DETERMINANTS OF ADOPTION OF IMPROVED FABABEAN VARIETIES, IN LIMU-BILBILO WOREDA OF ARSI ZONE, OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

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As members of the Examining Board of the Final MSc Open Defense, we certify that we have read and evaluated the thesis prepared by ……entitled

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DEDICATION

I dedicated this thesis manuscript to my late sister Almaz Abebe whom I lost during my stay here for MSc. Course at Hawassa University and her death makes me disturbed and put a bad and unforgettable pain in my life.

STATEMENT OF THE AUTHOR

I declare that this thesis is my own work and all sources of materials used for this thesis have been duly acknowledged. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Name:……... ……**Signature:**……..……

Place: College of Agriculture, Hawassa University, Hawassa

Date of Submission:…….

LIST OF ABBREVIATIONS

CSA	Central Statistical Authority
EIAR	Ethiopian Institute of Agricultural Research
ETB	Ethiopian Birr
KARC	Kulumsa Agricultural Research Center
SNNPRS	Southern Nations, Nationalities, and Peoples' Region
SPSS	Statistical Package for Social Science
STATA	Statistics and data
TLU	Tropical Livestock Units
WBOARD	Woreda Bureau of Agricultural and Rural Development
EIAR	Ethiopian Institute of Agricultural Research
NVRC	National Variety Release Committee

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DETERMINANTS OF ADOPTION OF IMPROVED FABABEAN VARIETIES, IN LIMU-BILBIILO WOREDA OF ARSI ZONE, OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

ABSTRACT

The study assesses determinants of adoption of improved fababean varieties in Limu-Bilbilo woreda of arsi zone, oromia national regional state Ethiopia. To this end, the objectives of this study were: to assess the status of adoption of improved fababean varieties production in the study area and to analyze determinant factors of adoption of improved fababean varieties in the study area. For this study, three fababean growing Kebeles were selected randomly, and a total of 170 fababean producing farm households were identified with probability proportional to size (PPS) of households from kebeles of . Descriptive analysis and logistic regression (binary logit) were used to identify the relative importance of the various factors associated with adoption of improved fababean varieties. The result of descriptive analysis indicated that about50.6 % of the sample respondents were adopters of the improved fababean varieties, while 49.4% were non- adopters. Results of the logistic regression analysis indicate that among, 15 identified explanatory variables experience of households in fababean crop production, livestock holding, family size in man equivalent and training attendance significantly influenced adoption of improved fababean varieties. The overall finding of the study underlined the high importance of training and experience sharing visits in the areas of extension service to support famers and thereby to facilitate adoption of improved fababean varieties. There is also need to consider farmers' experience asset holding position and labour situation in fababean crop production during the new fababean technology development, evaluation and dissemination process.

1. INTRODUCTION

1.1 Background and justification

Ethiopia like most of developing nations its economy is based on agriculture. The agriculture sector contributes to nearly 46% of GDP, 73% of employment, and nearly 80% of foreign export earnings of the country. The sector is dominated by smallholder farmers who practice rain-fed mixed farming by employing traditional technology, adopting a low input and low output production system (ATA, 2014)

Improved agricultural technologies are important to boost production to meet the national demand for food security and income generation. Since three decades, the national agricultural system has been working towards generating suitable food legume technologies, among others, and in collaboration with different stakeholders for disseminating the technologies to farmers. The distribution and land area coverage of improved varieties of food legumes are increasing from year to year. However, the rate of use and dissemination of the seeds of improved legume varieties still remains very low mainly due to limited capacity of the national seed system to multiply and disseminate the varieties to the target environments (Geletu **et al**. , 2012). Also Lura, et al (2013) identified high prices, limited access to credit, weak extension services and distribution inefficiencies among other factors as important factors limiting better use of both chemical fertilizers and improved seeds.

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Kulumsa Agricultural Research Center which is one of the respective centers for Ethiopian Institute of Agricultural Research (EIAR) is mandated for breeding, maintaining and

providing breeder and basic seeds of different crops. Thus, among the different crops, it has been involved in the production, popularization and scaling up of different fababean varieties for smallholder producers. Different development organizations have also been involved in the dissemination of improved fababean varieties among the farmers.

Limu-Bilbilo Woreda is one of the target areas where such efforts have taken place. To mention some of the varieties which has been promoted in the woreda are Gabalcho (EH 96009-1), Moti (EH 95078-6) and CS 20 DK.

1.2 Statement of the problem

Improving productivity of agriculture is one of the economic growth and development strategies of Ethiopian government.

Next to cereals, pulse crops play a great role in improving food security as well as income generation of smallholder farmers leading to improved export earnings of the country. Ethiopia is one of the top ten producers of total pulses in the world and the second-largest producer of faba beans after China (Yirga et al. 2010).

In Ethiopia, the national average productivity of fababean is 1.5 ton per hectare which is low when compared with that of the world 1.8 ton (Hailu et al., 2014).

In order to increase productivity and production of the crop, the national research system and the universities have been involved in agricultural research and variety development (Ababa & Prepared, 2007). Seventeen fababean cultivars have been released over three decades of breeding program (Tolessa, 2015).

Despite availability of a large number of fababean varieties released at national level in general and in the study area in particular, adoption by farmers has been low which could

be associated with different factors such as farmers' characteristics, socio-economic and institutional factors.

In the study woreda, three fababean varieties; namely, Gabalcho (EH 96009-1), Moti (EH 95078-6) and CS 20 DK were promoted by seed dissemination through the collaborative efforts of Kulumsa agricultural research center which is one of the respective center of EIAR (Ethiopian Agricultural Research Center) and Lemu-bilbilo woreda office of Rural Development to improve productivity and the income of the smallholder farmers.

In spite of such intervention, there are no studies assessing the possible constraints and opportunities that may be responsible for the low productivity of the crop. There are either little or no scientific evidence regarding the performance of the various extension/demonstration activities carried out in the study Woreda. Information with regard to adoption of improved fababean varieties on locally specific factors influencing the adoption of improved fababean varieties being promoted in the woreda has not been systematically and empirically studied and documented in the study area. Therefore, this study aims at understanding the specific factors influencing to adoption of improved fababean varieties and adoption status of the improved fababean varieties in the study area.

1.3 Objectives of the study

The general objective of this study is to assess factors influencing improved fababean production in Limu-Bilbilo Woreda. The specific objectives include:

1. To assess the status of adoption of improved fababean varieties production in the study area.
2. To analyze determinant factors of adoption of improved fababean varieties in the study area.

1.4 Research questions

1. What is the status of adoption of fababean varieties in the study area?

2. What are determinant factors of adoption of improved fababean varieties in the study area?

1.5 Significance of the study

The information obtained from this study will generate useful knowledge to development planners, policy makers and practitioners in reducing poverty through increased agricultural productivity and improving fababean farming and use.

1.6 Scope and limitations of the study

This study was undertaken in Limu-bilbilo, which is found in Arsi zone, Oromia National Regional State. It focuses on factors influencing adoption of improved fababean production among smallholder farmers. The study utilizes cross-section data due to resource limitation and therefore dynamic issues are unaddressed.

2. LITERATURE REVIEW

2.1 Definition and concept of adoption

Adoption is a decision to make full use of an innovation as the best course of action available. Rejection is a decision not to adopt an innovation. For most individuals, one means of coping with the inherent uncertainty about an innovation's consequences is to try out the new idea on a partial basis. In fact, most individuals will not adopt an innovation without trying it first on demonstration basis to determine its usefulness in their own situation. The decision stage in the innovation-decision process occurs when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation. (Rogers, 1983).

2.2Theoretical concept of adoption

Diffusion scholars have long recognized that individuals decisions about an innovation is not instantaneous action ,rather it is a process(Rogers, 1995)

There are several theories which attempt to explain the adoption process. Among them the diffusion of innovation theory is most cited by most authors of adoption. Some of the authors who cite this theory (diffusion of innovation theory) in their adoption studies are(PETROS, 2010) ;Mudiwa, 2011;Negash, 2007;

The diffusion of innovation theory states that the spread of a technology adoption could pass through different stages; these are knowledge stage, persuasion stage, decision stage, implementation stage, and confirmation stage (Rogers, 1995).
In knowledge stage, an individual is acquainted with the technology and gains some understanding how a given technology operates.

At persuasion stage the individual involved psychologically with innovation and he/she is eager to grasp more information about the existed technology/innovation. The main outcome from the persuasion stage can help to identify the favorable or unfavorable attitude towards the innovation, which contribute a subsequent change in overt behavior (that is adoption or rejection) consistent with the attitude held. At the decision stage individual involved in the activities which the innovation requires and this will lead the individual to make choice to adopt or reject the innovation. When an individual decided to adopt a given innovation he/she goes to implementation stage where mental exercise put into practice. At confirmation stage the individual/or other decision-making unit require some clarification for the innovation decision already made, here there is a room to change/reverse his/her decision if ambiguity happens on the information about innovation (Rogers,1995)

2.3 Adoption Models

In today's, most of scientific research paper it becomes customary to see econometric models as a tool for data analysis. Logit model is one of among the econometric model which has been applied to perform data analysis in adoption studies repeatedly.

The logistic regression (LR), also known as the logit model, was first proposed in 1970 as alternative for data analysis technique to overcome limitation of ordinary least squares(OLS) regression in handling dichotomous outcomes(Peng & So, 2002). It is a generalized linear model used for binomial regression. Like many forms of regression

analysis, it makes use of several predictor variables that may be either numerical or categorical. One of the Advantages of using logit model over the other model is that Logistic regression can be used to predict a categorical dependent variable on the basis of continuous and/or categorical independents variables.

The following (wokeneh Abebe, 2007);(Petros, 2010); (Woyesa, 2010);(Gecho & Punjabi, 2011); (Beshir & Wegary, 2014) and (Jl, Pelajar, & Jawa, n.d.) Some of the authors who use logit model to run the analysis part for data analysis and interpretation.

2.4Empirical Studies on Technology Adoption

In Ethiopia many adoption studies started over four decades ago and many of them focused on crop production, livestock production and soil conservation technology adoption.

The study conducted by (wokeneh Abebe, 2007) On Determinants of Adoption of Improved box Hive in Atsbi Wemberta District of Eastern zone, Tigray region , age as one of explanatory variable is insignificant. The result implies that there is no variation between adopters and non-adopters in mean age. In opposite to this the study carried out by (Ojo & Ogunyemi, 2014) on Analysis of factors influencing the adoption of improved cassava production technology in Ekiti state, Nigeria result found that age has significant result on adoption of improved cassava production technology.

In Africa, technological development has been modeled on western pre-selected packages and implemented everywhere, without considering their appropriateness to the environmental, cultural and economic context. Despite their active and continuous interaction with the environment as food producers, concern regarding women's technological knowledge on improved agricultural technologies, has never been included in policy making and implementation(less attention has been given by the local communities about women involvement in agricultural technology development). This omission of the knowledge systems of a significant proportion of agricultural producers makes it difficult to develop relevant techniques for rural farmers in the continent. In those societies where agricultural production is the mainstay of economic production, it is an acknowledged fact that men and women do different things, have access to different resources and benefits, and play different roles in the production cycle.(Africa, 1988).the study conducted by

(Ayalew, 2011) on Factors Affecting Adoption of Improved Haricot bean Varieties and Associated Agronomic Practices in Dale Woreda, SNNPRS, revealed that there is significant relationship between sex and the adoption of haricot bean production package at 1 % significant level.

In the finding of (EF & Hamidu, 2011) on Adoption of Improved Technologies in Soybean Processing and Utilization in Tafawa balewa local government area of Bauchi state, Nigeria the result indicate that education level has negative significant with the adoption of improved innovation of soybean ,this may be due to low educational levels of respondents and probably due to lack of understanding of the usefulness of soybean innovations. similarly ,(Amao & Awoyemi, n.d.) reported in their study of adoption of improved cassava varieties show that education was not a significant factor in the adoption of improved cassava varieties, but were positive which showed that they had direct relationship with the adoption of improved cassava varieties(Amao & Awoyemi, n.d.).while in the findings(Shehu **et al**, 2013);William Netege **et al** and (Victor Owsu and Emmanuel Donkor, n.d.) Result show that education plays a significant role in the adoption of technology.

Regarding farm experience The study conducted by (Zegeye et al., n.d.) Reveal no significant difference, in years of farming experience between adopters and non adopters of improved wheat varieties.

Concerning farm size the finding of (Chirwa,2005) indicate that plot size influence in the adoption decision of fertilizer technology and the coefficient is statistically significant at 1 percent level . The author concludes that farmers who have small plot of land economically is not efficient due to the packaging of fertilizer.

The study by(Mwangi,2001) on Adoption of Improved Bread Wheat Varieties and Inorganic Fertilizer by Small-scale Farmers in Yelmana Densa and Farta Districts of Northwestern Ethiopia confirm that Farm size influenced the adoption of improved bread wheat varieties positively and significantly. Although the mean farm size for adopters was

less than that for non adopters, there was a tendency detected in the logit analysis for the probability of adopting an improved wheat variety to increase slightly as farm size increased. Finally the conclusion from this study shows that farmers with larger farms have a slightly higher probability of adopting an improved wheat variety.

According to (Hassan **et al**, 2013) reported that Number of livestock (TLU) positively and significantly associated with both the probability and intensity of commercial fertilizer use. A unit increase in heard size would lead to an increase in the likelihood of commercial fertilizer use by 1.7%.similarly,(Gebresilassie & Bekele, 2015) on the study of Factors determining allocation of land for improved wheat variety by smallholder farmers of northern Ethiopia indicate that TLU affects the adoption level of farmers positively and significantly at 1% level of significance. .From this result the authors conclude that being owner of more livestock increase the level of adoption of improved agricultural technology.

A study by(Negash, 2007) on Determinants of Adoption of Improved haricot bean production package in Alaba special Woreda, Southern Ethiopia. One way analysis of variance (F= 2.063 and p=0.107) was conducted based on farm income of household heads and the test result showed insignificant mean difference between adoption categories in relation to farm cash income after fulfilling family requirement and bivariate correlation test result (r=0.194) reveals that the existence of positive and significant relation between adoption index of household heads and annual farm income.

Non -farm income/off farm income :participation of smallholder framers on non-farm activities can help to purchase important farm inputs such as fertilizer and improved seed. empirical studies conducted by (Ng **et al** , 2014) Econometric Analysis of the Factors that Affect Adoption of Conservation Farming Practices by Smallholder Farmers in Zambia reveal that shows Availability of off-farm income is statistically significant at affecting adoption of Conservation Farming CF in Zambia. Results indicate off-farm incomes reduce the odds of adopting CF among smallholder farmers, holding other things constant .

Membership of Farmers' Association**:** The positive sign on membership of association implies that most of those who have higher adoption indices are members. This result is expected because membership of association enables individual members to be exposed to new technologies through interactions with other members who have the knowledge. It also empowers them to obtain credit to purchase improve inputs by using the group as collateral for the loan. Formation of such groups will increase adoption of improved technologies.(Tiamiyu **et al**, 2014)

According to (Hundie, 2012) studies on Impacts of Adoption of Improved Wheat Technologies on Households' Food Consumption in Southeastern Ethiopia shows that Adopters are significantly different from non-adopters with respect to many of the variables considered among these variables access to institutional credit was important variable. Similarly ,(Mugisha, 2013) found that the study conducted on Technology Adoption by Sunflower Farmers in Northern Uganda reveal that access to credit encourages adoption of new technologies. The reason mentioned in the study was when farmers have access to credit; they can get resources to buy inputs which are important in the adoption of the technologies.

Participation in training**:** involving in different training concerning improved technology can facilitate the adoption of a given technology.(Mihiretu, 2008) on the study of Farmers' Evaluation and Adoption of Improved onion Production Package in Fogera District, South Gondar, Ethiopia. In this study the result show that majority of the 68.9% respondents were never participated in training, and the rest 31.1% of the non adopters attended training at different level of frequency.

Attending visit session A study by(wokeneh Abebe, (2007) on determinants of adoption of improved box hive in Atsbi Wemberta district of eastern zone, Tigray region reveals that credit, Knowledge, education level of household head, perception and visit demonstration

were positively and significantly influencing adoption of improved box hive, whereas age, family size, extension contact, market availability and beekeeping training were not significantly influencing adoption of improved box hive.

In most of previous findings participation in field day can increase the adoption of a technology ,to mention some of the author (Gregory & Sewando, 2013) and (Okuthe, 2014)

In the study conducted to understand the major factors affecting adoption of improved maize technology in Wolayta, Ethiopia, Yishak Gecho and Punjabi (2011) reported that number of livestock, external funding, targeted extension services, unaffordable input price, timely supply of chemical fertilizer and improved seed and farm size are important determinants of adoption of maize technology by smallholders.Farmers who adopted the new fababean technologies, whether the full package or individual components, obtained significantly higher yields. Simply replacing traditional varieties(Gregory & Sewando, 2013) with improved ones led to gains of 18%in Egypt, 8%in Sudan and 42%in Ethiopia . The study by Hassen (2014) revealed that labor availability, livestock ownership, farm size, distance to all weather roads, markets and input supply played a critical role in the intensity of adoption of improved forage technologies.

A study by Bedru Beshir and Dange Wagary (2014) examines that factors influencing farmers decision of hybrid maize in drought prone central rift valley of Ethiopia. Hybrid maize adoption in central rift valley was found to be influenced by age, years of formal education and farmland size.

A study by Bayissa Gedefa Woyessa (2010) indicates that among, 18 identified explanatory variables nine of them significantly influenced adoption of improved sesame varieties. Education, sex, family labor supply, livestock ownership ,total farm income earned ,perception on varieties attributes, farmer to farmers knowledge sharing and experience in sesame crop production have associated significantly and positively with adoption of

improved sesame varieties. Whereas, distance from market center has associated significantly but negatively

A Case study conducted in northern Ethiopia by Mohammed Endris and Lakew Wondimu, (2013) on fertilizers and improved seeds complementary in the process of adoption, revealed that fertilizers and improved seeds found to be complementary in the adoption process. Analysis of agricultural technology adoption using logit model indicated that, holding other factors constant, households with larger farm size, owning more animals, access to irrigation and larger proportion of literate family members are more likely to adopt new agricultural technologies. It was suggested that farmers have an incentive to adopt many technologies.

Farmers learn about new technologies from various organizations, programs, and projects dedicated to research, extension, or rural development.

A study by Tsion Tesfaye et al (2010) on the effectiveness of training offered by Ethiopian Institute of Agricultural Research to farmers shows that training offered by the research centers significantly improved knowledge of potato, onion and durum wheat extension packages.

The most important factors that significantly influenced knowledge of potato, onion and durum wheat extension packages were level of aspiration, education of farmers, information seeking behavior and extension contact. Similarly, the major factors that significantly influenced attitude of trained farmers include level of aspiration and education of farmers.

3. METHODOLOGY

3.1 Description of the study Area

This study was carried out in Limu-Bilbilo woreda which is one of the 22 woredas of Arsi zone of Oromia National Regional State. The total area of the woreda is 1031km^2 which is sub divided into 33 kebales consisting of 25 rural kebales and 8 urban kebales. (WBOARD, 2014)

The altitude of the woreda ranges from 1500m to 3800m above sea level. The Woreda is divided into two ecological zones; namely, high land (80%), mid-altitude or moderately cool (20%).The mean annual rainfall ranges from 800 to 1400mm and the average annual temperature is 6-26^{o}c. (WBOARD, 2014)

Mixed agriculture, i.e., crop and livestock production, the former being the main economic activity is practiced in the Woreda. There are two cropping seasons in the area, Belg (short rainy season) from February to April and for 'Meher' (main rainy season) from June to September. More than 75% of the total crops are produced during the main ('Meher') season. The major annual crops grown are barley, teff, wheat and maize from cereal crops, horse bean, field pea and lentils from pulses and linseed and rapeseed from oil seeds crops.

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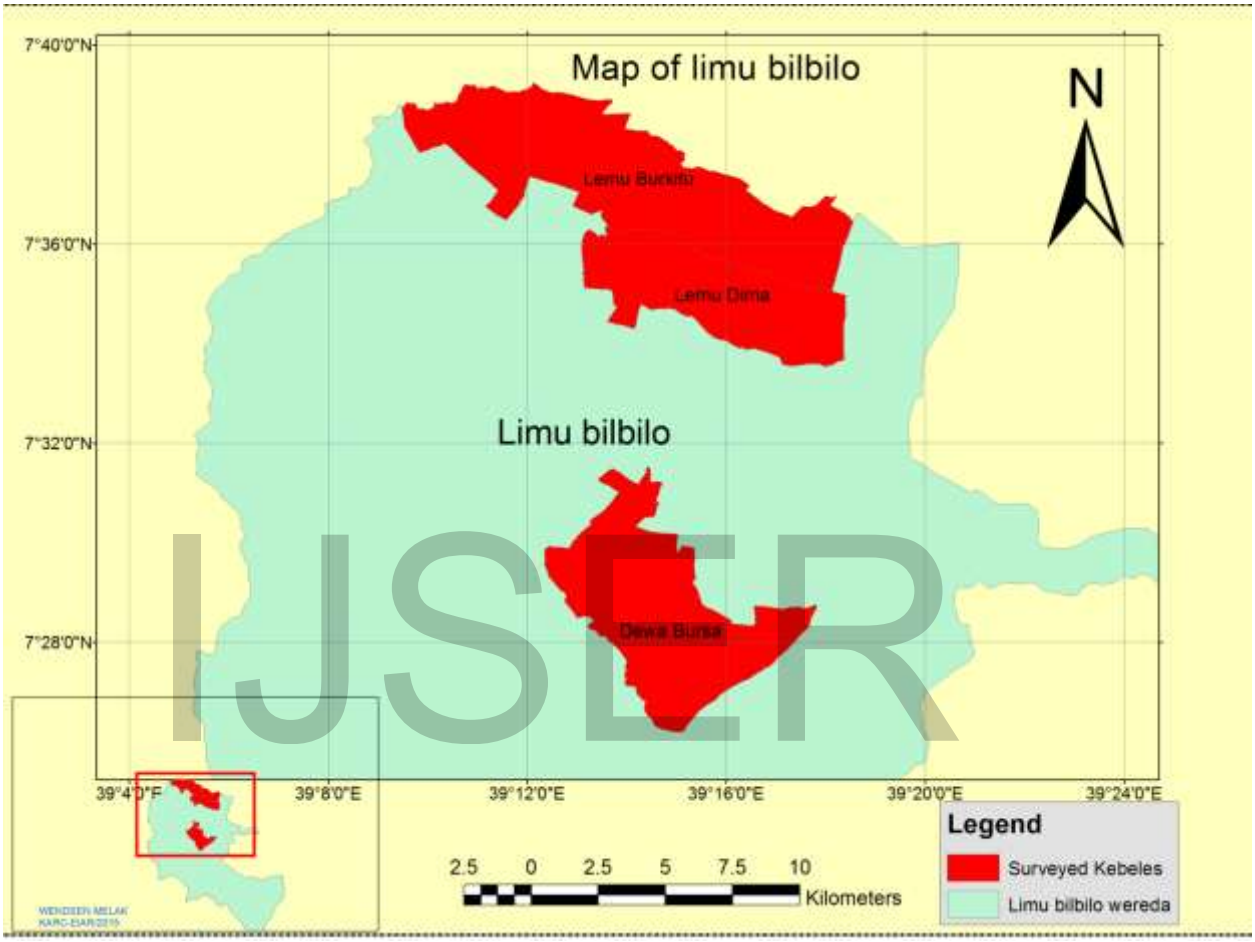
Figure 1 Map of the study area



3.2 Sampling procedure

Multi- stage sampling technique was used to identify sampled farmers for data collection. At the first stage, the woreda (Limu-bilbilo) was selected purposively based on presence of improved fababean varieties. At the second stage, three fababean growing Kebales were selected randomly, from kebeles of improved fababean producers. At the final stage of sampling procedure, a total of 170 farm households were identified with probability proportional to size of households of the Kebales and sample households drawn randomly from the fresh list of households at each Kebale.

Sample size determination was made following Green (1991), cited in Carmen et.al (2007) Accordingly, $n \geq 50 + 8$ m (where n is sample size and m is the number of independent variables). Therefore, the total respondent for survey, n=50 +8 x 15=170

The distribution of respondents by villages is presented in Table 2 where it shows that 42(24.7%) farmers were coming from dawa-bursa kabale, 57 (33.5%) from lemu-burkitu kabale, 71(41.8%) from Lemu-dima kabala.

Table 1 name of kabale and number of respondents (n=170)

name of kabala	Frequency	Percent
Dawa-bursa	42	24.7
lemu-burkitu	57	33.5
Lemu-dima	71	41.8
Total	170	100.0

3.3 Methods of Data Collection

3.3.1 Data Types and Sources

Both primary and secondary data was used in this study. The primary data involves socio-economic characteristics of smallholder fababean farm households, household assets and institutional characteristics related to fababean varieties.

The primary data pertaining to the year 2014/15 crop season was collected from sample respondents. The primary quantitative data were collected from the respondents using a pre- tested, structured interview schedule by enumerators who are familiar to the existing social settings. Training was organized to enumerators on the content and interview techniques. Then, the survey was conducted under close supervision of the researcher.

Also, qualitative data was collected through discussions with focused groups, field visits, and personal observations. There was one focus group (6-8 farmers) discussion per kebale to collect data and also check list was prepared. Adoption of improved fababean related issues were raised and discus to get their opinions. In addition, discussion with Kebale and Woreda officials, development agents and concerned woreda Agricultural office experts were held to supplement the information.

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Secondary data supporting the primary data analysis and interpretation were collected from various sources such as Kulumsa Agricultural Research Center (KARC) documents both

published and unpublished materials, reports of bureau of agriculture office at different levels, seed producer cooperatives, central statistical agency (CSA) and internet.

3.4 Methods of Data Analysis (binary logit model)

Both Descriptive statistics and econometrics models are the two analytical tools that were applied to achieve the set objectives.

Descriptive statistics was used to describe the socioeconomics and demographic characteristics of the sample households. Means, percentage, standard deviation, and frequency were analyzed using SPSS software package and statistical test were conducted using t-test and chi-square to test the continuous and categorical variables, respectively.

Econometric analysis involves application of a binary logit model in the framework of hypothesized determinants of adoption of improved fababean varieties. Logistic regression has been used to analyze data with dichotomous and categorical dependent variables. In this study the adopter and non adopter of improved fababean varieties are the two group categories. Like ordinary regression, logistic regression provides a coefficient 'β', which measures each independent variable's partial contribution to variations in the dependent variables.

The probability of adoption of improved fababean varieties was estimated by using logistic regression models by the following equations (Gujarati, 2008):

$$P_i = \frac{1}{1+e^{-Z_i}} = \frac{e^Z}{1+e^Z}$$

Where, Pi is a probability of adoption of improved fababean varieties for the i^{th} farmer,e- represents the base of natural logarithms and Z_i is the function of a vector of explanatory variables and is expressed as

$Z_i=\beta_0 + \beta_1x_1+ \beta_2x_2+\dots \beta_nx_n$ and that pi is nonlinearly related to *Zi* (i.e., *Xi)*

If Pi is a probability of adoption of improved fababean varieties then, $1-p_i$ will be the probability of not adoption of improved fababean varieties. Therefore, the odds ratio in favor of a household adopts an improved fababean varieties—the ratio of the probability that a household will adopt an improved fababean varieties. Therefore, the odds ratio in favor of a household adopts an improved fababean varieties—the ratio of the probability that a household will adopt an improved fababean varieties to the probability that he/she will not adopt defined over the two probabilities is given by the following relationships:

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i}$$

.

Finally, the logit model is obtained by taking the logarithm of equation above, i.e. a log transformation is needed to normalize the distribution.

$Li=\ln(\frac{pi}{1-pi}) = zi=\beta0 + \beta_1x_1+ \dots\dots+ \beta_{15}\, x_{15} +\varepsilon$

Where, Li is values of logit, $\beta_{1\dots.}$ $\beta_{15=}$slope of coefficient measuring the change in the estimated logit for a unit change in the value of the given independent variable (holding other independent variable constant), x1…x15 are explanatory variables that are assumed to influence the adoption status and are given in Table 1 below and ε_i =error term

3.5 Description of the study Variables

Dependent variable: is explained by the status of adoption of improved fababean varieties that is denoted as dummy variable (adopter =1, non-adopter =0). This study considers those farmers who grow improved variety of fababean at least in one of their plots in the study cropping season as adopters where as farmers who do not grow improved variety of fababean were considered as non-adopters.

Explanatory variables: The hypothesized variables are categorized under household demographic, economic and institutional variables characteristics are described as follows.

Gender of household head (Sex): in the past studies indicate that female-headed households know relatively little about improved technology when comparing with male-headed household. Therefore, in this study assume male farmers are more likely to adopt new technology (improved fababean in our case). It is recorded as 1 if the farmer is male and 0 (zero) if the farmer is female.

Age of household head (Age): Age is one of the demographic factors that is useful to describe households and provide indication about the age structure of the sample and the population. In traditional societies, age serves as an important indicator of the individual's position in the society. Older farmers will be in a position to experience much with their traditional farming practices, as the age of a farmer increase he/she can develop experience about a given technology (improved fababean varieties in this case) and are expected to be more responsive to newly introduced agricultural technologies. Therefore, in this study, it is hypothesized that the farmer's age and adoption of the given crop technology are positively related.

Education level (Educ): education which plays a great role in information sharing and processing of idea and utilization. Adoption is expected to correlate positively with education.

Experience in fababean farming: farm experience is expected to increase the probability of adoption of improved fababean varieties and is measured in number of years. It is expected to affect adoption positively.

Labor availability (Hhsize): Labor will be measured in terms of Man Equivalent. A farm with larger number of workers per hectare (unit of land area) is more likely to be in a position to try and continue using a potentially profitable innovation and it is expected to influence adoption positively.

Farm size (Land size): having a large farm size will increase the rate of adoption of improved fababean varieties.

Number of Livestock (TLU): livestock is the farmers' important source of income, food and draft power for crop cultivation in Ethiopian agriculture. It is measured in terms of Tropical Livestock Units .It is assumes to be positively related with adoption of technology.

Farm income (FarInc): those households with a relatively higher level of farm income are likely to purchase improved seeds or other essential agricultural inputs and this by itself pave the way to facilitate adoption. It is measured in Birr.

Participation in non-farm activities: income generated outside agriculture, can increase the probability of adoption of a technology. It is therefore, expected to affect adoption positively.1 if a farmers generating income from nonfarm activities 0 otherwise

Membership of organization /cooperatives**:** to be members of some formal institution will increase the exposure to have information regarding new technology; as a result of these it helps the household to improve the rate of adoption.

Access to Credit (Credit): It is expected that access to credit will increase the probability of adopting improved fababean technologies.

Participation in training (PAIT): Farmers who attend training will have a good understanding about improved fababean and have a chance to adopt the technology prior to those farmers who could not attend training. Therefore; this study assumes that attending training has a positive contribution for adoption of improved fababean varieties.

Attending experience sharing and visit session: those farmers who attend experience sharing and visit events will have more information and due to this, it is expected that attending training &visit has a positive relation with adoption of improved fababean varieties.

Attendance in field days (FD): Those farmers who attend field days will have an information concerning the improved fababean varieties as well as seed source (here due to attending field day the farmers can identify who has an improved fababean varieties in their kebale and they can plan to get or purchase in the next time, hence this improve adoption positively.

Frequency of contact with extension agent

Contact with extension agent: This refers to the number of contacts farmer had with extension agent to take advice in last cropping season. Therefore extension contact is hypothesized to have a positively influence on farmer's adoption of improved fababean varieties.

Table 2 Summary of hypothesized independent variables and their measurements

No	Independent variables	Units of measurements	Description of the variables	Expected relation
1	Gender (Sex) of household	Dummy	1 for male 0 for female	+/-

2	Participation in non-farm income activities	Dummy	if farmer has non farm income(1=Yes,0=No	+
3	Membership of seed producer cooperatives	Dummy	If the farmer is a member of seed producer cooperatives (1 = Yes, 0 = No)	+
4	Access to Credit	dummy	If the farmer access to credit (1 = Yes, 0 = No)	+
5	Participation in training	Dummy	If the farmer has participated in training on improved fababean technology (1 = Yes, 0 = No)	+
6	Attending travel and visit session	Dummy	If the farmer attend T&V on improved fababean technology (1 = Yes, 0 = No)	+
7	Attending field days	Dummy	if farmers have attended improved fababean technology field days (1 = Yes, 0 = No)	+
8	Contact with extension agent	Dummy	if farmers have Contact with extension agent (1 = Yes, 0 = No)	+

No	Independent variables	Units of measurements	Description of the variables	Expected relation
9	Age of house hold	Years	continuous	+
10	Education level of the household	Years of Schooling completed	continuous	+
11	Experience in farming	Number of years in farming	Continuous	+
12	Labor availability	Man equivalent	continuous	+
13	Land size	Hectare	Continuous	+
14	Number of Livestock	TLU	continuous	+
15	Farm income	birr	Continuous	+

4. RESULTS AND DISCUSSIONS

4.1. Description of the Socio-economic Characteristics of Sample Households

This study is based on cross-sectional data collected from a total of 170 farm households selected from lemu-bilbilo district of arsis Zone during 20115/16 cropping year. Of the total sampled households, 84(49.4%) were non adopters and 86(50.6%) were adopters farmers.

The socio economic characteristics of adopters and non-adopters are discussed in this section.

4.1.1. Household size and structure

The average family size of sample households was 6persons per households and the average family size for adopters was 6.3 persons, while it was 5.8 persons for non-adopters. The mean difference for family size is also significant for the adopters and non –adopters at 5 percent significant level.

Table 3 Distribution of sampled households by demographic characteristics

Description of variable	Overall		Adopter		Non-adopter	
Households' average family size	Mean	SD	Mean	SD	Mean	SD
	6.04	3.8	6.3	4.9	5.8	2.3

Note, SD= standard Deviation

Table 4 present results on use of improved varieties. Result show that 86(50.6%) respondents predominantly grow improved seeds in fababean farming, and 84(49.4%) predominantly grow local varieties. These results indicate that almost more than half of 86(50.6%) farmers grow improved fababean seeds in their farm during the survey year.

Table 4 distribution of sample household based on improved fababean production

		Frequency	Percent	Valid Percent
	NON-ADOPTER	84	49.4	49.4
	ADOPTER	86	50.6	50.6
	Total	170	100.0	100.0

Improved fababean grown by sample respondent

Table 5 result show that the variety Gebalcho(42.4%) grown first by farmers, next to Gebalcho Variety, the Variety Moti(7.1%) grown by sample respondent and put in the second place. One (.6%) person from the sampled respondent grow the variety dosh and also 2 person (1.2%) sampled respondent grow the variety both moti and Gebalcho on their farm and 5 persons (2.9%) of sampled respondent couldn't remember /know the variety sawn during survey season.

Table 5 name of improved fababean varieties grown first by sample respondents

		Frequency	Percent
	Not remember the name	5	2.9
	Moti	12	7.1
	Gebalcho	72	42.4
	Degaga	4	2.4
	Dosha	1	.6
	both moti and gebalcho	2	1.2
	Total	96	56.5

Ethiopia is assumed to be one of the primary centers of diversification for fababean. Since fababean is produced in many part of the country attention has been given for the development of improved varieties to help increase production and productivity of crops in the country.

Before releasing, newly developed varieties are tested by breeders and evaluated for their superiority over existing varieties by professionals (technical committee) and then checked by the national variety release committee (NVRC).Only those varieties that perform well during the evaluation and approved by NVRC are released or registered. (Ministry of agriculture animal and plant health regulatory directorate, crop variety registers issues no. 14.June, 2011.Addis Ababa, Ethiopia).

Table 6 show name of variety, year of release and Breeder/maintainer of improved

S.No	Variety	Year of release	Breeder/maintainer
1	Moti(EH95078-1)	2006G.C	HARC/EIAR
2	Gabelcho(EH96009-1)	2006G.C	HARC/EIAR
3	Degaga(R-878-3)	2002 G.C	HARC/EIAR
4	Dosha(COLL155/00-3	2009G.C	HARC/EIAR

fababean seed

Source:-ministry of agriculture animal and plant health regulatory directorate, crop variety register issues no. 14.June, 2011.Addis Ababa, Ethiopia

Seeding rate

Farmers in the study area were found to use varying seed rates ranging from 120 to 200 kg per ha, the maximum being equal to that of the recommended rate (200 kg/ha) by the research system. There was significant variation among the sample grower households in amount of seed used where the minimum was 120 kg while the maximum is 200 kg per ha.

Fertilizer and chemicals application

The majority 94.1% fababean producing households apply commercial fertilizer on their fababean fields where as the remaining 5.9% respondent farmers provided that they had no trend/habit to apply commercial fertilizer on fababean field. 53.5% sample farmers reported that they use agrochemical for fababean production in their farm. Among the sample respondent who apply chemical 4D (1.8%), palas (4.1), puma (0.6%), rexido (1.8 %), redomel (0.6%), tilt (4.7%), topic (30.6%), and 9.4% do not know/remember the name of the chemical used during survey year.

Weeding frequency

Among the sample respondents 85.9 reported to have used hand weeding. From these once (64.7%), two times (20%) and more than two times (1.2%) of them have used hand weeding on their fababean farm.

Table 7 Characteristics of sample farmers by adoption group: categorical variables (% age of farmers)

Variables	Category	Adoption category		Total sample	Chi square test	p-value
		adopters	Non-adopters			
Sex	Male	50.3	49.7	92.4	0.675	0.411
	Female	38.5	61.5	7.6		
Participation in off-activities	Yes	38.4	27.7	32.9	2.654	0.127
Membership	Yes	80.2	65.5	72.9	4.688	0.030**
Credit	Yes	14.8	11.0	12.9	6.368	0.012*
Training	Yes	53.5	27.4	40.6	12.011	0.001***
Participation in travel and visit	Yes	39.5	13.1	26.5	15.262	0.000***
Field day participation	Yes	48.8	27.4	38.2	8.284	0.004**
Get advisory service	Yes	87.2	66.7	77.1	10.144	0.001***

Computed from survey data Note ***,**,*significant at1%, 5% and 10% respectively.

Household's personal and demographic variables

Gender: Sample respondent were composed of both male and female.In general from the total sampled of 170 respondent 82(48.2%) were adopters and 88(51.8%) were non-adopters (table 7) .From sampled small holder farmers 13(7.6%) of them were female and 157(92.4%) 0f the respondents were male. This indicates that male farmers involve in fababean production related activity more than their female counterpart. This could be attributed to various reasons, which could be the problem of economic position of female headed households, including shortage of labor, limited access to information and required inputs due to social position.

The result of this study is in a complete agreement to many of previous researchers who have reported positive effect of gender with adoption of agricultural technologies. Alemitu (2011), in her study on factors affecting adoption of improved haricot bean varieties and associated agronomic practices in Dale woreda, SNNPRS found that male households are more likely to adopt haricot bean production package than their female counterpart.

Participation in non-farm activities: Most of the farmers (67.1%) interviewed reported that they had no access to off/non-farm income. Only 32.9% of the sampled households had accessed to off/non-farm income during the time of survey. Type of off/ non-farm activities available for farmers in the study area include daily labor, cart work (rent), petty trade, remittance, grain trading and making house furniture.

Among the households who participated in non-farm activities, adopters accounted about 38.4 % while non-adopters accounted 27.7% and the percentage difference was tested statistically and it was found to be insignificant ($\chi 2=2.654$, $p=0.127$).This shows that difference in adoption was not observed due to house hold engagement in off/non-farm activities

Table8. Distribution of sampled households by income from nonfarm /off farm activities

Access to **nonfarm /off farm**	N	Percent
No	114	67.1
Yes	56	32.9
Total	170	100.0

MEMBERSHIP OF SEED PRODUCER formal organization

Participation in social organization is expected to have an indirect influence on the adoption behavior of farmers. It links the individual to the larger society and exposes him/her to a variety of ideas. This exposure makes him positively predisposed towards innovative ideas and practices.

Among the households who participated in formal organization, adopters accounted about 80.2 % while non-adopters accounted 65.5% with 5% significant level there was significant

difference between the two groups in terms of percentage. The percentage difference was tested statistically and it was found to be significant ($\chi 2=4.688$, $p=0.030$). This result reaffirms previous findings of Onumadu, (2014) the study conducted on socio-economic determinants of adoption of improved rice technologies by farmers in Ayamelum Local Government Area by Anambra State, Nigeria. However, a study conducted by Lopes (2010) on adoption of improved maize and common bean varieties in Mozambique indicate that being a membership of an association is negatively associated with the adoption decision of the household.

Access to credit

Adoption of improved fababean varieties by farmers is motivated by the income gained from the sale of the produce. Farmers grow the fababean crop not for consumption purpose only but to fetch cash income which is allocated for purchasing farm inputs and meet other family needs. But constraints to adoption of improved fababean production are numerous: the cost of a seed, high labor requirement (during row planting) and technical skill need for of crop management are some of the constraints that hinder the adoption of this crop.

Farmers without cash and no access to credit will find it very difficult to adopt new technologies. It is expected that access to credit will increase the probability of adopting improved fababean varieties. Based on the survey result of this study distribution of percentage of respondents where only 11 %of non adopters have access to credit while the percentage 14.8% for adopters ($\chi 2= 0.543$, $P = 0.461$) as shown in Table 6,this implies that there is no significant relationship between access to credit and adoption of improved fababean varieties. From the survey result 148 (87.5%) of the total respondents could not access to credit and only 22(12.5%) of them were obtained credit during survey year, this implies that Poor access to credit was the major constraints faced by the farmers in the study area.

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PARTICIPATION IN TRAINING

The skill acquired through training helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement the recommendation.

Therefore training is crucial and it improves the small holder farmers' performance. For instance If a farmer has no skill and know-how about certain technology, he/she may have less probability of adoption ,in order to equips farmers with new knowledge and skills, providing a planed training is unquestionable .therefore, this help them to perform new practice properly. The skill acquired through training helps to carry out a new technology effectively and efficiently. Out of the total 170 farmers interviewed 60% of them had attended training while 40 % did not attend training program related to improved fababean varieties adoption (Table 9).

Table 9 distribution of respondents based on training attendance related to improved fababean

Training attendance	Frequency	Percent
no	102	60.0
yes	68	40.0
Total	170	100.0

With regard to the adoption category, 53.5 % adopters participated in training and 27.4 % of the non adopters attended training at different level of frequency. To determine the relationship between training and the adoption of fababean varieties chi-square test was computed. The chi-square analysis showed that ($\chi 2$=12.011, p=0.001) there existed a significant relationship between them at1% probability level (Table 7) above.

Travel and visit

It is a means of diffusing information to neighboring farmers to see and then motivate them to adopt the practice into their farm. Visiting improved fababean varieties field can helps the farmers to learn more about the technology. During visiting farmers can clearly understand the advantage of improved fababean varieties from their colleagues. Among the respondents, 125(73.5%) had not got opportunity to attained travel and visit where as the remaining 45(26.5%) had got an opportunity to attend visit fababean varieties field which was organized by kulumsa Agricultural Research Center(KARC) (7.1%), Ethiopian Seed Enterprise(ESE)(.6%), Lemu-bilbilo WBARD office (17.1%),NGO(1.2%) and DA(.6%)(Table 10).

Table 10 distribution of sample respondent based on travel and visit attendance arranged by different body

Training and visit attendance		Frequency	Percent
	0	125	73.5
	1 kulumsa Agricultural Research Center(KARC)	12	7.1
	2 Ethiopian Seed Enterprise(ESE)	1	.6
	4 Lemu-bilbilo WBARD office	29	17.1
	5 NGO	2	1.2
	6 DA	1	.6
	Total	170	100.0

With regard to the adoption category, 39.5 % adopters participated in travel and visit and 13.1% of the non adopters attended travel and visit at different level of frequency. To determine the relationship between travel and visit and the adoption of fababean varieties chi-square test was computed. The chi-square analysis showed that ($\chi 2$=15.262, p=0.000) there existed a significant relationship between them at1% probability level (Table 7).

Field day

Field day is one of the most popular methods of transfer of technology. Conducting field days on farmers' field is a good way of convincing other farmers to adopt new technology. In field day neighboring farmers will get an opportunity to observe how the new technology is put in to practice in the field. This situation may facilitate the adoption process.

Table 11 clearly indicates that, from the total sample households 38.2% of farmers have attended field days at different level of frequency while majority of the farmers (61.8 %) did not attended in field day program. Among the respondents, 65 (38.2%) who had got an opportunity to attend field day on fababean varieties field which was organized by kulumsa Agricultural Research Center (KARC) (7.1%), Ethiopian Seed Enterprise(ESE)(.6%), Lemu-bilbilo WBARD office (17.1%), NGO (1.2%) and DA (.6%) respectively (Table 11).

Table 11 distribution of sample respondent based on field day attendance

field day participation	Frequency	Percent
0	105	61.8
kulumsa Agricultural Research Center(KARC)	27	15.9
Ethiopian Seed Enterprise(ESE)	2	1.2
Oromia Seed Enterprise(OSE)	2	1.2
Lemu-bilbilo WBARD office	30	17.6
5 NGO	3	1.8
DA	1	.6
Total	170	100.0

With regard to the adoption category, 48.8% adopters participated in field day and 27.4% of the non adopters attended field day which was organized by different organization. To determine the relationship between field day and the adoption of fababean varieties chi-square test was computed. The chi-square analysis showed that ($\chi 2$=8.284, p=0.004) that there is a significant relationship between adopter category at5% probability level (Table 7)

Contact with extension agent (get advisory service)

This refers to that the respondent get advisory service regarding improved fababean varieties. The effort to disseminate new agricultural technologies is within the field of communication between the change agent (extension agent) and the farmers at the grass root level. Here, getting advisory service from extension agent is hypothesized to be the potential force which accelerates the effective dissemination of adequate agricultural information to the farmers, thereby enhancing farmers' decision to adopt new crop technologies. Table 12 Adoption categories and their response to get advisory service. Out of the total 170 farmers interviewed 75.9% of them had got advisory service while 24 % did not got advisory service related to improved fababean varieties.

Table 12 sample respondent based on getting advisory service from extension agent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	41	24.1	24.1	24.1
	1 yes	129	75.9	75.9	100.0
	Total	170	100.0	100.0	

With regard to the adoption category, 87.2% adopters had got advisory service and 66.7% of the non adopters had got advisory service from extension agent. To determine the relationship between advisory service and the adoption of fababean varieties chi-square test was computed. The chi-square analysis showed that ($\chi 2$=10.144, p=0.001) there existed a

significant relationship between them at1% probability level (Table 7 reported that extension advisory service affect negatively) .This result is in complete agreement with the finding reported by(Kassa & Legesse, (2013) and against (Lopes (2010).

Table 13.Characteristics of sample wheat farmers by adoption levels: continuous variables

Variables	Adoption category				Total sample		T test
	Adopters		Non-Adopters				
	Mean	StDv	Mean	StDv	Mean	StDv	
Age of house hold	43.090	12.173	42.256	13.843	42.688	12.974	0.676
Education level	5.928	3.613	5.398	3.436	5.653	3.522	0.329
Labour availability (ME)	3.170	1.983	3.143	1.513	3.156	1.750	-0.2751
Land holding	2.556	2.490	2.632	1.716	2.593	2.146	0.818
Livestock holding size(TLU)	12.375	6.894	10.838	7.761	11.750	7.377	0.177
Farm income	27,000.85	36,657.64	12,649.57	23,279.73	1,9571.95	31,221.49	0.003**
Farming experience	21.60	12.218	21.17	13.371	21.39	12.751	0.432

Computed from survey data ** significant at 5%.

Age of household head (Age): As indicated in Table13, The overall mean age for samples household is 42.688and the mean age of household head for adopters and non-adopters are

43.09 and 42.26 years respectively. To check whether there is a significant mean difference in age between adopters and non-adopters t-test Statistics was run. The result of t-test showed that there was statistically no significant mean age difference between adopters and non-adopters.

Education level

As indicated in Table 13, the overall mean grade completed for samples household is 5.653and the mean grade completed of household head for adopters and non-adopters are 5.928and 5.398 years respectively. To check whether there is a significant mean difference in grade completed between adopters and non-adopters t-test Statistics was run. The result of t-test showed that there was statistically no significant mean grade completed age difference between adopters and non-adopters.

Table 14 show that sample respondent who attend formal education More than half of the interviewed farmers were educated, 100(58.8%) of sample respondent attend primary school (1-8) grade, 33(19.4%) had completed grade 9-12, nine respondents (5.3%) had secondary education and one respondent (0.6%) had attend post secondary school (above grade 12).This result show that majority of sample respondent 100(58.8) had primary education.

Table 14 distribution of Respondents who attend formal education (n=143)

Grade (years) completed	Frequency	Percent
grade 1-8	100	58.8
grade 9-10	33	19.4
grade11-12	9	5.3
above grade 12	1	.6
Total	143	84.1

Labor availability (Hhsize): Family labor was assumed to be the main source of labor required for farm operations such as land preparation, planting, weeding, and harvesting. Hence, information was generated on labor availability of sample households in order to examine the influence of labor availability on adoption of improved fababean varieties.

The man equivalent (ME**)** family labor availability was calculated for the sample respondents (Appendix Table 2). The survey result on labor availability across adopter categories in Table 13 - shows that, the average number of available labor force in terms of man equivalent for non-adopters was 3.143 with standard deviation of 1.513 and for adopters 3.170with standard deviation 1.983.

Farming Experience: Experience in fababean crop production of sample households was assumed to influence the adoption of improved fababean varieties. The survey results show that the average years of experience in crop production of the sampled households was 21.39years with standard deviation of 12.751 years. When the sample households considered independently into adopters and non-adopters groups, the average years of crop production experience of adopters was higher (21.60years) than that of non-adopters (21.1.7years). The mean difference for years of experience in fababean production is insignificant for the two groups at 5 percent significant level .This implies that having a longer experience in crop production may not be in a better position to know how to produce and the potential benefits of new crop than farmers with shorter experience in crop production activities.

Farm size (Land size):- From the total sample farmers in the Woredas the overall mean land holding is 2.593ha with standard deviations of2.146 ha of land. The mean land holding size for adopter is 2.556 and non adopter posses 2.632 ha of land. As (Table13) indicate the t-test reveals that, from sample farmers, there was no significant difference between average landholding of adopters and non adopters in the study Woreda.

Farm income (FarInc): Households' income from sale of farm product such as crops and livestock and livestock product is one of the important factors determining adoption of improved technologies. The amount of household income obtained from sale of farm product average is presented in Table 13.

.From the survey result it was learnt that Adopter farmers earned 27,000.85Birr gross income during survey year, while non-adopters earned Birr 12,649.57Birr. When comparing the gross income for adopters and non-adopters group, adopters was greater than was earned by non adopters.

As depicted in Table13 the t-test reveals that, from sample farmers, there was significant difference between average gross income of adopters and non adopters at 5 % significant level in the study Woreda.

Number of Livestock (TLU): In rural Ethiopia Farm animals have an important role such as source of draught power, food, such as, milk and meat, cash, animal dung for organic fertilizer and fuel and means of transport. The average size of livestock kept by adopters and non-adopters are presented in Table 13. The livestock species found in the study area are cow, oxen, sheep, goat, chicken, donkey, sheep, calves and heifers. To help the standardization of the analysis, the livestock number was converted to tropical livestock unit (TLU).The conversion factors used were shown in Appendix1.The average livestock ownership of sampled households was 11.750TLU, and for the adopters was 12.375TLU while for the non adopters was 10.838 TLU. The mean comparison showed that the livestock owned mean difference between the two groups is not significant at 5 percent level.

4.2 Econometric results and discussion

Analysis of the Determinants of Adoption of Improved fababean Varieties

In this sub-section, the results of the logistic regression model is presented and discussed. It is well known that technology adoption decision of farm households is influenced by different socioeconomic, technical and institutional factors. Many factors are hypothesized to influence the adoption of improved fababean varieties based on theoretical models and empirical evidence. A total of fifteen (7 discrete and 8 continuous) variables were selected and used for developing and estimating logit regression model.

Results of the logit model (Table 16) revealed that four factors are significant in influencing farmers' decision to adopt improved fababean varieties. Accordingly years of experience of household head with fababean crop production and total livestock the HH own are significant at 10% significance level, total family size in man equivalent is significant at 5% significance level and training attendance is also is significant at 5% significance level .

Fababean production experience of the HH head

As expected, fababean crop production experience has a positive and significant relationship (at 10 % level) with probability of adoption of improved fababean e varieties. The odds-ratio of 0.9 for fababean crop production experience implies that other things being kept constant, the odds-ratio in favor of adopting improved fababean increases by a factor of 0.9 as a farmer' fababean crop production experience increases by one year. This implies that farmers who have longer years of experience in fababean crop production have adopted improved fababean varieties compared to those who have the lower years of experience in fababean crop production.

Total livestock the HH own

As expected, the variable has a positive and significant relationship (at 10 % level) with probability of adoption of improved fababean varieties. The odds-ratio in favor of adopting improved fababean varieties, other factors kept constant increases by a factor of 1.0 as livestock increases by one TLU. This implies that a farmer who has number livestock will be more likely to adopt improved fababean varieties.

Labor availability

As expected, family labor supply has also a positive and significant relationship (at 5 % level) with probability of adoption of improved fababean varieties. The odds-ratio in favor of adopting improved fababean varieties, other factors kept constant increases by a factor of 0.9 as family labor supply increases by one-man equivalent for an average farmer.

Training attendance

As expected, attending training related to fababean production has also a positive and significant relationship (at 1 % level) with probability of adoption of improved fababean varieties. The odds-ratio in favor of adopting improved fababean varieties, other factors kept constant increases by a factor of 1.0 as household increases by one training attendance.

Table 16 logit model results for determinants of adoption

Variable	Odds Ratio	Std. Err.	Z	P>z
Gender of respondents	6.99	9.225	1.47	0.141
Age of Respondent	1.01	0.036	0.35	0.725
Grade completed	0.98	0.059	-0.33	0.742
Access to Credit	0.93	0.111	-0.64	0.525
Farming experience of the HH	0.99	0.034	-0.26***	0.797
Total land the HH owned	0.87	0.105	-1.15	0.25
Total number of livestock the house hold owned(TLU)	1.01	0.034	0.3***	0.766
Total family member(ME)	0.99	0.154	-0.05**	0.956
Total farm income	1.00	9.75E-06	2.45	0.014
get income from on farm	1.38	0.539	0.81	0.416

Participation in Formal organization	1.25	0.535	0.53	0.598
Training attendance	1.01	0.503	0.01*	0.991
Participation in travel and visits	3.55	1.876	2.4	0.016
Participation in field days	1.79	0.869	1.2	0.231
Getting extension Advisory service	2.59	1.158	2.13	0.033
_cons	0.03	0.061	-1.87	0.061

Source model result, Note *, ** and ***are significant at 1% and 5% and 10% significant level.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1SUMMARY

The study area lemubilbilo woreda is one of the potential fababean producing woredas found in woredas of Arsi zone of Oromia National Regional State. .The main theme of this study was to identify farmers' adoption status of fababean and factors influencing the adoption of improved fababean varieties. A total of170 sample households (157 male and 13 female) drawn from 3 kebeles of the woreda were interviewed using structured interview schedule. Qualitative data were collected using group discussion among selected fababean growers and extension development agents who were working in the respective kebeles.

In order to increase productivity and production of the crop, the national research system has been involved in agricultural research and variety development (Ababa & Prepared, 2007). Seventeen fababean cultivars have been released over three decades of breeding program (Tolessa, 2015).lemubilbilo woreda is among the area where the improved fababean varieties were introduced to improve the income and food security status of farmers.

The analysis was done with the help of both descriptive and econometric tools employing SPSS version 20and stata version 12 software. Mainly Chi-square test and t-test were used to test the variation of the sample group they have towards adoption of fababean varieties.

The econometrics Model binary logit was employed to estimate the contribution of hypothesized independent variables on dependent variable.

Descriptive statistical analysis results show that adopters of improved fababean varieties were better educated, male headed households, have more access to experience sharing visit, attend training ,have more numbered of livestock, have more number of labor available in the family, have large size of land ,have more gross income and participate in extension activity and communication(such as field day and getting advisory service)more than the non-adopters of improved fababean varieties .

The logit analysis of the determinants of adoption of improved fababean varieties result indicated that, the probability of adoption of improved fababean varieties is significantly influenced by, Fababean production experience of the HH head, Total livestock the HH owns, Labor availability and Training attendance

5.2CONCLUSIONS

In conclusion, from this study one can understand that improved fababean varieties were more profitable than the use of traditional varieties. Hence, adopters have benefited substantially from the use of improved fababean varieties. Farmers 'gross income of house hold is found to be pertinent in gauging the probability of adoption. In addition to this, having resource such as livestock has contributed to the adoption of improved fababean varieties by facilitating farm operation for instance during land preparation.

As demonstrated by the econometric analysis, family labor availability, livestock ownership, fababean crop production experience, training attendance were found to be important determinants of the adoption of the improved fababean varieties

The finding of this study revealed that the main differences in adoption level of improved fababean producer were also related to getting training, experience sharing visit. Because of this those sample households who did not get training, who have no chance to visit other society on the adoption of fababean varieties did not adopt so that provision of training for all and arranging field day visit and tour program with certain period of time in production season will be very much important to farmers to adopt new technology

5.3 RECOMMENDATIONS

Getting Training was found to have a positive and statistically significant influence on adoption of improved fababean varieties. Therefore, training should be considered for a wide dissemination and adoption of the varieties.

Farmers experience in fababean crop production was found to be significantly influence adoption decision of improved fababean varieties. Thus, it is important for research, extension organization and NGOs to target experienced farmers during on farm research and improved fababean technology promotion as they can easily understand about the technology which, in turn helps for convincing neighbor farmers to adopt the technology.

Labor availability in the family was found to be significantly influencing farmer's adoption decision of improved fababean varieties. The diffusion of the technology could, thus, be facilitated through farmers who have large family size to be used as contact farmers.

Experience sharing visits was found to be significantly influence adoption decision of improved fababean varieties. Thus, it is important for different practitioner and development body to consider Experience sharing visits which have play important role in creating demand towards newly released varieties. Therefore, arranging travel and field visit is an appropriate means of introducing the technology.

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LIST OF APPENDICES

Appendix 1 Conversion factors to compute tropical livestock unit equivalents

Animal category	TLU
Cows or ox	1
Heifers	0.75
Calf	0.25
Sheep or goats	0.13
Poultry	0.013
Donkey(adult)	0.7
Horse/mule	1.10

Source: Varviko (1991)

Appendix 2 Conversion Factors Used to Estimate Man-Equivalent (ME)

S/N	Age group	Male	Female
1	Less than 10	0.00	0.00
2	10-14	0.35	0.35
3	15-50	1.00	0.80
4	Greater than 50	0.55	0.50

Source: Storck et al. (1991

Appendix 3 the interview schedule

Survey for Determinants of Adoption of Improved Fababean Varieties, in Limu-bilbiilo woreda of Arsi zone, Oromia National Regional State, Ethiopia

Identification

Name of enumerator_____

Date of interview_____

Name of kebele_____

Questioner's number_____

Do you grow fababean? (Remark: if the respondent answer is no please discontinue and proceed to the next farmer)

Yes = 1 No =0

Name of household head/ respondent _____

1. Gender (Sex) of the household/ respondents _____ Male=1 Female=0

2. Age of the household / respondents _____

3. Level of education of household head/ respondents

0=illiterate/informal education _____years completed for others

Demographics characteristics

4. Total family size _____

5. Household demographic characteristics

ID Code	Name of Family Member(start with HH	Sex Male=1 Female=0	Relation to the head of HH**(codes A)**	Age (years)	Education Level**(codes B)**
1					
2					
3					
4					
5					
6					
7					

8					
9					
10					
11					
12					
13					
14					
15					

Codes A=Relation to HH head: 1=spouse, 2=child, 3=relatives by blood 4=hired labor, 5 .other (specify)_____

Codes B=Education level: 0=unable to read & write, 1=Read and Write, 2=Primary school 3=grade 10-12 4. Above grade 12

6. Farming experience of household head_____(in years)
7. Household head experience in fababean farming in years field pea_____in years
8. Experience in growing improved fababean varieties_____in years and for improved field pea____in years

Resource ownership and use

Land ownership in 2006 E.C

9. Total land owned _____hectare(s)
10. Total land cultivated _____ hectare(s)
11. Total land allocated for crop production_____hectare(s)
11.1 own land _____hectare(s)
11.2 rented in_____hectare
11.3 others (specify)_____hectare(s)

Livestock ownership

12. List number of Livestock ownership currently owned by the household

Category					Remark
	Do you own? 1=yes 0=no	Number of livestock currently owned			
		local	improved	Total	

Cows					
Oxen					
Heifers					
Calves					
Goats					
Sheep					
Poultry					
Donkey					
Horse					
Others					

Crop Production

13. Crop production by the household in 2006E.C

Crop grown	Area coverage(ha)	Average yield /ha	Total annual harvest(qt)	Amount of seed used	Saved for next season
Maize					
Teff					
Wheat					
Barley					
fababean (Improved varieties)					

fababean (Local varieties)					
field pea					
Linseed					
Tomato					
Others (Specify)					

Farmers Adoption status of improved fababean varieties

14. Have you heard of improved variety of fababean? 1=Yes 0= No

15. If yes, when have you first heard of about improved variety of fababean? _____years in E.C

16. from who/ which source? _____

1) Research center (KARC) 2) Seed enterprise 3) lemu bilbilo WBARDoffice 4) NGO 5) Others (Specify)___

17 .Which improved variety of fababean have you first grown?

1) Moti 2) Gebalcho 3) CS 20 DK 4) others (specify) _____

18. Which improved variety/varieties of fababean you have grown so far and when you have grown them?

Name of	Year	Year	Amount	Number	Did you stop	If yes

Variety	first known	first grown	grown/ha	of years grown	using the variety?1=Yes 0= No	*Reason for stopping using code A)
1.moti						
2.Gebalcho						
3.CS 20 dk						
Other (specify)…….						

Code A* Reason for stopping

1) Availability of better variety 2) Unavailability of seeds 3) High seed purchase price
4) Low yield in my field 5) disease and pest problem 6) others (Specify) _____

19. Did you produce improved fababean variety(s) seed last year (2006 E.C)? 1. Yes 0= No

20. If yes, which improved variety (varieties) you produce?

1=Moti **2**=Gabelcho **3**=CS- 20-DK **4**= both 1 and 2 **5**=1, 2, and 3 **6**=other (specify)_____

21. Area Coverage by improve variety (varieties) of fababean in 2006 E.C _____ hectares

	Improved variety(s)				
Name of variety(code A)	Amount sown in hectare	Amount produced(Qt)	Amount(Qt) sold	Unit Price/ qt	Total Price/qt
Total					

Code A: **1**=Moti **2**=Gebalcho **3**=CS- 20 DK 4 =others (specify)_____

22. If no, for question number 19 above what is/ are the reason(s) not to produce?

1. Unavailability of the seed 2. Belief that the improved variety(s) has no yield advantages over the local variety(s)
3. Price of the seed 4. Not heard about the improved variety (s) 5. Others (specify)__

23. How much fababean Seed (amount of seed) did you use per /ha? _____
24. Do you use (apply) Row planting on fababean?
1=Yes 0=No
25. If your answer is yes, to which variety you used this method?
1) Improved 2) Local 2) 3) Both
26. What is the spacing between plants?_____ cm
27. What is spacing between rows?_____cm
28. Did you use methods of hand weeding using hoes? 1=Yes 0=No
29. If you use hand weeding what is the frequency of weeding?
1. One times 2.Two times 3.more than two times
30. Did you apply chemicals on fababean cultivation? 1) Yes 0) No
31. Name of chemicals_____
32. Amount applied __ per ha
33. Did you apply fertilizer on improved fababean cultivation? 1) Yes 0) No
34. If your answer is yes to Question No 33 above, which kind of fertilizer you used?
1) DAP 2) Urea 3.both
35. If your answer is No, to Question No 33 above, what is your reason?
Reason for not applying _____
36. Do you face labor shortage problem in Fababean production?
1) Yes 0) No
37. If yes, how do you solve labor shortage problem?
1) By hiring 2) Asking for cooperation (Debo/Jigi) 3) All 4) Others (Specify) _____
38. How much fababean Seed did you produce last season? _____ Quintals
39. How much fababean Seed did you sale last season? _____ Quintals
40. If yes for whom you sale? _____
41. How is marketing done? 1 = Individual, 2 = Group marketing 3.others (specify)
_____
42. Who sets the market prices? 1= Farmers as a group, 2 = Traders,
3 = Farmers in consultation with traders 4= other (specify)_____

43. What was the price of one quintal of fababean seed you produced?
Local _____Birr Improved_____Birr
44. What is the trend in price in the last 3-4 years?
1) Decreasing 2) stagnant 3) increasing

Household's annual farm income

45. Household's annual farm income from sale of crops in 2006 E.C.

Commodity	Carry over from previous year(stored)	Last season produced	purchased	total	consumed	seed	Other use	Amount sold (Qt)	Unit price	Total price
Maize										
Teff										
Wheat										
Barley										
fababean										
field pea										
Linseed										
Tomato										
Others (Specify)										
Total income										

46. Income from sale of livestock in 2006 E.C.

Animal type	No of livestock at the beginning of the year	No of livestock at the end of the year	Number sold	Total income (birr)
Oxen				
Cows				
Heifers				
Sheep				

Donkey				
Horse				
Poultry				
Others……..				
Total				

47. Income from sale of livestock products in 2006 E.C.

Product type	Amount collected per year/kg(litter)	Consumed	Amount Sold in litter/kg(litter)	Unit price	Total revenue
Milk					
Cheese					
Butter					
Egg					
Others					
Total					

Household's annual non-farm income

48. Do you get an income from non –farm activities in 2006E.C?
    1) Yes 0) No
49. If yes, from which non-farm activities did you get?
    1. Daily Labor 2.petty trade 3.remmitance 4 aid from relatives 5. Aid from government/NGO 6.Others specify_____
50. List income from non-farm income of the following source

No	Non- farm income source	Total income in birr
1	aid (relatives)	
2	(government or NGO	
3	Daily Labor	
4	petty trade	

5	Others (specify)	

Institutional factors
Membership of organization (group)

51. Are you involved in formal Organizations in your area?
1= Yes 0= No
52. If yes, type of Organizations & responsibility

Credit
53 Have you ever used credit for improved fababean varieties?
1=Yes 0=No
54. If yes, from where did you get the credit?
1. From government (microfinance) 2. From non government
3. From friends 4. Any other (specify) _____
55. If yes, how many times did you get in the last season? _____times
56. If yes, what amount of loan did you get in the last season? _____Birr
57. What is the repayment period of your credit?
1. Every 6 months 2.One year 3.Two years 5. Other (specify) _____
58. If no, for question no 54,what was the reason?
1. Not available 2. Interest rate is high

3. Lack of collateral 4.self sufficient 5. Any other (specify) _____

Extension or communication Variables

Participation in training (PAIT)

59. Have you ever received training on improved fababean production in the last season?

1) Yes 0) No

60. If yes, how many times (last season) No of times_____ and who arranged for you?__

1) Kulumsa Agricultural Research center (KARC) 2**)** Ethiopia Seed Enterprise (ESE)

3. Oromia Seed Enterprise (OSE) 4.Lemu bilbilo WBARDoffice 5) NGO 6) others (Specify) _____

Attending training & visit session

61. Did you participate in **training & visit session (experience sharing visit)** in the last season?

1) Yes 0) No

62. If yes, how many times (last season) No of times_____and who arranged for you?__

1) Kulumsa Agricultural Research center (KARC) 2) Ethiopia Seed Enterprise (ESE)

3. Oromia Seed Enterprise (OSE 4.Lemu bilbilo WBARDoffice 5) NGO 6) others (Specify) ____

Attending Field day

63. Have you participated in field day on improved fababean in the last season?

1) Yes 0) No

64. If yes, how many times (last season) No of times_____and who arranged for you?__

1) Kulumsa Agricultural Research center (KARC) 2) Ethiopia Seed Enterprise (ESE)

3. Oromia Seed Enterprise (OSE 4.Lemu bilbilo WBARDoffice 5) NGO 6) others (Specify) _____

Seed Enterprise (OSE) 4) lemu- bilbilo WBARDoffice 5) NGO 6) others (Specify)_ _____

Contact with extension agents

65. Do you get advisory services from extension agents? 1) Yes 2) No

66. How frequently do the extension agents visit you in last season?

1) Monthly 2) bi-weekly 3) Weekly 4. Others (Specify)_____