Determinates Of Farmers' Adoption Decisions Of Improved Seed Variety In Dabat District, Ethiopia

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ABSTRACT: Determinates Of Farmers Adoption Decisios of Improved Seed Variety In Dabat District, Ethiopia Tewodros Getnet Addis Ababa University, 2014 Intellectuals believe that in many countries augmenting agricultural productivity is the main, perhaps the only, means of meeting basic needs of alarmingly growing population. Productivity is a matter of intensive use of available resource by using improved technology. However, studies in Ethiopia demonstrate law level of farm technology adoption. Therefore, clear understanding of factors behind is important for policy makers. Thus, it's the focal objective of this study. In the study, technology stands for improved seed variety. Here for this research the researcher use Years of use of adopted practices as a measure of adoption. Individuals use the length of the period of use of the technologies as a possible indicator for the extent of adoption of technologies. In order to achieve these objectives cross sectional biophysical; demographic and socio-economic data were collected from 129 randomly selected households in two selected kebles of Dabat Woreda. A two stage stratified random sampling procedure was used to select kebeles and households. The study is done manly based on survey data supported by case study, key informant interview and secondary data sources. The data were analyzed using both univariate and bivariate analysis. In this study different factors including demographic (sex, dependence ratio, education), land related (land holding, plot number, land fragmentation), income related (farm income and off-farm income), geographical (agro-ecology, plot distance) and farmers perceptions were considered and found to be statistically significant with different level and direction of relation. The major findings of the study give an idea about the importance of giving attention on the impact of these farm inputs rather than the quantity and numbering users. In addition to this, the finding calls attention to the importance of farm insurance and demonstration sites in the diffusion process of these farm inputs.

1.1 Background of the study

Introduction

Transformation of the agricultural sector in the country was started in the mid of 1990s after the formulation of a development strategy centered on agriculture, ADLI (Bansal et al., 2011). Since then, the sector is leading the overall economic development of the country, and eventually will transform the economic setup to industrialization. The sector, however, is still characterized largely by small-scale subsistence farming and low productivity. Low productivity is purely due to limited use of improved seeds and associated technologies (Spielman et al., 2009). The national strategy and empirical evidences chimes with a widely held view that poverty reduction in Ethiopia is impossible without significant growth in crop yields for major staples, and this requires improving farmers' access to fertilizer, improved seeds, agricultural credit and other inputs (EDRI, 2011). In fact, the importance of quality seed in agriculture has been recognized as primary wealth since ancient time. Mannu (200 BC) stated that good seed in good soil yields abundantly (Mannu 200BC cited in Poonia, 2013). Indeed, it has dominated development thinking for the past four decades, and some developing countries have implemented it with some success, as part of a 'green revolution' since 1950s (Bansal et al., 2011). Previous Ethiopian governments have also toyed with the idea and have selectively implemented this strategy in the 1960s and 70s as part of major 'package Programs (the comprehensive and the minimum package program) (Bansal et al., 2011). However, one can ask is this worked? And what were the limitations of such a strategy? FAO report on Africa 2010 identified Seed and fertilizer as a key input for improving crop production and productivity (FAO, 2012). Poonia (2013), estimated that the direct contribution of quality seed alone to the total production is about 15–20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs. 2013). Following this fact, the Ethiopian government and other concerned Non-Governmental Organizations have made many efforts. However, the result that has been achieved is not to the expected. Among 600 seed varieties for 50 different crop since1966 the ESE has only been able to produce 111 different varieties of just 26 different crops in 2009/10 cropping season (Abebe, 2010).

1.2 EMPIRICAL EVIDENCES AND RESEARCH GAP

A review of previous studies is important as it provides some conceptual and theoretical basis for identifying the relevant variables to be included in the analysis. Adoption of technological innovations in agriculture has attracted the attention of development economists and policy makers since the modernization period 1950s. The decision of whether or not to adopt a new technology hinges upon a careful evaluation of a large number of technical, personal, geographical, institutional and socio-economic factors. Adoption analysis, in general, presupposes that innovations exist and the study of the adoption process evaluates the reasons or determinants of whether to adopt or not, the intensity and when adoption takes place. Empirical studies identify numerous variables as being important to household's decision to use new farm technologies. There have been few studies conducted to assess determinates of the rate of adoption of improved agricultural technology by examining different variables as factor. There is inconsistence among the findings. For instance, Polson and Spencer, identified farm size as a positive factor for technological adoption as it increases the resource base of a family whereas in Van der Veen's (cited in Feder et al., 1985) study he found that the smaller the farm the higher the intensification. similarly, for Croppenstedt and Demeke, family size is positive for farmers adoption decision of farmers while Sain and Martinez found it as a constraint as it create budget consternate. In addition, Croppenstedt and

Demeke found gender to be insignificant in Ethiopia. On the other hand, Holden et al., (2008) reported that female-headed households were less likely to use chemical inputs on their farm plots in Ethiopia. However, most identified education as a significant positive factor. Beside this inconsistence of the findings, in the study area there was no prior study done on adoption. Generally, to the knowledge of the authors, very limited analysis has done of factors influencing the intensity or extent of utilization of the technologies once they introduced. On the contrary, more have been saying about the importance of technology on agriculture. Thus, careful analysis is desirable on why farmers continue to practice essentially the same farming methods with very little seed varieties and inorganic fertilizer for so long while there role on productivity are well known.

1.3 Objective of the study

In view of the above facts, the main objective of the study is to assess determinant factors affecting improved seed varieties adoption decision of farmers in Dabat district.

1.4 Literature Review

Definitions and measurements of adoption

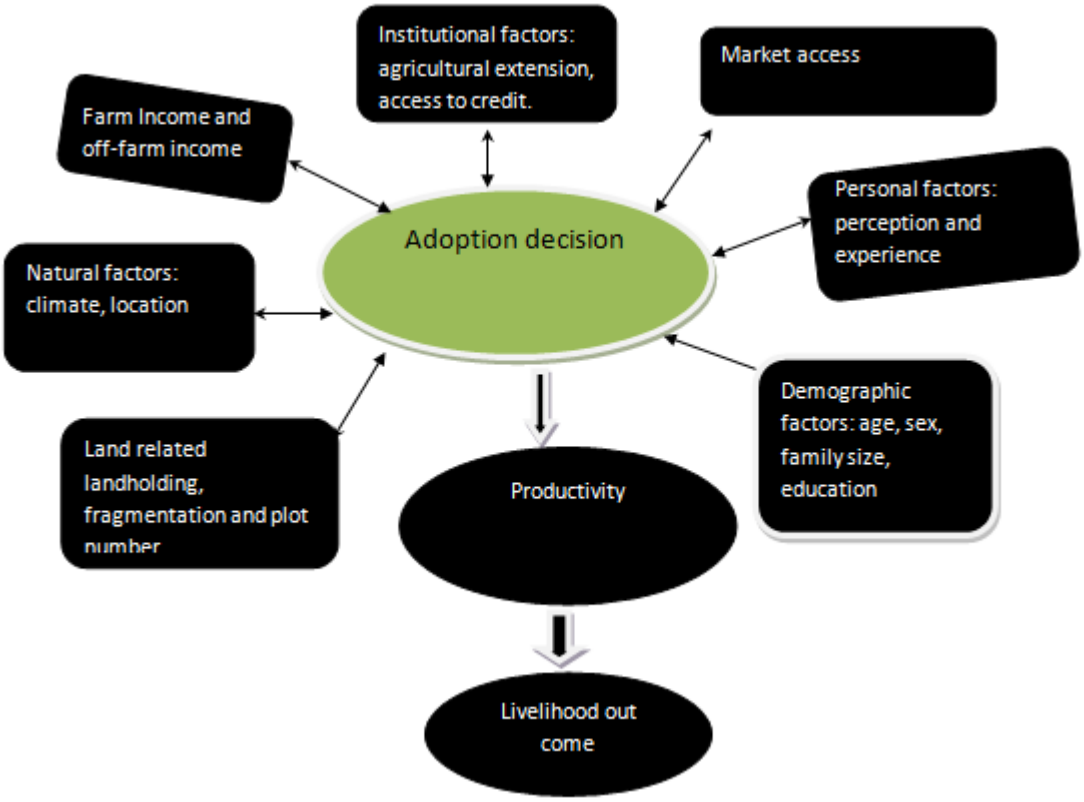
Definition of adoption

In this context, agricultural technologies include only physical objects such as seeds and fertilizer, not farming methods. The technology may not be new as such, but novel to the farmer. Thus, following Rogers (2003), a new technology (or innovation) is defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption". Adoption and diffusion of technology are two interrelated concepts describing the decision to use or not use and the spread of a given technology among economic units over a period. However, Adoption and diffusion are distinct but interrelated concepts. Adoption commonly refers the decision to use a new technology or practice by economic units on a regular basis. Diffusion often refers to spatial and temporal spread of the new technology among different economic units. Many researchers belonging to different disciplines have defined the two concepts in relation to their own fields. Among others, the definition given by Rogers (1983) is widely used in several adoption and diffusion studies. He defined diffusion as the process by which a technology is communicated through certain channels over time among the members of a social system. This definition recognize the following four elements: (1) the technology that represents the new idea, practice, or object being diffused, (2) communication channels which represent the way information about the new technology flows from change agents (extension, technology suppliers) to final users or adopters (e.g., farmers), (3) the time period over which a social system adopts a technology, and (4) the social system. Rogers (1983) then defined adoption as use or non- use of a new technology by a farmer at a given period of time.

1.5 MEASURING ADOPTION

Adoption of individual can be measured by different means. These includes from the simplest method of asking people (individuals) whether he/she has been using a particular technology or technologies or not and then categorize him/her as "adopter" and" non- adopter" according to the responses to the most complex measures of Multiple technology adoption index developed by Bezabih (2000). Here for this research the researcher use ***Years of use of adopted practices*** as a measure of adoption. individuals use the length of the period of use of the technologies as a possible indicator for the extent of adoption of technologies. The measurement of adoption or the computation of the adoption score is not only including the number of adopted varieties but also including the number of years he/she has been using each of the adopted practices or technologies. For example, if a farmer has adopted 5 improved varieties and has been using them for 2,3,4,5, and 6 years respectively from the past ten years, then his adoption score will be 20= 2+3+4+5+6. After computation of the adoption scores of each individual, the level of adoption or the categorization of the cases can be done by using a method involving mean (μ) as a score greater than the mean(>μ) as adopter whereas a score below the mean less than (< μ) as non-adopters of new seed varieties.

1.6 Conceptual Frame Work of the study



Source; *own survey (2014)*

As clearly shown above in the diagram, improved technology adoption decision of household is a factor of different factors. It includes income, access to market, institutional, asset ownership and other personal and demographic factors. Finally, this adoption decision of farmer has impact on productivity and livelihood outcome of the household.

1.7 Description of the study area and Research Methodology

Description of the Study Area Location

Dabat is one of the districts in Ethiopia, Part of the Semien Gondar Zone. Dabat is bordered on the south by Wegera, on the west by Tach Armachih, on the northwest by Tegeda, and on the northeast by Debarq. Both Dabat and Wekin lie on the Gondar-Debarq highway. Dabat is located 814 km, away from Addis Ababa (the capital city of Ethiopia)

1.8 Data Source and of Data Collection

Method

Data's were collected from primary and secondary sources. Household survey, case study and key informant interview are used to collect Primary data. In case of secondary data source, both published and unpublished materials are used.

Sample Size and Sampling Technique

Sample size

There are several approaches to determine the sample size. In this study, sample size were determined using Cochran (1963) cited in Israel (1992) formula. The resulting sample size is demonstrated in Equation 1.

$$n_0 = \frac{Z^2 pq}{e^2} \quad \text{..... EQ(1)}$$

Which is valid where n_0 is the sample size, Z^2 desired confidence level, e is the desired level of precision, p is the estimated proportion of an attribute that is present in the population, and q is 1-p. $n_{0=}\frac{(1.65)^2(.5)(.5)}{(.07)^2} = 139$

Based on the resent study done by CSA in dabat woreda a total of 162,256 and 31,111 population and households are living respectively. Similar source also revealed that in randomly selected two sample kebeles of the woreda 7684 individuals are living. From the survey conducted for this study in collaboration with kebele administrative' in the two sampled kebles (Chila and Geunatba) about 1742 households are found, which is the N value for the formula(see table 3.2). Since the total number of unit of analysis (i.e., household) is small and known, for the study the adjusted using the formula below:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}} \quad \text{... ...EQ}$$

Where n is the sample size and N is the population size.

$$n = \frac{139}{1+\frac{(139-1)}{1742}} = 128.8 \approx 129$$

Thus, a sample of 129 was used.

Sampling technique and procedures

For this study, both non-probability and probability sampling techniques are used. The sample procedures are described in step as follow:

Step 1: A Non-probability sampling technique is used to select the study area. The researcher selected DABAT district for two reasons; first-it is because the area is known in its food insecurity problem. Secondly, it is because the researcher is well aware of the area in terms of culture, language, and customary practices, which makes the data collection process easy.

Step 2: A two stage stratified random sampling were used to select kebeles to be included in the study. Dabat district is a combination of 30 kebeles. Of the total 30 kebeles only four of them are urban kebeles and the rest twenty-six are rural kebeles (areas without municipalities). Since this study is all about determinates of farm technological adoption, only the rural residents were the focus (26 kebles out of 30).

Step 3: in this step the researcher again stratified kebles in to two based on their agro-ecological characteristics. According to Dabat District Finance and Economic Development Bureau report (2013), the study area has two major agro ecology; Dega and Kola agro ecology. Since the number of kebeles in each stratum excluding the four urban kebeles have small difference, the researcher select one kebeles in each stratum randomly. Therefore, among the twenty six rural kebeles "Chela" from Dega agro-ecology; and "Gewnataba" from Kola kebeles were selected. These kebeles reflect a significant variation in rainfall, agricultural potential, market access conditions and population density.

Step 4: Then, household from each kebeles were selected in a and proportional random, to their population. Accordingly, from 129 sample households around 85 samples of households were selected from "Dega (chila)" kebele while the rest 44 households were selected from "kola (Gewnatba)" kebele.

Step 5: among the sample, distinction was made among adopter and non-adopters in a proportional manner. This data was gathered from agricultural Bureau of Dabat district and from the preliminary assessment in collaboration of the two-kebele development agents. Accordingly, the sample accounts a total of 77 adopters and 52 non-adopters.

Method of data analysis and variables

Following the completion of the data collection, the data are edited, coded and verified. The data, which is checked for inconsistencies, missing data, reasonableness were entered in the PCs using SPSS version 20 software and analyzed. The farm household data were analyzed using both Univariate and bi-variety method of data analysis. Here the dependent variable is adoption. it has two categories, which is adopter and none adopter. Once the dependent variable, analytical procedure and its requirements are known, it is necessary to identify the potential explanatory variables and describe their measurements. The major variables expected to have influence on the household to adopt or not are explained below in the table.

Table 3.3: *Summary of variables and researchers expectation*

Independent variables	Measurement	hypothesized relation
Age	Number	Negative
Sex	Male(0) ; female (1)	Low adoption is expected for female
Education	Illiterate(0);read & Write (1); 1-8 grade(2); 9-10 grade(3); otherwise(4)	Positive
Family size	Number	Positive
Dependence ratio	Number	Negative
Land holding	Number	Negative
Number of plot	Number	Negative
Average land size	Number	Positive
Agro-ecology	Kola(0); Dega(1)	High adoption is expected in kola
Plot distance	Number	Negative
TLU	Number in TLU	Negative for fertilizer ; were positive for ISV
Ox ownership	Number	Positive
Income	Number	Positive
Off-farm income	Number	Positive
Credit access	Access(0) ; don't have the access(1)	The higher the credit access, the higher adoption rate
Access to extension support	once a week(0) ; once in a month ; once in three month(2); once in six month (3); once a year(4); not at all(5)	The higher the support, the higher the adoption rate
Farmers perception	Useful(0); not sure(1); not useful(2)	As perception towards farm input is positive adoption will be increased

Source: *own survey (2014)*

1.9 RESULT AND DISSECTION OF THE STUDY

Demographic and Social Factors and ISV Adoption Decisions

Sex of household head and farm technology adoption

According to the survey result, depicted in table 1.1, 86.6% percent of the sample household was headed by male and the rest 13.4 percent by females. When we see the comparison by use of agricultural inputs, about 60.7 % male-headed households were used improved seed whereas only 29.4 % of female head households use those improved seeds during 2013 cropping season. The chi-square test shows that there is significant relationship between use and access to agricultural technology and sex of household head with chi-square 5.887 and p-value of .015 at 1 degree of freedom. This finger clearly shows that, the role of sex in accessing and applying new farm inputs that will enhance productivity (see table 1.1). Although, results from studies in Ghana by Doss and Morris (Doss and Morris, 2001 cited in Knepper, 2002) and Croppenstedt and Demeke, (1996) found gender to be insignificant in Ethiopia. This study and Holden et al., (2008) reported that female-headed households were less likely to use new farm input on their farm plots in Ethiopia. This may be due to the customary prohibition of women participation in political and economic activities which limit their information and access to improved farm inputs.

Age of household head and farm technology adoption

Household age and family level dependence ratio was considered and hypothesized as one of the potential variables that would have negative impact on adoption decisions of farmers. The minimum and the maximum age of household head in the sample were 25 and 82 years old respectively. In addition, the mean and the standard deviation of the sample were 52.22 and 10 respectively. The mean age of non-adopter and adopter household heads is 52.78 years and 53.99 years respectively for improved seed adopters and non-adopters. The statistical analysis and the table above reveal that there is no significant difference in the mean age of sample household heads between adopters and non- adopters. This result is in contradict with Kaliba et al., (2000), who found that older heads of households were more likely to use fertilizer and other farm inputs in Tanzania. The reason for this result could be due to the fact that it is through increasing years of farming that higher level of education and experience achieved which in effect leads to a higher use of fertilizer. On the other hand; Sain and Martinez, (1999) reported the opposite effect for households in Guatemala on the use of improved maize seeds as older farmers are less flexible to test new farm inputs. Differently from the above results, the works of Croppenstedt and Demeke, (1996) in Sub-Saharan Africa and this study too found age of head of the household to be insignificant within even ten present significant levels. This is because even if the hade of the household is old, he/she may have children who have role on farm activities and decision over farm inputs.

Household head level of education and farm technology adoption

The researcher of this empirical study and other scholars believed that education plays an important role by helping decision makers to think critically and it will increase their information source and their ability of understanding the sources efficiently. Producers with more education have better accessible and are more efficient in practicing and evaluating innovations as compared to uneducated producers. From the sample, about 40 percent of the samples were illiterate while the rest 60 percent of them were who can read and write and above that education level. Pearson chi- square, in this study, reveals the significant and positive relation of farm technology adoption and level of education at less than 1 percent significance level in one degree of freedom.The survey result indicated that nearly 85 percent of household who are more educated (elementary, secondary and above) are adopters of improved seed varieties. However, as shown below, only 42.3 percent of illiterate household heads were use improved seed varieties. This result fits with most findings including, findings of Holden et al., (2008) in Ethiopia and Croppenstedt and Demeke, (1996) in Sub-Saharan Africa; Ayinde et al. (2010); Diagne & Bekele 2010 and money other reveled the positive role of both formal and informal education.

Family size, dependence ratio and ISV adoption

Family size in the study was considered as the number of individuals who resides in the respondent's household. Large family size is assumed as an indicator of labor availability in the family. Based on this fact and because availability of labor have influence on innovation, this variable was hypothesized to have positive and significant relationship with adoption of new farm technologies. In the sample, as depicted in table, 12 and 1 individual were the maximum and the minimum household/ family size. The mean of the family size in the sample are higher than the mean of the woreda, which are 6.33 for the sample and 4.68 for the district. The higher proportions (almost 55%) of the sample household family size were between seven to nine individuals. In the study, 77.8 percent of households having more than ten family size are among adopters of improved seed varieties and whereas none of households having family size less than three use improved seed varieties. This indicated that as family size increase level of technology adoption also increase. In line with this the statistical test showed that there is significant difference between adopters and non-adopter categories at .05 significant level.. Moreover, the mean of the adopter is higher than the sample and the non-adopter too. This result matches with the findings of Feder et al., (1985). This is because new technologies increase the seasonal demand for labor, so that adoption is less attractive for those with limited family labor or those operating in areas with less access to labor markets. In addition, Kaliba (2001) on the study he conducted on factors influencing adoption of new wheat and maize varieties in Tanzania reported the same result. This is because larger families would theoretically have more family members available to work on household's crop production as Croppenstedt and Demeke, (1996) indicated.

However, it is not always the case that larger families positively affect new technology adoption. For instance, Sain and Martinez, (1999) pointed out that larger families would be less likely to use improved maize seeds as the increased financial strain of larger families led to budget constraints.

Family Level Dependency Ratio and ISV Adoption of Household

In terms of family level dependence ratio, 3.5 were the maxima for the sample. Here dependence ratio not only used as a proxy to measure family level dependence but also used to measure availability of adult labor in the family. Inverse relation is assuming (dependence ratio and adult labor availability). For the study, total dependency ratio was calculated based on Ethiopian age classification, which is the ratio of economically none active population (young (>15 years old) and old (<64 years old)) and economically active population (between 15 & 64 years old). The mean dependency ratio is 120 and 134 for improved seed adopter and non-adopter respectively, which means every 100 economically active individuals are expected to support 120 and 134 person respectively for adopter and none adopter. The overall mean dependency ratio of sample households was 130. The result in agreement with prior expectation and Feder et al. work (1985).. As shown in table above, in this particular study mean difference of dependency ratio between two groups were statistically significant at less than 5% p-value. This is because the economically productive age has to support themselves as well as additional persons for their livelihood. As dependency ratio increases, the need for enough food and other basic needs also increase. Therefore, capitals for agricultural investment will decrease. In addition, new technologies increase the seasonal demand for labor, so that adoption is less attractive for those with limited family labor.

Table 1.1. *Independent variables and their statistical result*

VARIABLES AND THERE RELATION TO IMPROVED SEED VERITIES ADOPTION DECISIONS					t or X^2 value	
	Minimum	Maximum	Mean	Stand.dev	t or X^2	p- value
sex					5.887	.015
Age	25	82	52.22	10.102	2.299	.563
Level of education					38.874	P=.0001
Family size	1	12	6.33	2.028	2.008	.047
Dependency ratio					3.34	.0001
Land holding	1	13	5.15	2.268	.097	.923
Average land size	0.17 timad	3.5	1.61 timad	.59	-2.129	.036
parcel of land	2	11	5.473	2.117	2.608	.010
TLU(tropical livestock unit)	0	18	5.61	3.068	3.131	.002
Ox ownership					6.71	.0001
Agro ecology					3.370	.066
Average farm distance	8 minute	45	26.1		2.018	0.041
Annual Farm income per birr	9o1.87	1199.78	4.051	. 0001	4.012	.0001
Participation of off-farm activity	1114.07		9.24	.003	8.895	P=.003
Access to extension support					1.257	.262
Access to formal credit					.051	3.235
Farmers perception					15.676	. 0001

Asset ownership and farm technology adoption

Land holding and farm technology adoption

Land is perhaps the single most important resource, as it is a base for any economic activity especially in rural area and agricultural sector. Total land holding measured in timad (quarter of a hectare), which includes own land, shared and rented land, were used as a proxy for measuring land holding. In the area the survey reveal that the largest share of the sample household own land below six, owner of four to six-timad land alone accounts about 58 percent. The mean and standard devotion of the sample land holding were 5.15 and 2.27 respectively. Moreover, one and thirteen timad was the minimum and the maximum land holding in the sample In the study, the mean deference between adopter and none adopter was insignificant. This is explained that small farms might exploit farmland more intensively. They have more labor available per unit of land and larger farmers have higher transaction costs to use hired labor. Thus, the probability of adoption for small farms

becomes higher as compared to large farms. This finding agrees with the finding of Van der Veen (1970) cited in Feder et al., 1985. On the contrary, some argue that the probability of adoption may increase with farm size because the potential benefits from adoption of new technologies are larger in absolute sense for large farmers (Zepeda, 1994). Some authors argue that, the positive relationship may be explained by fixed transaction and information acquisition costs associated with the new technologies (Just et al., 1980 cited in Feder et al., 1985). In addition, farm size is an indication of the level of economic resources available to farmers and thus probabilities of adopting improved varieties and fertilizer increase as this resource base increases (Polson and Spencer, 1991).

Land fragmentation and farm technology adoption

In relation to measurement of land fragmentation, many have been used the number of plots, which reflects land fragmentation to a certain extent, but cannot capture the variation in average plot areas (Chen et al., 2009). In this study; however, average land size is used as a proxy for land fragmentation to see its effect on farm technology adoption. It has been suggested that fragmented land holdings allow producers to be more adaptive to certain circumstances but may more non-adaptive when factor prices and technology changes (McClosky, 1975 cited in Monchuk et al., 2010). In the sample, .17 and 3.5 timad (one fourth of a hectare) were the minimum and the maximum average land size. The mean and the standard deviation were 1.61 and .59 respectively. The study showed that there is significant relations between land fragmentation and adoption decision at 5%. This may be due to scale neutrality of these farm technologies. This result goes in line with the findings of McClosky, (1975) cited in Monchuk et al., (2010).

Number of plots and ISV adoption

Unlike average land size, number of plots was hypostasized to have negative impact on adoption. From the sample, as indicated in the table, 2 and 11 parcels are the minimum and the maximum respectively. The mean of the sample were 5.47 with 2.117 standard deviation. .Unlike the researchers expectation, the value of the t-test reveal that there is a significant and positive relationship between adoption and plot numbers at 5% level of significance. This may be because when farmer have more plot land he/she may have the courage at least to try these improved farm inputs on some of their plots.

Livestock and ox ownership and ISV adoption

Asset ownership of households is important factor, which is supposed to determine households' level of farm technology use. Asset ownership which is usually used as a proxy to explain the wealth status of rural households can be explained by different variables. However, often the number of oxen & livestock owned used as a proxy of wealth status determinant in addition to farm size ownership. Moreover, Oxen are a very important input that farmers use in the production system. Livestock production plays an important role both in crop production and as cash in the study area. Livestock provide milk, meat, traction power and transport. Livestock that are owned by the sample households include cattle, sheep and goat and poultry. The maximum and the minimum tropical livestock holding were 0 and 18. When we see tropical livestock ownership across adopter and non-adopter the result reveal that direct and significant relation between improved seed adoption decision of households and tropical livestock ownership. Livestock is an integral part of crop production activities in the study area. With regard to the contribution of labor, oxen ownership is an important variable. In the study area, as witnessed by the survey result, 38 percent of households have no ox and 48.8 percent of them own one or two ox. However, only 13% own more than four. The mean was 1.19 with 1.269 standard deviations. Zero and seven were the minimum and the maximum number of ox ownership. Similarly, the survey revealed that, ox ownership have a positively and significant role on adoption. This finding agrees with the findings of Croppenstedt and Demeke, (1996), they used oxen ownership as a proxy for wealth and found it to be positively related to use of fertilizer in Ethiopia. Above all, in the study area livestock's are main source of living during critical period and serving as insurance. Thus, as the number of livestock holding in general and ox in particular increase, farmers level of confidence to try new thing including farm technology increase. In addition, ox is an important source of non-human labor force.

Geographical Factors Affecting ISV Adoption Decision

Agro-ecology zone and farm technology adoption

This variable stands for climate expressed in terms of agro-ecological classification. A farming system is a classification of agro-ecological zones where diversity in land quality, distribution of rainfall, and ability to grow diverse food crops is differentially distributed within the two agro-ecological zones. In the highlands the distribution and amount of rainfall is better as compared to lowlands. Hence, It was hypothesized that the magnitude of farm technology adoption of household increase as we go from highlands to lowlands. For the study among the total sample households (129), 85 (65.9%) of the sample respondents were from "Chila" kebele and 44 (34.1%) of them were from "Gewnateba" kebele. These distinctions were made in a random and proportional to their respective population as clearly shown in methodology section. Moreover, among randomly selected sample households from Chela kebele 62.6% of households were adopters whereas 34% from Gewnateba kebele households adopters. The statistical test showed that there is significant relationship between agro ecology and use of improved seed verities at less than 1 and 10 present significant level respectively. Unlike expected by the researcher, therefore, farmers in dega agro-ecology use more ISV than kola ecology. The difference is due to high access to these farm inputs in dega kebele, farmer's perception and high land holding in kola kebele as land holding and farm technology adoption have inverse relation in the study area and found in this study. These results agree with Motuma et al., (2003) work on Adoption and continued use of improved maize seeds.

Plot distance

Households were also asked the walking distance for all the plots from their homesteads. Accordingly, the average distains of plots in the "*Kola"* keble are very distant, while

plots in the "*Dega"* kebele are nearer to homesteads. The overall average plot distance for the two kebles were 26.1, with 45 and 8 minutes of walk maximum and minimum. When we see the link across adopters and non-adopters over average plot distance it is found to be significant at 5% significant level as depicted below in the table. For instance, the mean of adopter were 29.3 whereas 35.5 were for non-adopters respectively. Therefore, the study shows the tendency that more distant plots (further away from their homesteads) received less new farm inputs including seed and fertilizer. This is because the tendencies of farmers to reduce risk by giving a good follow up over their farmland as they expect unusual production due to improved farm input applied for the first time. This finding agrees with the finding of Holden and Lunduka (2011).

Farm Income and Off-Farm Income; and farm technology adoption

According to office of agriculture and rural developments of Dabat district, the major cereal crops grown in the study area are sorghum (in the Kola) & wheat (in dega). However, Tef, is the second most important crop in the study area in both Kola and Dega kebels in terms of both production and consumption. More than 50 percent of sample farmers do not have land for vegetable and perennial crop production. However, as revealed from the survey result every household in the study area own land for cereal production. Household income in the study area are not only depends on the agricultural potential and the relative price obtained by the farmers for agricultural produce and livestock and livestock products, but also on the time of sale and the type of off-farm activities a household performs. In the study area, as it is observed from the survey results the relative share of income from cereal to the total annual household income is the largest. It is followed by livestock production and off-farm activity, respectively. The average yearly household per capita income of the sample households is found to be Br. 901.87. Most of the sample farmers earned average annual income between 251 and 500 birr. All households having per capita income level of below 251 *birr annually* are almost non-adopters. On the other hand, from the sample, about 63 percents of respondents having more than 1001 Br. annual per capita income are adopters. Actually, high income may also be the result rather than the cause. The group statistics, also showed that there is significant difference in income per capita between the adopter and non–adopter households at less than 1 percent, where household income per capita in the non-adopter group is 403.49 Birr. This amount is by far less than the mean income of the sample and the mean income of adopter households too, i.e., 1309.41 Birr. Off-farm income, which is, an income generated by a household working off the farm also serves as a means of surviving of life when the income from on-farm activities could not be as expected. It includes both earned and unearned off-farm incomes. Households in the study area perform various off-farm activities like livestock trading, grain, vegetable and wood trading, remittance etc. The income from such activities greatly improves the households' entitlement potential in the study area especially during time of stress. As the study uncover, from the total sample only 26 percent of the sample participate in off-farm activities while the rest 74 percent do not participate in any off-farm activities. Moreover, data on off-farm income indicates that the overall yearly average income of the households in the study area was 1114.07 ETB. Average maximum and minimum was 2852.36 and 183.59 ETB respectively.

When we see the link between adoption decision and off-farm activity, indicates the inverse and significant relation of farm technology adoption and farmers off-farm activity participation. This study result and scholars argue that, if the household generates more income on the off-farm activities than do the farm activities, they may not spend more time on the farm so that the probability of new technology adoption on the farm sector may be reduced. However, as indicated above farm income was found to be positively and significantly related to adoption. This is because, as to the theory of risk-averse peasant, peasant risk aversion inhibits the adoption of innovation, which could improve the output and income of peasant farm families but might have high seasonal variability. Risk aversion declines as wealth or income increases. Moreover, it increase farmers ability of buy these farm inputs.

Institutional Factors

Access to extension support and credit service; and ISV adoption

Access to extension support

The adoption of any new agricultural practice needs adequate mechanism for transmitting information. Lack of relevant and timely information can prevent a widespread adoption of new technologies. In the study area, the widely used means of disseminating information is through extension service in which development agents are assigned to a group of farmers to provide extension services. Extension service here refers to advice, training, demonstration and distribution of input. Extension agents contact farmers on an individual basis, though farmers who have suitable plots in adjacent locations are teamed up for demonstration. The study result showed that, as depicted below in the table, about 27 percent of the sample households did not get any technical support and visits from extension agent during 2013 cropping season. Surprisingly, some of the respondent (12 percent) were also report as if they do not know even whom were assigned in their kebele as a development agent.

Table 1.2: *Extension support and level of ISV adoption*

Extension support	ISV	
	adopter	Non-adopter
ones a week	56.0%	44.0%
Once in a month	40.0%	60.0%
Once in three month	63.6%	36.4%

Once in six month	50.0%	50.0%
Once in a year	76.9%	23.1%
no visit	53.1%	46.9%
statistics	x^2=1.257 p= .262	

Source: *Field survey, 2014*

As depicted in the table above, statistical test exposes statistically insignificant relation between ISV adoption decision and extension support. This may be because most of the respondent gather information and decide about the kind and amount of improved technology from their relatives or neighbors as well as through tray and error by their own.

Access to credit service

Credit for the purpose of consumption or purchase of agricultural inputs including improved seed, chemical fertilizer, etc were hypostasized as a positive impact on adoption decision of farmers over agricultural technology. In the study area, different organizations provide credit to the farmer. The purpose of such organization is in one way or in other way to meet food need in long and short term. From the sample households, 74.3 percent get credit access while 25.7 do not take credit from formal sources within the past three years due to various reasons. The main source of credit in the study area is relatives and neighbors, which accounts for 50.4 percent of households. The rest 26.4%, 17.1% and 6.2% borrow from formal sources these are farm association, *PSNP/HABP* and *ACSI* respectively. The comparison by adopter and non-adopter over credit access disclosed that 61.4 percent users of formal credit are within the adopter group. In line with this argument the statistical test reveal that the significant relations of ISV adoption and credit access at 0.05 p-value.

Farmers Perception on the role of ISV and Farm ISV Adoption Decision

As the researcher try to depict in the first section of this document, most scholars and government directions believe and indicate use of new improved agricultural inputs in the production system enhance productivity. It is the best and sometimes the only solution taking account of alarmingly increasing population. Similarly, most but not all of respondents have good view over fertilizer and improved seeds. From the sample households, 86% of respondents perceive that use of improved seed varieties surly increase productivity. However, information collected from key informant interview and case study reveal that farmers have frustration about the effect of these new farm inputs on the future. When we see the effect of attitude on adoption decision, about 77% of respondents who sure of ISV role are adopters while none of households with bad attitude and even those who are in dilemma are adopters. This clearly indicated that the positive role of perception over adoption of farm technology. However, there are households who believe that fertilizer and improved seed variety increase productivity, but who did not use these farm inputs. Therefore, as clearly uncovered by the study, one can understand there are other factors, other than perception, that matters farmers to adopt or not to adopt new farm inputs. Similarly the statically test, indicated in table 1.1, show the significant role at 1% p-value. Therefore, as long as there is a concern and agreement on the role of technology on productivity at policy level, it would be better to create similar filing on the end users through short-term tanning and demonstrations.

1.10 CONCLUSION AND POLICY RECOMMENDATION

This study has scrutinized factors affecting farmers' decision of modern farm technology adoption by giving special interest on ISV. In fact, due to different factors in Africa population growth take place alarmingly. Since land is static in nature, many believe intensive use of land through application of improved farm inputs as a solution to meet the need of this growing population. Among many other farm inputs, ISV are supposed to have significant role on productivity. However, in many areas of developing countries many studies found low adoption rate. this is due to money Factors including demographic, social, institutional, income and geographical factor. Beside efforts done by the government and other non-governmental organizations to produce and diffuse ISV in the country, the major finding of the study implies the need for giving attention to the following issues:

- Concerned stockholders and agencies need to emphasize on the effective use of the technology input rather than on the quantity distributed and numbering users.
- Since in one way or another way, risk aversion behavior is the most significant factor affecting adoption decision in the study area, it is also wise to provide crop failure insurance for new farm input adopter households.
- Having demonstration sites for new farm inputs in nearby of the farmer is also important, which will make farmers decision rational and easy.
- Further assessment is needed on determinates of improved farm input use under different agro-ecology and socio-economic conditions (eg., Dega Vs Kola).