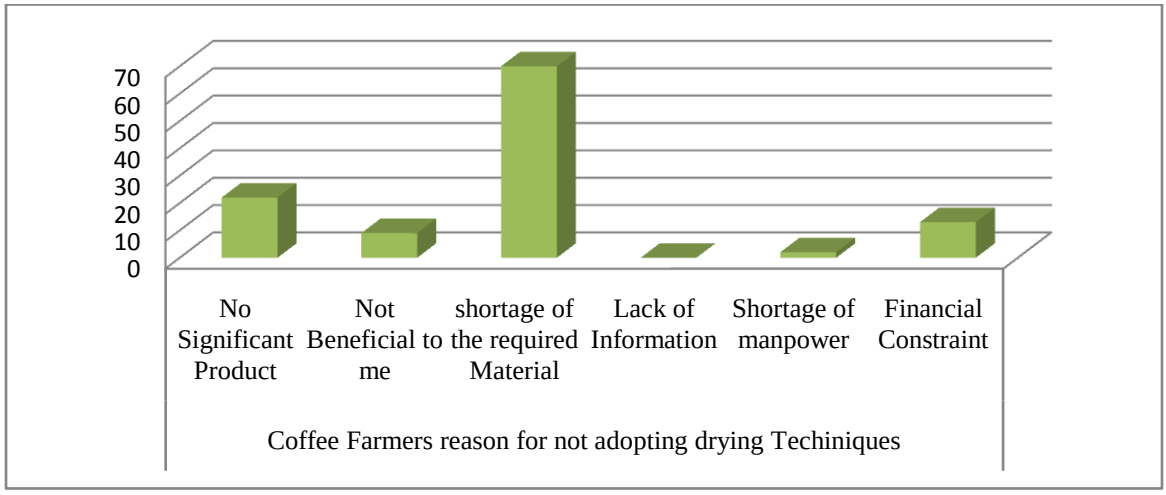

Figure 4.9 Reasons for not Adopting Drying Technique

Source: Field Survey, 2014

4.4.4 Reasons of Respondents for not Adopting Stumping Technique

The rehabilitation of coffee trees at the stage of exhaustion age is very important as the yield starts to become uneconomical. To make the trees economically productive again, they need to be stumped in order to cut out the old, unproductive wood and stimulate the growth of new wood that will bear fruit. This can be viable through Clean Stumping technique, largely applied in our country, which is a systematic renewal of old coffee plants.

Table 4.5 Reasons for not Adopting Stumping Technique

S/no	Respondents reason for not adopting Stumping Technique	Response Rate	% age From total
1	Fear of tree death	7	8
2	Fear of income reduction	24	27
3	No relevant coffee fruit	3	3
4	Shortage of saw & labor	32	36
5	Do not know about it	24	27

Source: Field Survey, 2014

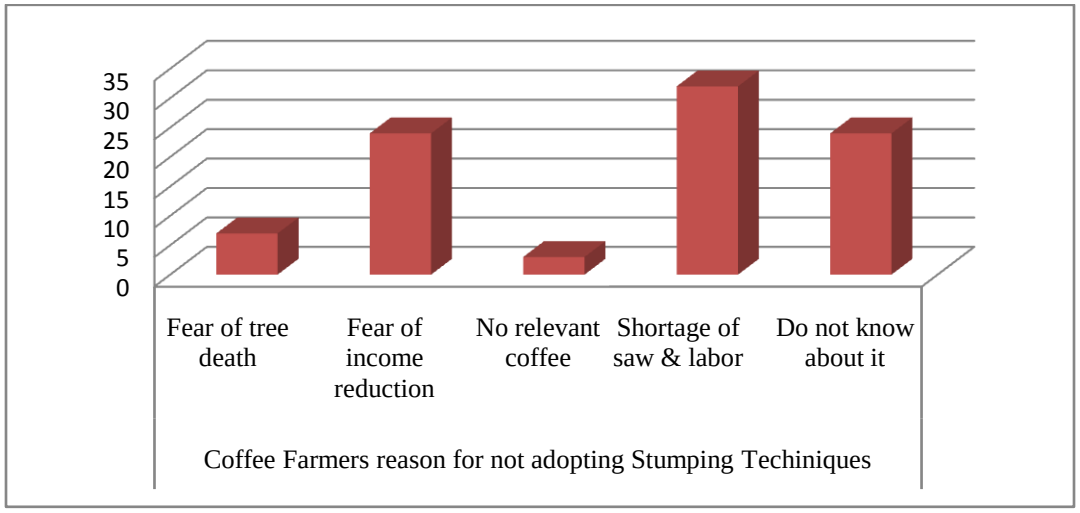

Figure 4.10 Reasons of the sample household for not Adopting Stumping

Source: Field Survey, 2014

The reason given by respondents for not adopting Stumping technique varies from place to place. Fear of tree death, income reduction, unavailability of relevant coffee trees,, lack of saw and labor, and lack of know-how were the main reasons given (Table 4.5; Fig. 4.10).

This implies that appropriate training and the required material, such as saw, should be provided. Since clean stumping needs to be carried out as soon as the harvesting of the previous crop has been completed. This will counter the temptation to leave the old stem which might have flowered or budded and shown some crop potential.

4.4.5 Reasons of Respondents for not Adopting Land-Preparation Technique

Adoption of better technology for land preparation for the purpose of good establishment of coffee trees has paramount importance in coffee production.

Most (64%) respondents were not able to adopt the technique because the timing overlaps with other farming activity. Other farmers claim fear of not getting the seedlings required for planting, not convinced for the extra effort engaged in this activity, and lack of know-how (Table 4.6; Fig. 4.11).

Table 4.6 Reasons for not Adopting Land-Preparation for coffee plantation

S/no	Respondents reason for not adopting Land-Preparation Technique	Response Rate	% age From total
1	Overlap with other agricultural activity	40	64
2	Fear of not getting seedlings	13	21
3	Not convinced by the benefits	8	12
4	Do not know about it	2	3

Source: Field Survey, 2014

Figure 4.11 Reasons for not Adopting Land-Preparation Technique

Source: Field Survey, 2014

Land preparation technique, as its name implies, requires a period of time for the whole process. For instance, 'holing' is expected to be done six months to three months ahead of the anticipated planting date as early digging of planting hole is beneficial for soil weathering in the hole.

Traditionally, the local coffee farmers plant seedlings at one and half ($1^1/_2$) pace interval due to scarcity of land. The generally recommended spacing for s coffee is 3.5 by 2.5

meters. But, it was difficult to apply such practice due to topography of the area and small plot/farm size possession of the sample household.

4.4.6 Farmers Responses to the Stages of Chemical Fertilizer Application Technology

Chemical fertilizers have a number of benefits, if safely applied, especially in improving productivity. Nurseries and newly established coffee plantation require inorganic fertilizer like DAP or Urea. However, due to the harm in interfering with the ecosystem its application must be controlled so as to utilize the technology to the extent of its maximum benefit.

Different responses were obtained in determining the growth stages of coffee plants for chemical fertilizer application. Most farmers (58%) apply fertilizer within 1 year or below growth stage, while others apply at higher growth stages (Table 4.7; Fig. 4.12).

Table 4.7 Response on Growth Stages of Coffee for Chemical Fertilizer Application

S/no	Growth Stages for Chemical Fertilizer application	Response Frequency	% age
1	1 year & Below	35	58
2	2-6 Years	8	13
3	above 6 years	8	13
4	For all stages	10	16

Source: Field Survey, 2014

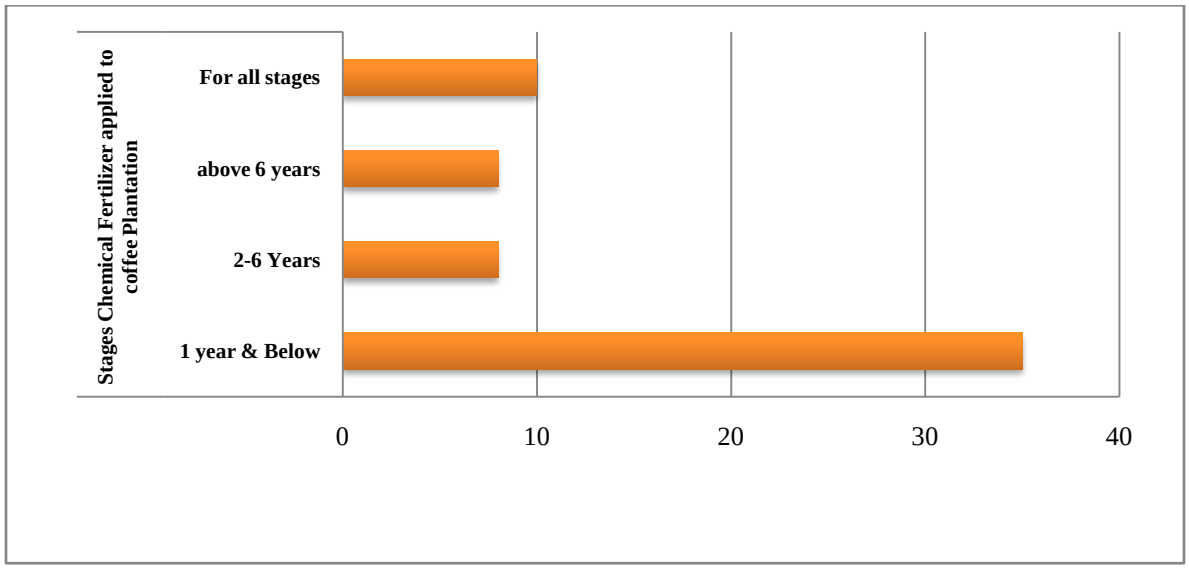

Figure 4.12 Growth Stages of coffee for Chemical Fertilizer Application

Source: Field Survey, 2014

According to sample household response, it is uneconomical to use chemical fertilizer (inorganic fertilizer), like DAP or Urea. Instead, compost, organic fertilizer, is highly utilized that is prepared from green manure and farmyard manure.

According to the information from the survey, there was no efficient market for coffee inputs, including seeds and seedlings, stumping equipments, appropriate storage, sacks, processing plants, packing machines, and the likes were not readily available. Suppliers of these inputs were not easily accessible to farmers on timely manner. Besides, the absence of a reliable financial support system that can fill the gap has severely hampering coffee transaction and the income of the smallholders in the district.

4.5 Institutional Factors

Institutional factors in the context of this study include support provided by various institutions and organizations to enhance the use of improved technologies such as access to market, use of credit, training participation, field day visit, membership of cooperative and extension agent contact. Therefore, a new technology is only as good as the mechanism of its dissemination.

According to the respondents, the extension agent (DA) contact with coffee farmers was rated as inadequate to change attitude and perception. Even, the necessary training that has been given to coffee farmers by DAs had not reached and covered all sample farmers. Only 45 farmers have responded that they had participated in a training program, while 105 farmers had not yet trained on any of the coffee technologies. Nevertheless, 69 percent of farmers had a positive perception about the impact of any coffee production technologies; whereas, the remaining households replied negative perception about the techniques. Furthermore, about 65 percent of the sample farmers didn't participate in local leadership.

Those farmers who had frequent contact with DAs account 40% of the total sample households, which indicates that they have better access to new information than other farmers.

In addition, about 52 farmers had responded that the timely availability and access to the required technologies has positive impact on production, while the remaining 98 farmers (54%) had responded as having a negative impact. Thus, good extension programs and contacts with coffee farmers are key aspects in technology dissemination and adoption.

As per the information from councilors and officials of the district, the low level attention and resource allocation provided for the coffee sector has brought a significant adverse impact on the type and quality of extension service due to budget and manpower constraints. This brought the existing coffee extension structure where some task force members consider it as the task of agricultural offices failing to own it. Furthermore, the development agents who are meant to undertake coffee extension activities are burdened with activities other than they are trained for.

Regarding the current price of coffee in the local market, sample coffee farmers differ in their perception. According to the survey of the study, 75 percent of the sample farmers have negative opinion about the current coffee price; whereas the remaining 25 percent of the households have perceived positively. Even if some farmers are exerting efforts to supply better quality coffee (fully ripened red cherries, clean cherries without foreign materials), the market did not pay them any price premium for their effort.

In general, transaction costs in both input market and output markets (outlets for produce) were high and not well organized, and market centers (primary markets) were not equipped with the necessary facilities.

4.6 Socio-Economic Impact of Coffee Technology Adoption on the Sample Households

The recommended coffee adoption technology is believed to have considerable impact on socio-economic aspect of the coffee farmers. This entails, where the right varieties of coffee are planted with the right agronomic practices in favorable environment, the existing yield per unit area is supposed to double.

4.6.1 Response of the sample household heads to frequency in year for coffee trees to bear fruit

Once coffee trees reach fruit bearing stage they may not produce coffee beans every year. Depending upon the environment, they may escape one year and give fruit after two years or more. In this regard, farmers' response varies. The majority (77%) had responded that their coffee trees produce fruit biennially. Only 5% of the household heads responded more than two years while others had claimed to be annually (Fig. 4.13).

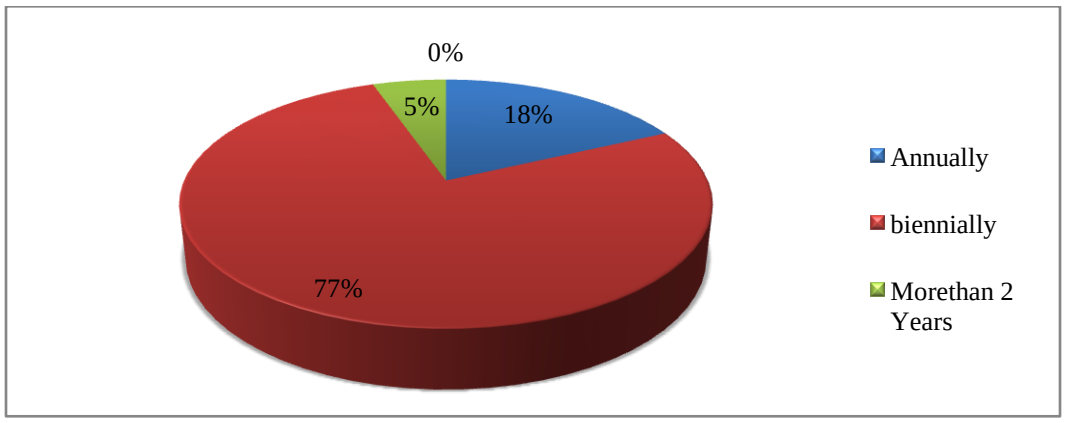

Figure 4.13 Coffee Farmers response to frequency in year for coffee trees to bear fruit

Source: Field Survey, 2014

Based on this information, the source of risk for coffee plantation was with the year-to-year variability of yield as a result of the problem with bi-annuality in coffee fruit bearing. This

nature of bi-annuality in coffee fruit bearing substantially increases the cost of production and change labor utilization.

4.6.2 Impact of Adoption of Coffee Plantation Techniques on Income of the household

According to most farmers (66%), the impact of adoption of coffee production technologies was not promising; in fact, it has reduced their annual income. Only 26% of the sample farmers had responded positively, in that, the adoption of the technique has shown improvement on their income (Fig. 4.14). This signifies that adoption of coffee technologies were expected to improve productivity and even to double production yield; but, in this study, the opposite is true.

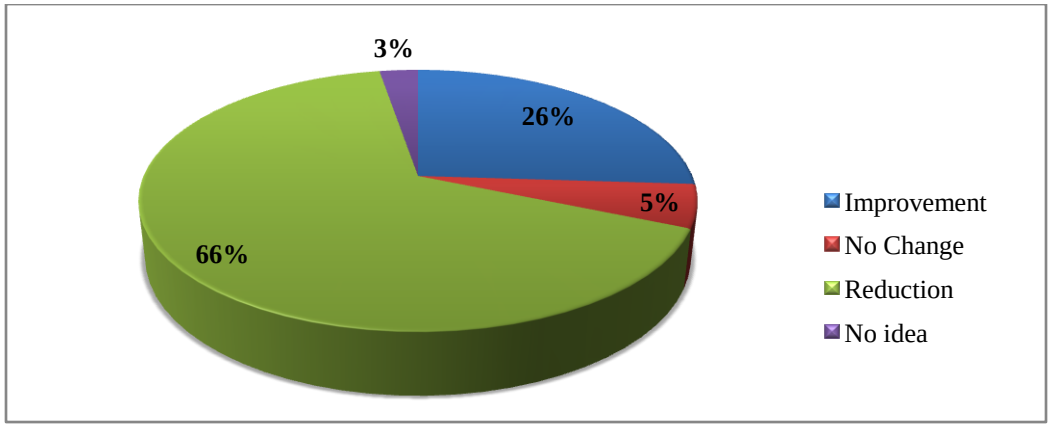

Fig. 4.14 Impact of Adoption of Coffee Production Technology on Income

Source: Field Survey, 2014

4.6.3 The Household Perception on market price of the coffee

With regard to price of coffee beans in the market, the majority (79%) of farmers consider it either as satisfactory or optimal. To our dismay, only 2% of coffee farmers rate the price as very good. At the same time, a large number (19%) of the farmers had claimed the price was unsatisfactory (Fig. 4.15). The result implies that coffee production was not an attractive sector due to the price value as set by the market.

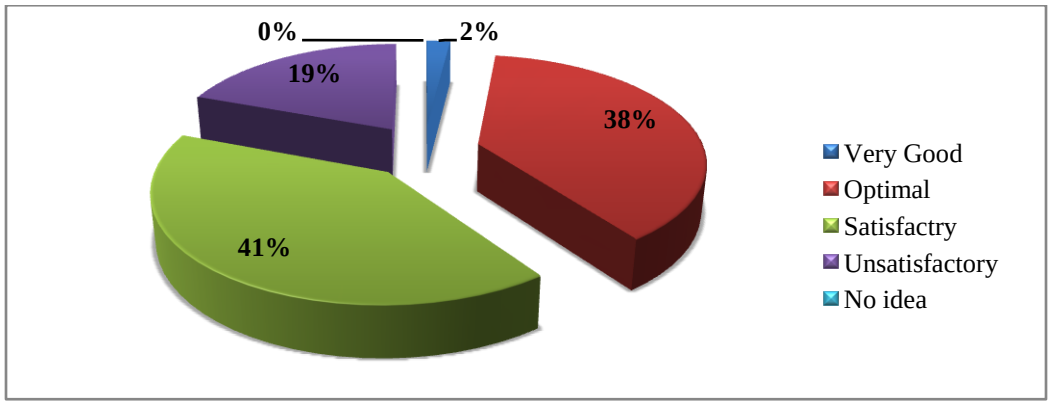

Figure 4.15 Household Perception of market price of coffee

Source: Field Survey, 2014

4.6.4 Respondents view on the Attractiveness of Coffee Production as a Business Enterprise

Coffee production has been a rewarding business enterprise for many years in many countries. However, in this study many farmers, 63% of them, were dissatisfied in their involvement of coffee production and were contemplating to switching to better productive venture, such as 'Khat' plantation, which is a dominant cash crop and a main source of income for large percentage of farmers. Among the respondents only 17% had claimed to be satisfied (Fig.4.16).

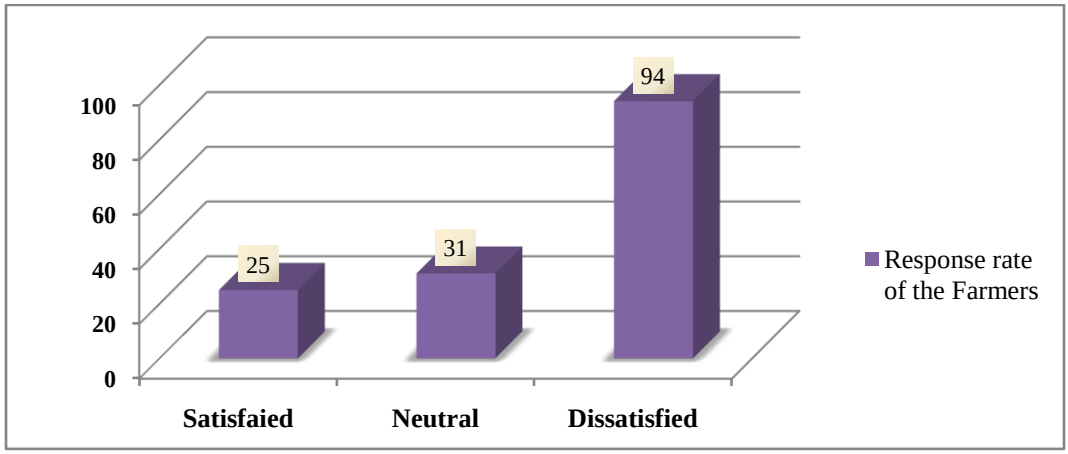

Figure 4.16 Respondents view of coffee production as a business

Source: Field Survey, 2014

4.6.5 Reasons for Dissatisfaction in Production of Coffee

The reasons forwarded for farmers' dissatisfaction of coffee production were several, but the most glaring ones were damage of their crops by CBD and the price of coffee in the market. A good number of them could not even identify clearly the reason for their dissatisfaction (Fig. 4.17).

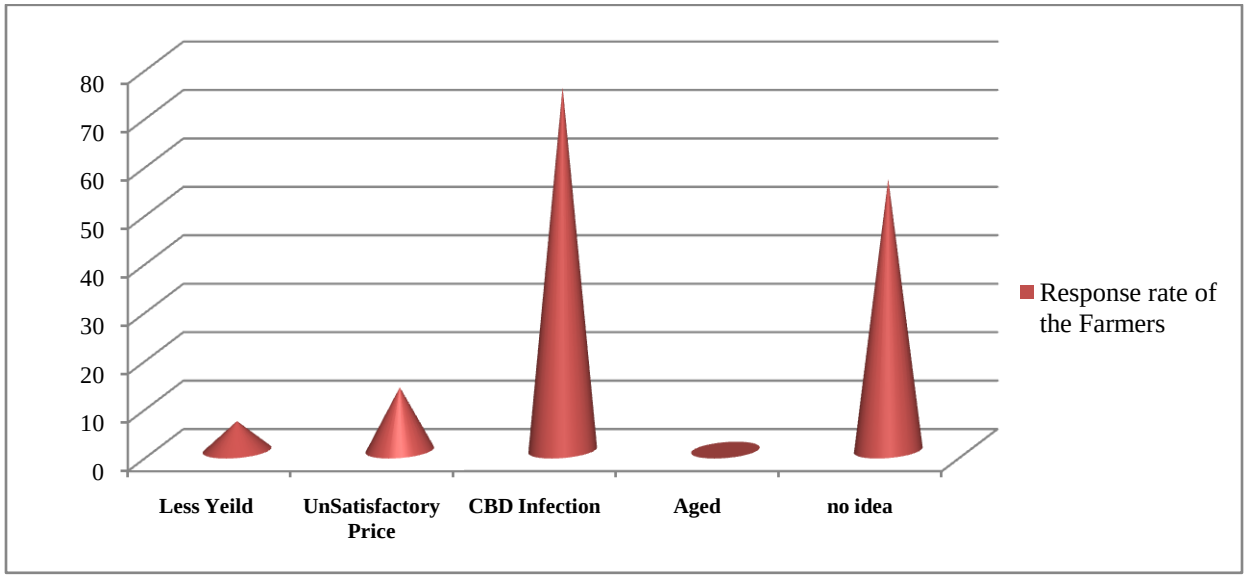

Figure 4.17 Reasons for Dissatisfaction in Coffee Production

Source: Field Survey, 2014

Therefore, the main challenge for expansion of coffee plantation into large scale farming is due to the existing cultivars which have low resistance and very susceptible to CBD, while one of the best options for CBD control is planting CBD resistant cultivars/seedlings.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

As repeatedly stated, coffee production is a highly cash crop business and foreign exchange commodity. Its contribution to households' income and food security is very high. However, determining factors that affect adoption of coffee production technology are not well understood.

This study was conducted in order to assess factors influencing adoption of coffee production technology by farmers in the area. The study tried to investigate the status of adoption and factors influencing farmers' adoption behavior. Determinants for adoption of coffee technology considered in this study include factors together with several socio-economic factors and institutional and technical support system which greatly affected the adoption of coffee plantation technologies and consequently production and productivity of the sector.

Non-adoption and variation in level of adoption among households was found to be influenced among other things by households' size, coffee farm and farming experience, participation in coffee production extension- like raising coffee seedlings, participation in extension events (training, field visiting and hosting demonstration), education level, and generally resource owner-ship and income position.

The risk of bi-annuality in coffee fruit bearing with variability in yield, and low resistance of the existing cultivars to CBD had caused a significant yield and quality loss which drove farmers to look for more productive venture than coffee production.

In addition to this, the low technical and institutional support to the district's coffee sector aggravated the problem that is attributed mainly to weak extension service. Coffee farmers were still using traditional way of production, relatively labor intensive due to lack of adequate training and access to improved technologies and management practices, the

absence of a reliable financial system which severely hampers the coffee transaction and inefficient market of coffee both in inputs and output outlets.

The overall findings of the study underline the importance of technical and institutional support system in the area that involve budding new cultivars resistant to CBD and resolve the risk of bi-annualtiy of coffee bearing fruit, reliable financial support system to sustain input supply and assist output outlets, and well trained and organized coffee extension program, in order to create awareness for adoption of the recommended coffee technologies.

Thus, policy makers and development interventions should confer more emphasis to improvement of such technical and institutional support system in such a way that to achieve wider adoption of coffee technologies.

5.2 Recommendations

In order to enhance the overall benefits from the coffee sector through the adoption of coffee production technologies for the region in general and the district in particular, major recommendations that emanated from this study deserve special attention are:

The reasons for not adopting recommended coffee technologies in this study were due to lack of required input supply timely, lack of access to information, insufficient availability of the locally required materials for making coffee drying bed, low resistant to CBD cultivars and the risk of bi-annuality in coffee fruit bearing that raise cost of the technologies for adoption, as well as reluctance to accept land preparation technique due to overlapping with other agricultural activity and scarcity of land. Thus, establishing an independent, responsible and accountable institution which deal with technology adoption and other related issue for the coffee sector of the district is inevitable.

Low price of coffee and the contribution of coffee to households' income as compared to other crops, specially 'khat', has significantly affected the adoption process. In veiw of this, increasing income from coffee by improving the per tree yield and doubling productivity of coffee is crutial. This can be possible by introducing productive coffee

seedlings and CBD resistant coffee varieties in all coffee growing areas through advanced research and developing strigent policy measures both at micro and macro levels pertaining to coffee marketing.

The majority of coffee in the area have the problem of biannual bearing. It brings the risk of bi-annuality in coffee bearing fruit with variability in yield. This has further eroded the confidence of farmers on their coffee productivity and, hence, affected the process of adoption and diffusion of new tehnologies. Therefore, budding new cultivars resistant to CBD and resolve the risk of bi-annualtiy rather than the locally preferable cultivars. Hence, the seed/seedling system has to be enhanced through conventional multiplication and micro-propagation techniques with sufficient budget, qualified manpower, equipments for biotechnology lab and the necessary chemicals for protocol optimization and micro-propagation.

The general impression of the study shows that low level of adoption to the recommended coffee production technologies. The situation can be improved by developing alternative technologies that can address the socio-economic and agro-ecological charcteristics of all coffee growing areas. Besides, there should be consistent improvement in coffee development activities which can be supported by continuous research and development so as to amplify the adoption and diffusion process of the technologies.

Coffee production is a long term investment and long-years income generating commodity once it is established with good agricultural management practices. But, coffee farmers in the district are critically suffering from shortage of finance for production, post-harvest, and processing activities. Subsequently, it needs long term credit services with collateral of their own coffee farm. This helps to improve production, productivity, processing, warehouse management, quality controlling and to maximizing the income of the farmers with a concern of ecological friendly, traceable product supply in a sustainable way. Thus, it is necessary to strengthen and encourage existing financial institutions that are supposed to support the coffee sector.

Knowledge and skill gaps had been observed in the production/management and processing/quality maintenance by extension agents and coffee farmers in the district. Strengthening capacity building programs though a short term on the job training should be organized and provided regularly to coffee experts at all levels. Farmers should also get a frequent training and follow-up from the experts and DAs on their coffee management and quality maintenance.

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Annexure I

TOOLS FOR DATA COLLECTION

QUESTIONNAIRE FOR THE SAMPLE HOUSEHOLD

Code: **Date:**

Sl.No Respondent's Background characteristics

A. Personal and household characteristics

A1. Sex of the respondent 1.Male 2.Female

A2.Age of the respondent --------- years

A3. Education level of the respondent

1. Illiterate 2. Read and a write. 3. 1-4 years of schooling. 4. 5-8 years of schooling

5. ≥ 9 years of schooling.

A4. Family members.

No	Name	Age	Sex	Total

A5. How many of your family members take care of your coffee culture? (Put sign "("In front of the above members name)----------

A6. When did you started coffee growing? (specify the year)----------

A7. Do you think you have sufficient labour?

1. Yes 0. No

A8 Do you have off – farm income? 1. Yes 2. No

If yes, explain your job ----------

B. Farm and resource ownership

B1. Land use pattern

Crop type	Area cultivated (hectare)	**Crop type**	Area cultivated (hectare)
Sorghum		Tobacco	
Maize		Vegetable	
Chat		Spice	
Coffee		Fruits	
Teff		Other	
Groundnut			

B2. What is the total size of your farm? ---------- (Hectare)

i. Size of land being utilized ---------- (ha)

ii. Unutilized or bare ---------- (ha) (for what purpose it will fit?)----------

B3. What is the size of your coffee plot, with respect to the age of your coffee?

1.< 1 year ---------- ha 2. 1-6 year of age ---------- ha 3. > 6 years ---------- ha 4. Total ---------- ha

B4. Livestock ownership

Type	Owned	Type	Owned
Cows		Donkey	
Oxen		Camel	
Heifers		Poultry	
Bulls		Horse	
Goat		Mule	
Sheep			

B5. Do you have the necessary coffee farm tools?

1. Yes 2. No (name the tools you lack)

C. Technical data

C1 . what type of local coffee variety do you have ?

a. Kubaniya b. Shimbure. c. Abadiro d. Other (specify the name if possible)----------

C2. Do you have any CBD tolerant variety?

1. Yes 2. No

C3. What types of coffee diseases are believed to be serious in your coffee?

a. CBD b.Coffee leaf rust c. Other (specify the name) d. Coffee tree death

C4.Do you make any effort to preserve the high quality or CBD tolerant variety of coffee?

1. Yes 2. No

If yes, how do you manage it? ----------

C5. Is your coffee farm rain-fed or irrigated? ----------

If irrigated how often do you get the water ----------?

C6. How often do your coffee trees bear fruits?

a. Yearly b. Biennially (once in two years) c. Not at all d. More than two years

C7. If it bears fruit biennially, what do you think is the problem?

C8. What cultural practices do you use to solve the problem of biennial bearing?----------

---------- ----------.

C9. To which type of the coffee varieties do you give special treatments?

a. Shimbure b. Kubaniya c. Hariro d. Abadiro e. Other

C10. For which of your crop type do you spend more money for purchase of inputs ? Give rank to the following alternatives.

a .Chat b. cereal crops c. Coffee d. Vegetables e. Others

C11 How often do you sell your chat?

a. Semi annually b. Annually c. Monthly d. Quarterly e. Other (specify)

C12 On average how many hours per day you and your family spend to take care of your coffee? ----------

C13. How many days per week do you and your family spend to take care of your coffee?---
---

C14. How many hours per day you and your family spend to take care of your chat? ----------
---

And how many days per week? ----------

C15. Have you ever tried to raise your own seedlings?

1. Yes 2. No

C15.1 If no why?

a. Lack of seeds b. Water shortage c. Labor shortage d. Shortage of materials

e. Availability of seedling in nearby areas

C15.2 If yes, what problem did you face while preparing? -------

C16. What time do you believe is the proper time for coffee plantation?

a. April –may b. Phagume (why?) c. June – Julyd. September

C17. What type of cultural practices do you use for your coffee Plantation?

a. For less than 1 year old coffee ----------
b. For 1-6 years old ----------
c. For coffee greater than 6 years ----------

C18. From where do you get seedlings?

a. Privately raised b. Contract nurseries c. Government prepared nursery.

C19. How do you get the seedlings, if your sources are contract and government nurseries?

a. Paying cash c. For free
b. Credit d. Paying down payment

C20. Have you over planted seedlings by the pressure of kebele leaders or DAs?

1. Yes 2. No

C20.1 if yes, when?

a. How many seedlings? ----------

b. Have they survived? 1. Yes 2. No

D. Institutional and extension services.

D.1 Do you meet with the extension agents?

1. Yes 2. No

D2. Are you acquainted with the coffee technologies?

1. Yes 2. No

D2.1 if yes, in what kinds of technologies? ----------

D3.Do you have trainings on coffee production technologies?

1. Yes 2. No

D3.1 If yes, what kinds of technologies? ----------

D4. Have you participated in local leadership? ----------

D5. Are the necessary technical advice and materials available at the proper time?

1. Yes 0.No

D5.1 If no, is it before or after the proper time? --------

D6. What do you think about the impact of modern techniques of coffee production on your income?

a. Improvement b. Reduction c. No change d. No idea

D7. State the unit price of the following cash crops per kilogram (if you have)

Crop	Least price	Medium	Highest
Chat			

C o f f e e			
Groundnut			
P u l s e s			

D8. What do you think about the price of coffee?

a. Very good b. Bad c. Good d. Medium e. no idea

D9. Where do you sell your coffee?

a. At home b. Take to market

D10. To whom do you usually sell your coffee?

a. Small shopkeeper b. Contrabandists c. Official coffee collectors d. Others

E. Response to technologies

E1. Do you prepare hole for coffee plantation three months ahead of actual plantation time?

1. Yes 2.No

E1.1 If yes, what is the size of the hole? ----------

E1.2 If no, when do you prepare? What is the size of the hole? ----------

a. Within a week ahead of plantation b. Just on the day of plantation c. Two weeks ahead d. One month a head e. Other (specify)

E2. What is the spacing you use between adjacent holes and between

Adjacent rows?

a. Less than 2m by 2m b. 2m x 2m c. 2m x 2.5 d. Other

E2.1 If it is less than 2m x 2m, specify your reason ----------
---

E3. When do you plant your coffee? Specify the month. ----------

E4. Why don't you follow the recommended time for hole preparation or pit excavation?

a. Because it is time for other crop's management b. Fear of not getting seedlings
b. Not convinced by the benefits e. Other reason (specify) ----------

E5. Do you use chemical fertilizer for your coffee?

1.Yes 2. No

E5.1 If yes, at which age of the trees?

a .≤ 1 years age b. 1 to 6 years age c. Greater than 6 years d. For private nursery

E5.2 If no. why?

a. Fertilizer is not economical b. Financial constraint c. Not convinced by its advantage
d. Shortage of water e. Other reason (specify) ----------

E7. Do you spray fungicide against coffee berry disease (CBD) on your coffee?

1.yes 2. No

E7.1 If yes, how many times do you spray?

a. 3 round b. 5 round d. 4 round e. 6 round

E7.2 If no, why?

a. Not economical b. Financial constraint c. Lack of access to the chemical

d. Lack of spray tools e. Not important f. Do not know about it

g. Other reason (specify)

E8. Do you exercise any of coffee pruning technique?

1. Yes 2. No

E8.1 If yes, what kind? ----------

E8.2 If' no', why?

a. Labor shortage b. Shortage of tools c. It reduces yield e. It has no effect on yield

f. Not understood g. Never heard about it

E9. Do you stump your old coffee trees?

1. Yes 0. No

E9.1 If yes, which type?

a. Complete stumping b. Partial stumping c. Other type (specify it)----------

E9.2 If no, why?

a. Fear of tree death b. Fear of income reduction c. No relevant coffee d. Shortage of saw

e. Not convinced by the benefit f. Shortage of labor g. Do not know about it

E10. If you have started to stump, why do you stop it now ? ----------

E11. Do you Desuckerize your stumped coffee?

1. Yes 2. No

E11.1 If yes, how often?

a. Quarterly b. Semi-annually c. Annually d. Other convenient time

E11.2 If no, why ?

a. Not aware c. shortage of labor
b. Don't know the benefit d. not interested

E12. After you harvested the led cherries how do you dry it?

a. Spreading on bare land b. Spreading on flat stone c. Spreading on the roof
d. Spreading on prepared bed

E13. If you do not prepare bed for your coffee drying, what is the reason ?

a. Lack of materials c. Low product of my coffee e. Lack of Finance
b. No benefit to me d. Labor shortage f. other reason (specify)

F. General Item

F1. Have you planned to plant coffee seedlings this year?

1. Yes 0. No

F1.1 If yes, how many seedlings will you plant?----------

F1.2 If no, why?----------

a. No land or saturated demand b. Other important crop considered c. Not interested
d. Other reason (specify) ----------

F2. What do you feel about your coffee production?

1. Satisfied 1. Neutral 2. Dissatisfied

F2.1 if dissatisfied what is / are the reasons?

a. Less yield b. unsatisfactory price c. CBD infestation d. Aged

e. Other reason (specify) _____.

F3. What are you planning to do with your coffee?

a. Use different techniques to improve quality and quantity produced C. Expand the plot

b. Maintain at the existing situation d. Replace by other crop

F3.1 If you decided to uproot and replace by other crop, by which crop?

a. Chat b. vegetables c. Cereal crops d. fruits e. other (specify)

F4. What assistance do you expect from the government if you want to sustain coffee production?

_____

Annexure II

INTERVIEW SCHEDULE FOR THE WOREDA COUNCILLORS AND OFFICIALS

Code: **Date:**

Sl.NoRespondent'sOpinion Towards Over all Organization Structural Set up

2. How do you explain the trend of organization of coffee extension system to over all structural set up?
   1.2 How do you evaluate the linkage of the extension system, Agriculture Research Center and coffee producer farmers?
3. What are problems of extension service delivery system(Provision of technical advices and training) With regard to the following aspect?
   2.1 Types of services being delivered (technical advices, demonstration, training, seed, materials etc)
   2.2 Target groups for extension service (farmers, commercial growers, suppliers, cooperatives, owners of processing plants etc)
   2.3 Efforts in promoting coffee technology package (demonstration of improved varieties, production system and management practices and others)
   2.4 Varietal profile of the existing coffee varieties (their ecological niches, quality)
   2.5 Monitoring and evaluation mechanisms (how often?, by whom?, how?)

4. How the problem of input supply system manifested within the Woreda?

    3.1 Trends in input supply system

    3.2 Types and sources of inputs

    3.3 Input delivery system

    3.4 Availability and affordability of different specialty coffee varieties

    3.5 Efforts in coffee seedling multiplication and distribution (number of nurseries, quantity of seedlings multiplied annually)

5. Do you determine with justification the strengths, weaknesses, opportunities and threats/challenges in coffee production, processing and marketing?