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Gender Roles in Agricultural Production and Decision-Making Power in Smallholder Farmers in Oromia Regional State, Ethiopia.

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ABSTRACT

Agricultural production in Ethiopia is predominantly undertaken on smallholder individual and family managed farms as well as is resource poor farmers who produce 90–95% of all cereals, oil seeds and other crops. This smallholder farmer is unable to feed the fast growing population and unable to reduce the dependence on food aid. This study therefore was conducted in order to understand the socio-economic factors that determine their decision for the adoption of agricultural technology.

In conducting this research, both primary and secondary data were collected. Primary data were collected from the total sample size of 392 female and male-headed household farmers in the study area. Apart from the household survey, qualitative data were collected from 160 respondents by using participatory research methods. Multi-stage sampling technique was used to select female and male-headed household farmers from the study populations. The collected data were analysed descriptively and logistic regression model as well as SPSS 20.0 computer software.

The main finding of logistic regression shows that educational status, land size, total livestock owned, access to extension services, and credit services availability were statistically significant variables and affect both household heads decision for adopting new agricultural technology. Understanding these factors, it's important for policy makers and developers of new technology to understand farmers need as well as their ability to adopt technology in order to come up with technology that will suit them. On the other hand, national agricultural plans and policies should be based on detailed *gender analyses that acknowledge the existing gender differentials and layout strategies and detailed, actionable items to narrow such gaps.*

Key terms*:* Agricultural production, decision-making power, socio-economic, new technology, national agricultural plan & strategy.

1. Background of the Study

Agriculture is the backbone of many developing economies. It accounts for 32% of the African GDP, supports the livelihoods of 80% of the African population, employs 65% of the Africa's labour force and 70% of the poorest people in Africa (AFDB, 2010). Smallholder agriculture is the predominant form of farm organization in Sub-Saharan Africa (SSA) (FAO, 2009). Agricultural growth is critical for sustainable development, rural poverty alleviation as well as hunger eradication in most developing countries (World Bank, 2007).

Ethiopia is characterized by a high rate of poverty incidence (WB, 2015) and low human development index (UNDP 2014). Although agriculture employs about 85 percent of the labor force (MoARD, 2010), accounts for about 44 percent of the national gross domestic product, and accounts for about 71 percent of total exports of the country (EEA, 2012), the poor performance of this sector is among the key development constraints in the country. It is not only gender inequalities in access to ownership of, control over, and use of livelihood assets and inputs that matter in Ethiopian agriculture, but also disproportionate employment opportunities for women and men (FAO 1997; 2011; Barrett et al. 2009). There is clear evidence that gender differentials in varied forms could be potential sources of poverty and food insecurity (Quisumbing et al. 1995).

Regardless of the fact that the roles and needs of female farmers are recognized in policy, agricultural policies still do not address the needs of women farmers satisfactorily and tend not to be adequately translated into practice in agricultural development programs and planning. In almost all these countries households headed by females belong to the poorer level of society and often have lower incomes than households headed by males. Hence, the purpose of this paper is to shed more light on the roles of female and male-headed households in crop production and decision-making power with empirically examining the participation of both sex in crop production, the decision-making power among both heads, the accessibility and benefits to agricultural resources among the farmers and finally the socio-economical factors that limit the participation of female headed farmers.

2. Objectives of the Research

Studying gender roles agricultural production and decision-making power among smallholders as a basic key to understanding structures and actions, including production relationships within and across households, goal setting and priorities, mobilization of resources, and the decision-making process vis-à-vis the rights to benefits derived from increased farm production (A. Tiruneh et al, 2001). Thus, this research work was trying to explore and address gender roles production and decision-making power in smallholder farmers of Oromia, Ethiopia.

2.1 Specific Objectives

1. To examine the socio-economic factors that determines smallholder farmers' decision for the adoption of agricultural technology.
2. To suggest and provide information to policy makers and planners to develop the appropriate policy measures that consider the primary gender roles in agricultural production which brings sustainable production among smallholder farmers.

3. Significance of the Study

The significance of this study is to analyses gender roles in agricultural production and decision-making power in Ethiopia context. Therefore, this study aims to increase understanding of the female household heads and male household heads role in crop production and decision making power in the rural livelihoods. The other importance of this research work is that it adds to the literature by providing more evidence on the causal mechanisms behind the gender role in agricultural production and decision-making practices. Besides, the study would be aimed to contribute to the existing body of knowledge on gender issues by highlighting important areas which women's participation would be important to bring about economic, social and environmental sustainability.

4. Literature Review

4.1 Farm Household Decision for Adopting Agricultural Technology

Gendered roles, inequalities, and constraints in the social economy typically put women at a disadvantage compared to men in regards to agricultural production. As a result, women often have less overall leverage than men within the household to influence major household decisions in agricultural production. For instance, large export firms may be more likely to contract out with a male household member instead of a female household member of smallholder farms, even though both male and female labor are used in the production of the crop. In Kenya, for example, earlier research suggested that more than 90 percent of export contracts to smallholder farms were made with a male household member (Dolan 1997).

The use of agricultural technologies can improve economic productivity and/or reduce time spent needed in agriculture production, processing, and transporting. Beneficial technologies include improvements to the land or soil; new water management practices; the use of new crop varieties that either produce higher yields, are more resilient, or have greater nutritional content; and more efficient harvesting methods (Feed the Future Indicator Handbook: Definition Sheets April 2012). It also includes technologies that improve processing and handling. Accelerating technology adoption is a fundamental prerequisite to increasing agricultural productivity for

food security, inclusive growth and poverty reduction. One of the key challenges is the unequal access to, and use of, new technologies by men and women farmers in the field. Addressing the gender differences between women and men farmers in Africa and other developing regions, therefore, represents a significant development potential in the fight against hunger and poverty.

Adoption of innovations has been defined as the decision to apply an innovation and to continue to use it (Rogers and Shoemaker, 1971). Different factors determine the adoption of different agricultural innovations and technologies (Akudugu *et al*., 2012). Agriculture extension agents and economists have long been interested in understanding the importance of the adoption of new agricultural technologies by rural smallholder farmers and several factors have been identified as influencing the adoption behaviour of farmers from qualitative and quantitative models (Oladele, 2006). Economic, social, physical, and technical factors and dynamics influence the adoption of various agricultural technologies. Rao and Rao (1996) found a positive and significant association between technology adoption, age, farming experience, training received, socioeconomic status, cropping intensity, aspiration, economic motivation, innovativeness, source of information and agent credibility.

Generally in farming systems research, unequal gender relations are taken for granted which according to Kingiri (2010) is why technological innovations tend to benefit men more than women, lessen the workload of men and increase the activities linked to women due to the gender division of labor and unequal access to resources such as processing. Doss stresses that when women do not adopt new technologies, it is important to understand why, and this has implications for the types of policy responses required. She differentiates between non-adoption due to; different preferences, in which case the policy response is to develop, design and test technologies (e.g. seed varieties) that meet the needs and preferences of women and the fact that women face different constraints than men, in which case the policy response is to address these (gendered) constraints. (Doss 2001: 2088).

Similarly, Farmers' access to labor (family or hired) critically impacts their ability to adopt new technologies and augment overall production. High-yielding crop varieties not only may add to total labor requirements, but they often exacerbate seasonal peaks in labor requirements (Knox and Meinzen-Dick 1999). Peaks typically occur at planting, weeding, and harvest times. If the new varieties have a shorter growing season and permit additional multiple cropping, there may be consequent overlapping of the harvesting and planting of successive crops with very sharp increases in seasonal labor requirements. Unless local labor markets are elastic, increases in demand for labor raise seasonal wage rates, which can quickly dampen the profitability of new technologies, particularly for farms that cannot get by with family labor alone. In this case, female-headed households may be at a disadvantage because they have fewer male members and fewer resources to buy outside labor. Even when family labor is not constraining for small

farms, women's available labor supply may be quite limited due to many competing demands for their labor, thereby leaving them little time to manage new technologies.

Furthermore, the profitability of new technologies is affected by input and output prices, both of which are often influenced by government policies in developing countries. As such, policies that discriminate against agriculture have worked against the uptake of capital or cash-intensive technologies, although more recent devaluation and market liberalization policies have in many cases improved relative prices for traded agricultural goods and, therefore, induced adoption of technologies associated with them. Whether these changes in output prices provide enough incentives for female farmers to adopt new technologies associated with tradable agricultural goods depends crucially on patterns of intra household decision making a factor often neglected in conventional studies of price policy.

Understanding gender-specific constraints to adoption may help agricultural research systems develop new varieties and technologies that are better suited to women's needs, aid extension systems in identifying the most binding constraints to adoption, and help development practitioners and policymakers address the elimination of these gender-specific constraints. It also suggests some criteria for evaluating the gender-specific impact of new technologies, which may help guide the prioritization of technologies to be developed and the choice of technology to disseminate in particular settings.
This is a serious gap that must be bridged if the problem of low technology adoption among farmers is to be addressed and agricultural productivity improved. Generally, this study attempts to fill in some of these gaps. In doing so, it first uses survey data collected in rural Oromia from both female and male household farmers to determine the agricultural production activities and decision making power within a household.

5. Research Method

The appropriate research approach that employed for this research work was both qualitative and quantitative approaches. Both quantitative and qualitative data from the study area were collected with the administration of survey method, which was designed and tailored according to the nature of my research objectives. The study covers both primary and secondary data sources. Primary data was collected from female and male-headed household farmers living in sixteen rural peasant associations of the study areas. The secondary data were collected from different sources like, research papers, journals, working papers, and district, zonal and regional documents.

5.1 Sample Size Determination

The sample size for collecting quantitative data for this research work was determined by using (Cochran, 1977) formula as indicated on Kurebwa (2013). The researcher was used the following formula to calculate sample size $n = \frac{N}{1+N(e)^2}$

By using this formula, the assumed confidence level is 95%, a 5% margin of error, and a variability of 50%. The following steps used to determine the sample size derived from the above formula to collect quantitative data using questionnaires survey.

Where;

n = designates the sample size used;

N = Designates the total number of household heads in two study sites which to be studied;

e = designates maximum variability or margin/error (0.05);

$$\text{Therefore;} \quad n = \frac{N}{1+N(e)^2} = \frac{34,566}{1+34,566(0.05)^2} = 392$$

5.2 Sampling Technique

Since the population under the study is large significantly, it was not practical to study all members of the population; a sample was selected by appropriate sampling technique for data collection using well designed method for the study. Therefore, sample households were selected through a multi-stage sampling technique for questionnaires.

5.3 Data Collection Instruments

The study covers both primary and secondary data. Primary data was collected with the help of semi-structured questionnaires; Likert rating scale; direct personal observation, interview, focus group discussion, and participatory research methods like small (case study) were used in collecting primary data sources from two groups of female and male-headed households working in rural agricultural area. The secondary data was collected from different sources. Semi-structured questionnaires, which designed after developing pre-test, was conducted for the study areas to identify and avoid vague and sensitive questions.

5.4 Method of Data Analysis, Presentation and Interpretation

Chi-squre test and t-test were used test the hypothesis in the context of sampling analysis for comparing sample variances with the theoretical variances, and logistic regression were used for identifying the important factors that determine the decision household farmers for adopting the agricultural technology for increasing the productivity their produces. Statistical package for

social science (SPSS version 20) was used to analysis the data.

Logistic regression model was selected and used to analyze which and how much the hypothesized explanatory variables was related to the adoption of agricultural technology that is the socio-economic factors that affect household head farmers in the study area. The dependent variable is a dummy, which takes a value "1" if the household head was assumed to be adopt agricultural technology and '0' otherwise.

Thus, the cumulative logistic probability model is econometrically specified as follows:

$$P_i = E(Y = 1/X_i) = \beta_i + \beta_i X_i$$

Where, X_i is the independent variables that is Y=1 means that female and male household farmers adopting the agricultural technology for the farming activity. Let us consider the following representation of adoption decision of household heads in agricultural activities.

$$P_i = E(Y = 1/X_i) = \frac{1}{1+\exp^{[-\beta_i + \beta_1 x_1]}} = \frac{1}{1+\exp^{[-Z_i]}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

The ratio of the probability of adopting agricultural technology to the probability of not adopting agricultural technology can be written as;

$$x = \frac{P_i}{1-P_i} = \frac{1+\exp^{[Zi]}}{1+\exp^{[-Zi]}} = e^{Zi} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

$$L_i = \ln\left[\frac{P_i}{1-P_i}\right] = Z_i = \beta_i + \beta_i X_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

$$L_i = \ln\left[\frac{Pi}{1-Pi}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_9 X_9 + e \ldots\ldots\ldots\ldots 4$$

$$L_i = \beta 0 + \beta 1 AGE + \beta_2 Radio + \beta_3 Edu + \beta_4 Fsiz + \beta_5 LandS + \beta_6 LiveN + \beta_7 Mcoop + \beta_8 DisF + \beta_9 ExteS + \beta_{10} CredS + e$$

6. Results and Discussion

6.1 Socio-Economic Characteristics of Households

It is believed that socio-economic charactering of studied population was pertinent in providing insights the general features of the area under study. Hence, an attempt has been made to describe some important characteristics of the studied population. Results from the survey include characteristics of female and male-headed respondents on age, household family size, marital status and educational attainment of the study area.

6.2 Age of Respondents

As indicated in Table 4.1, of the 392 households interviewed across the two districts, 196 (50%) were female-headed farmers (FHh) and 196 (50%) were male-headed farmers (MHh). Age is

among the variables that are frequently used in smallholder agricultural studies. It has an implication for labor availability of household in farm activities, farming experience which is important for adopting new technology, agricultural technology adoption decisions, and productive efficiency.

The results of data collected from the respondents show that the average age of female heads were 46.7 and 49.2 years in Ambo and Tokey districts respectively whereas, the average age of male heads were 43.1 and 45.3 years in two districts respectively. On average the female heads have more mean age than male heads in two districts that is, the mean age of female heads is around 3 to 4 years higher than that of male heads. This imply that, male headed households in the two districts were young and economically active age, while female headed households were on average, older and less active age than the male household heads. In Ethiopia, significant age differences are common between husbands and wives, and the wife is usually younger than her husband. As the results of this, there is a high likelihood that the older husband dies before his wife dies and hence most of young women are becoming the head of the family and have taking all family responsibility. In this context, it is shows that female heads are generally older than male heads (Holden et al. 2011). This reflects the fact that a significant proportion of female-heads were widows.

6.3 Marital Status

As regard to marital status, majority (> 60 %) of female-heads were widowed in both districts. This result is consistent with the finding of Moghadam (2005), the majority of female heads of household in developing countries are widows followed by divorced or separated women. However, according to Chen (1998), widow headed households tend to have less productive assets and fewer savings than widowers, and are less likely to have pension income, and often depend heavily on the economic support of their sons.

As to the gender of household farmers in the country, the census of CSA (2013) shows that among the entire households in the country, 22.2% were female headed households. The results of this study shown from the table 4.1, widowed females were high percentage in Ambo than in Tokey district. Almost all (> 97 %) of male-head households in both districts were married. On the other hand twenty five percents of female-heads were either divorced or separated, whereas just 1% of male heads fall into these categories. This imbalance implies that divorced men are remarrying in greater numbers and/or moving out of the rural areas than the female households in areas.

6.4 Family Size of the Respondents

In the study districts the male heads had more family size than the female heads. The observed

household family size gap was that in Ambo district where female household heads have 1.9 fewer household members than male households whereas in Tokey district male-headed household farmers have 1.2 higher family sizes than the female-headed household farmers. This has important implications for household labor availability and access to labor through social arrangements, which is an important source of agricultural labor in the areas. The possible explanation of household size differences between male and female headed households is mostly due to the absence of a male head in female headed households however other factors are also likely to play a role. Similar result also found by Ethiopian according to CSA (2013), female household heads also tend to have smaller household sizes than do male household heads. Nationally, on average, female heads have 1.6 fewer household members than their male counterparts (4.6).

6.5 Education

In rural Ethiopia, many women are uneducated. Female household heads and male household heads in two districts showed significant difference in access to education and literacy rate. As it can be seen from figure 4.1, there is much difference between female and male-headed households in terms of educational qualifications. That is to say, the male-headed farms in both cases have also better level of education than those who are female-headed household farmers in certain educational levels. Figure 4.1 shows that a sharp gender gap also seen in terms of non-education and literate class among household heads in both districts. Female household heads are less educated, on average, than male household heads. The document of World Bank (2014) indicated, in rural Ethiopia, many women are uneducated. The national figure puts the percentage of literate women at only 29 percent, which is 20 percent lower than the adult male literate population. According to the finding of (Reimers and Klasen, 2013), education is a basic asset in terms of productive work that is the number of years of education is correlated with agricultural productivity.

Besides, more numbers (high proportion) of male-headed households were at primary (5-8), but very few numbers (low proportion) of female-headed households were secondary in both districts. Lockheed et al. (1980) found that education usually had significant positive effects on productivity. Moreover, Knowles et al. (2002) used national data to estimate the long-term effect of women's and men's education on output per worker and reconciled evidence in Barro and Lee (1993, 1994) and Klasen (1999, 2002), concluding that the education level of women had a statistically significant positive effect on labour productivity, while the education level of men was lower and its effects uncertain. Estimates in Quisumbing (1996) suggested that productivity would increase by 24 percent if all women farmers received at least one year of primary education.

6.6 Results from Logistic Regression

As it is shown in binary logistic regression result, from total of 10 explanatory variables hypothesized to explain the decision of adopting new agricultural technology, only five explanatory variables for MHh and FHh were found to be significant whereas, the remaining were not significant in explaining the variations in the response variable.

$$IN\left[\frac{Pr(Ii=1)}{1-Pr(Ii=0)}\right] = Y = \beta_0 + \beta_1 AGE + \beta_2 FSHh + \beta_3 RADO + \beta_4 EDHh + \beta_5 FHha + \beta_6 TLU + \beta_7 PCOOPS + \beta_8 DISFL + \beta_9 EXCON + \beta_{10} ACCRS + e$$

Table 5.28 Maximum Likelihood Estimates of Logit Model and the Effects of Explanatory Variables on the Probability of adopting decision of agricultural technology.

Variables	FHh				MHh			
	B	S.E.	Wald	% Δ	B	S.E.	Wald	% Δ
INTERCEPT	3.944	12.089	0.106	-	2.027	3.314	0.374	-
AGE	-0.567	0.233	5.916	-43.3	-3.486	4.041	0.744	-24.86
RADO	1.539	1.475	1.088	-	0.298	1.060	0.079	-
EDHh	3.659***	5.540	0.436	-	1.370***	2.080	0.434	-
FSHh	0.854	0.897	0.908	14.6	0.726	0.723	1.009	27.4
FHha	0.347**	0.707	0.240	65.3	0.066**	0.953	0.005	93.4
TLU	1.515**	1.435	1.115	51.5	1.012**	1.257	0.092	1.2
PCOOPS	1.277	1.592	0.643	-	0.128	3.052	0.002	-
DISMKT	-0.642	12.585	0.017	-35.8	-0.012	10.054	0.000	-1.2
EXCON	0.615**	0.775	0.630	-	1.040***	1.658	0.393	-
ACCRS	0.611*	0.962	0.403	-	0.327*	1.500	0.053	-
N	192				192			
Likelihood ratio	46.87***				30.65***			
McFadden's R^2	0.3707				0.2695			
Over all predicted	82.4				74.2			

- Significant variables were affecting the household head decision in adopting agricultural technology at 0.01 (***), 0.05 (**) and 0.10 (*) levels of significance.

Age is an important factor that influences the probability of deciding and adopting new agricultural technology because it is said to be a primary concealed characteristic in adoption decisions. Age of the household farmer has been found to be negatively associated and with less likely to decide for adopting new agricultural technology of both households. It is possible to estimate that, one year increase on the age of female-headed farmer leads to decline the odds of adopting new agricultural technology by 43.3 %. The possible explanation is that younger

farmers are more likely to adopt a new technology, because they have had more schooling than the older farmer. It is estimated that one unit of age increased on male-headed household leads to decreasing the odds of adopting agricultural technology decisions by 24.8 %. In both household heads, statistically it was not significant for adoption decisions of new technology.

Ownership of radio had significant impact on the decision of adopting new agricultural technology. The effect is positively associated with the likelihood of adopting new technology in both household heads. The odds ratio indicate that female-headed household farmers who have radio in the house were 4.6 times more likely in adopting new agricultural technology than the others female households who have not owned this asset in their house. Thus, the more the ownership of radio asset in their house of female farmer household, the more they made decision for adopt new agricultural technology. Similarly, the odds ratio of MHh who have radio was 1.3 times more likely in deciding for adopting new agricultural technology than the others male-headed households who have not owning of this asset. The female-headed households are more benefited than the MHh by ownership of radio in adopting agricultural technology and significant at 0.05 percent.

The model result also shows that, education is positively significant for adoption decision of new agricultural technology where households with more education are more likely to adopt new technologies. This explanatory variably had positive and significant impact at 1 % significant level on the likelihood of adopting new agricultural technology. This shows that as the educational level of farmer household increase, the probability of deciding to adopt new agricultural technology also increased significantly. This means that educational level has strong impact on decision of farming household heads to accept and practices new agricultural technology. The result from this study shows that, if the female household farmers have some form of education, they are 38.8 times more likely to adopt new agricultural technology than females without any form of education. Educational status of male household farmers also have positive and significant factor in determining the decision on adopting new agricultural technology at 5% significance level in the study area. Besides, male farmer who has some form of education is 3.9 more likely to adopt new agricultural technology than those male farmers without any form of education. This indicates that, education has strong influence on male household head decision to adopt new agricultural technology and bring farmers to practice modernizing agricultural activity.

The number of family members contributing to agricultural labor was found to positive and significant relationship with adopting of improved technology in both household farmers at $p < 0.05$. It is estimated that each additional unit increase in the number of female family members increases the odds of adopting new agricultural technology by 14.6 %. This implies that the adoption of new agricultural technology to become effective it depend on the availability labor force in the family. It is estimated that each additional unity increase in members of male farmers increases the odds of adopting new technology by 27.4 %. This means large family

members of male household normally have the capacity to relax the labor constraints required during land preparation and would be adopted new technology.

The size of farming land had positive and significant influence on the likelihood of adopting new agricultural technology decision at 5 % significant level in both female and male-headed household farmers. One unit increase of farming land leads to an increases of 65.3 % and 93.4 percent in the odds of deciding for adopting agricultural technology in female and male household farmer respectively

The number of livestock owned was positively associated with an adopting new agricultural technology in household farmers. This variable has significant influence ($P < 0.05$ %) on the decision of new agricultural technology adoption in both female and male household farmers as expected. The number of livestock owned in FHh and MHh were positively associated with the likelihood of adopting crop technology and also significant in both cases. In both household heads that owned more number of livestock were more likely to adopt the crop technology than the household that have no or less number of the livestock. The odd in favor of adopting crop technology was increased by a factor of 1.05 for FHh and 1.08 for MHh that had more number of livestock.

Participation of household farmer in agricultural cooperative society had not significant impact on the decision of adopting new technology in female headed household farmers but positively related to the odds of adopting new technology decision in female and male-headed household farmers. The odds in favor of adopting new agricultural technology by a factor of 3.59 times among female farmers, this implies that female-headed farmers who have participating in cooperative membership are over 3.5 times more likely to adopt new agricultural technology than female farmers who are not participating in primary cooperative society in the area. Besides, the effect of cooperative society membership was positively but insignificant with the likelihood of adopting new agricultural technology in male-headed household farmers. The odds that indicate the adopting of technology in MHh was 1.14 times favoring male farmers who have membership in cooperative than that of MHh who are not participating in the cooperative society.

The distance of female farmer house to the market center is found to be negative and significant relationship with the odds ratio of adopting agricultural technology decision. This indicates that female households near to the market center are more likely to adopt new agricultural technology than females far away from the center of the markets. In this aspects, improving accessory roads and connecting these sub-accessory roads to the main roads would have helping the farmers to engage easily in adoption of new agricultural technology especially for female farmers who have the problem of free movement in the society. One unit increase in distance of FHh house from the market leads to a decline of 35.8 % in the odds of deciding for adopting agricultural technology in female household farmer. Therefore, the distance of house from the

market center for FHh household is associated with a decreasing the decision for adopting agricultural technology. Similar pattern also shown for MHh households, a unit increase in distance of male farmer house from the market leads to a decline of 1.2 % in the odds of adopting agricultural technology. Thus, the far distance of MHh farmer house from the market center is associated with a decrease in decision for adopting agricultural technology.

The positively significant of an explanatory variable of extension service was as expected. The positive coefficient and significant of this variable indicates that the availability of extension service in the area and its accessibility for them encourage the farmer to decide and adopt improved agricultural technology. That means access to extension services creates awareness and hence increases the probability of adoption of new agricultural technology. The female headed farmers who have in contact and received agricultural extension service were found to be decided and adopt improved agricultural technology 1.85 times higher than female farmer that have not been contact and received any agricultural service. Similarly, male headed household farmers who have frequently contact and received agricultural extension service from the development agent were found to be decided and adopt agricultural technology by factor of 2.8 times more than male headed household farmer that have not any contact and received agricultural advisory services from the development agent in the area.

Access to credit service for both FHh and MHh were positively and significantly influence the log odds of adopting improved agricultural technology decision at 10 % significant level in the study area. This implies that when the farm households are accessible to credit services, they are motivated towards adoption of improved seed technology. This is because as farm households get sufficient credit, they are able to purchase the improved seed on the time it is required, and with the desired amount. It means that both household farmers who have access to credit service are more likely to adopt new agricultural technology than those farmer households who have not access to credit service. It is estimated that the odds of technology adoption decision increases by a factor of 1.8. Similarly, the odds ratio of male household farmer that access to credit service was 1.4 times more likely to adopt improved maize technology than the male farmers that have not access to the credit services in the area.

7. Conclusions

Survey result shows that, female-head households have more mean age than male heads in study area. On the other hand male heads had more family size than the female heads. As to educational status of household heads, female household heads are less educated, on average, than male household heads. That is to say, the male-headed farms have better level of education than those who are female-headed household farmers in certain educational levels.

The binary logistic regression model was used to identify the determinant of household heads

decisions for adopting new agricultural technology. The result of binary logistic regression shows that, educational status of household head, land holding size, total livestock owned, access to extension services, and credit services availability were statistically significant variables and affect the decision of both household heads to adopt new agricultural technology negatively and positively.

8. Recommendations

Facilitation of female farm households to adopt improved agricultural technologies is therefore crucial. However, female farm households may be too poor to be able to adopt recommended technological packages. In this case, a special mechanism needs to be applied like safety net schemes and targeted interventions for credit constrained household to help them adopt improved agricultural technologies.

In Ethiopia, efforts have been undertaking to improve agricultural technologies in different agricultural research institutions but it play insignificant roles in changing the mode and means of farming system of smallholders in the country. To increase the likelihood of adopting modern agricultural technologies by smallholder farmers, policy makers should put emphasis on overcoming credit services and extension services constrained of farmers.

Understanding the factors that influence adoption decision of agricultural technology is essential in planning and executing technology related programmes for meeting the challenges of food production in the country. Therefore to enhance technology adoption by farmers, it's important for policy makers and developers of new technology to understand farmers need as well as their ability to adopt technology in order to come up with technology that will suit them.

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