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Research Article

SOCIOECONOMIC IMPACTS OF ADOPTING NEW AGRICULTURAL TECHNOLOGY ON FARMERS, IN SOUTHWEST ETHIOPIA

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A B S T R A C T

This study was undertaken to assess the socio-economic impact of adopting new agricultural technology on the livelihoods of the farmers, in southwest Ethiopia. The major objectives of this study is to assess the socio-economic impact of adopting agricultural technologies on producers in terms of education, frequency of feeding and ability to finance. A random sample of 323 farmers were selected using multistage random sampling from the study area. Multiple regression Models, Logistic regression models, test hypothesis: Z-test, t - test and coefficients of determination methods of data analysis were used in this study. Comparisons were made between agricultural technology adopters and non-adopters using the Z- test and regression analysis. This study defines agricultural technology adopters as those who use agricultural technology. If the producers not adopt the agricultural technology, he/she is considered as non-adopters. To assess the impact of adopting agricultural technology on the educational status of the family, the ratio of children in schools to the total number of school aged children in the family, expressed as percentage. The ability of the household to feed the family was also seen in terms of the frequency of feeding the children and the adult. The percentage of farmers having corrugated iron sheet roofed houses, the percentage of farmers having separate kitchens other than their living rooms for cooking and the percentage of farmers having separate structure for livestock other than the living room were used to assess the impact of agricultural technology adoption on the housing conditions of the farmers. It was found that technology adopters are better off than the non adopters in terms of sending children to elementary school, housing conditions and ability to finance their families' food requirements. The impact of father's education, number of children and livestock ownership on the improvements in the livelihoods of the farmers and the problems facing the farmers were also emphasized. After all analysis, it can be concluded that adoption of agricultural technology enables the farmer to send children to school, have improved housing conditions, and food secured than the non-adopters. Finally, the results were recommended as creating the awareness about the uses of education, business awareness and advising the producers and non-producers of agricultural technology adoption.

INTRODUCTION

Agriculture plays an important role in economic growth, enhancing food security, poverty reduction and rural development. It is the main source of income for around 2.5 billion people in the developing world (FAO, 2003). Smallholder agriculture is identified as a vital development tool for achieving Millennium Development Goals, one of which is to halve the people suffering from extreme poverty and hunger by 2015 (World Bank, 2008). However majority of smallholder farmers relies on traditional methods of production and this has lowered the level of productivity. For instance Over 70% of the maize production in the majority of developing countries is from smallholders who use traditional methods of production (Muzari *et al*., 2012). These farmers generally obtain very low crop yields because the local varieties used by farmers have low potential yield, most of the maize is grown under rain-fed conditions and irrigation is used only in limited areas, little or no fertilizers are used and pest control is not adequate (Muzari *et al*., 2012).

Increasing agricultural productivity is critical to meet expected rising demand and, as such, it is instructive to examine recent performance in cases of modern agricultural technologies (Challa, 2013). Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output (Jain *et al*., 2009). According to Loevinsohn *et al.* (2013) the most common areas of technology development and promotion for crops include new varieties and management regimes; soil as well as soil fertility management; weed and pest management;

irrigation and water management. By virtue of improved input/output relationships, new technology tends to raise output and reduces average cost of production which in turn results in substantial gains in farm income (Challa, 2013).

Various authors define technology in different ways. Loevinsohn *et al*., 2013 define technology as the means and methods of producing goods and services, including methods of organization as well as physical technique. According to these authors new technology is new to a particular place or group of farmers, or represents a new use of technology that is already in use within a particular place or amongst a group of farmers. Technology is the knowledge/information that permits some tasks to be accomplished more easily, some service to be rendered or the manufacture of a product (Lavison 2013). Technology itself is aimed at improving a given situation or changing the status quo to a more desirable level. It assists the applicant to do work easier than he would have in the absence of the technology hence it helps save time and labor (Bonabana-Wabbi 2002).

Adoption on the other hand is also defined in different ways by various authors. Loevinsohn *et al*., 2013 defines adoption as the integration of a new technology into existing practice and is usually proceeded by a period of 'trying' and some degree of adaptation. Citing the work of Feder, Just and Zilberman (1985), Bonabana-Wabbi defines adoption as a mental process an individual passes from first hearing about an innovation to final utilization of it. Adoption is in two categories; rate of adoption and intensity of adoption. The former is the relative speed with which farmers adopt an innovation, has as one of its pillars, the element of 'time'. On the other hand, intensity of adoption refers to the level of use of a given technology in any time period (Bonabana-Wabbi 2002).

Adopters of improved technologies increase their productions, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers (Kasirye, 2010). Adoption of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Ravallion and Chen, 2004; Kasirye, 2010).On the other hand, non-adopters can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation (Jain *et al*., 2009).

Statements of the Problems

To the best of my knowledge, there has been no study undertaken on the impact of adopting new agricultural technology of farmers. If we agree that new agricultural technology contributes to the economy of the farmers as well as the country. It is also important to study the problems facing the farmers of this product.

There are limited researches conducted on farmers and its correlates with products in Ethiopia. The implication is that the agricultural producers were not given attention. Beside this, most research papers focuses on the national level technology adoption than at zone or wereda level. Measuring and analysis of socioeconomic change of the farmers, on zone and/or wereda households becomes sound enough to put an agenda on the poor, targeting of policy makers in intervening on that particular study area.

This study focuses on the assessment of socioeconomic impact of new agricultural technology adoption on farmers in terms of education, food security, improvements in housing conditions, and the ability to finance in the family in times of food shortfalls.

Objectives of the study

General Objective

The main objective of this study is to assess the socioeconomic impact of adopting new agricultural technology farmers in terms of *education, food security, improvements in housing conditions and the ability to finance* in the family in times of food shortfalls.

Specific Objectives

The specific objectives of this study are as follow:

- To assess the socioeconomic impact of new agricultural technology adoption on farmers in terms of education.
- To investigate the food security of the farmers in the study area.
- To analysis the housing conditions of the farmers.
- To assess the ability to finance in the family.

MATERIALS AND METHODS

Data Collection Methods

This study was conducted in southwest Ethiopia. The study area includes two zones, Illu Abba Bor zone and Bunno Bedelle Zone. The study applied multistage sampling procedure. The participants of the study were selected using multistage random sampling. First the districts in zones were categorized according to the types of crops they produce. Random samples of districts were then selected at the first stage and the data were then collected from the administration offices of the selected districts. On the second stage, the peasant associations (PAs) were grouped in the same way and sampled for the study. At the third stage, the villages were grouped in the same procedure and sampled randomly. Finally, the households (farmers) were selected using systematic random sampling procedure. The sampling frames were prepared by discussing with peasant associations (PA) leaders. The summary of the sample size taken for the study is given in *table 3.1.*

Table 3.1 Sample size taken for the study

Administrative Zone	Sampled Distinct	sample size
Bunno Bedelle Zone	Bedelle	45
	Gechi	52
	Yayo	48
Illu Abba Bor Zone	Alle	50
	Bacho	40
	Dega	42
	Mettu	46
Total	**7**	**323**

The secondary data was collected from Agricultural Development Offices and publications of the distinct and Zones

Methods of Data Analysis

The main objective of this study was to assess the impact of adopting agricultural technology. To meet this objective, different comparisons were made between the adopters and non-adopters of new agricultural technology. To assess the impact of adopting agricultural technology on the educational status of the family, the researchers were used the ratio of children in schools and those who have attended regular schools to the total number of school aged children in the family, expressed as percentage.

The ability of the household to feed the family was also seen in terms of the frequency of feeding the children and the adult. The percentage of farmers having corrugated iron sheet roofed houses, the percentage of farmers having separate kitchens other than their living rooms for cooking and the percentage of farmers having separate structure for livestock other than the living room were used to assess the impact of agricultural technology adoption on the housing conditions of the farmers. The strategy used by the farmers to finance the household expenditures in times of food shortfalls and/ or crop failure was also another parameter to assess the impact on the food security of the farmers. With this respect, the percentage of farmers using food aid as one of the strategies or the only strategy in times of food shortfalls and crop failure was used.

There are different techniques used in assessing an impact. These include the mean test, regression analysis and partial budgeting. The partial budgeting technique is a planning and decision making frame work used to compare the costs and benefits of alternatives faced by a farm business (Roth and Hyde, 2002; Dalsted and Gutierrez, 2004). Thus, we used the mean test and regression analyses which are explained as follows.

The Z- test for the difference between two population means

Suppose that there are two samples drawn independently from two populations with mean μ_1 and μ_2, respectively. Then, the test about the significance of the difference between the two means takes one of the following forms:

$H_0 : \mu_1 - \mu_2 = 0$ Vs $H_1 : \mu_1 - \mu_2 \neq 0$ --------------- (1)

OR

$H_0 : \mu_1 - \mu_2 = 0$ Vs $H_1 : \mu_1 - \mu_2 > 0$ --------------- (2)

OR

$H_0 : \mu_1 - \mu_2 = 0$ Vs $H_1 : \mu_1 - \mu_2 < 0$ ------------ (3)

Where, H_0 and H_1 stand for the null and alternative hypotheses, respectively.

The test statistic is then given by:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad \text{------------------ (4)}$$

Where, n_1 is sample size from population1, n_2 is sample size from population2, $\bar{X}_1$ is the mean of the sample taken from population1, $\bar{X}_2$ is the mean of the sample taken from population 2, S_1^2 is the variance of the sample taken from population 1, S_2^2 is the variance of the sample taken from population 2.

For a specified Type I error α , the null hypothesis will be rejected if: $|Z| > Z_{\alpha/2}$, for the first form; $Z > Z_\alpha$ for the second form; and $Z < - Z_\alpha$ for the third form of the hypothesis. Rejecting the null hypothesis means that there is a significant difference between the means of the two groups.

The Regression Analysis

The method of data analysis to measure the functional relationship between a quantitative dependent variable and one or more independent variables is the regression analysis. A linear regression equation of the a dependent variable Y on k independent variables $X_1, X_2, \ldots, X_k$ is given by

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \varepsilon \quad \ldots\ldots\ldots\ldots (5)$$

Where,

$\beta_1, \beta_2, \ldots, \beta_k$ are the slopes (the change in Y for the unit change in the explanatory variable X_i), β_0 is the value of Y when all independent variables assumes zero value ε is the random term. The coefficients of the linear regression model are estimated under the assumption that the random term assumes normal distribution with *zero mean* and *constant variance*. The values of the random term are also assumed to be independent of the values of the variables in the model and of the values of the error term for other cases.

After fitting a linear regression model by estimating the coefficients (Using *SPSS*), we have to test whether the coefficients are statistically significant. This can be done either by testing the overall significance of the model or by testing the significance of the individual coefficients.

Logistic Regression Analysis

In logistic regression model, the dependent variable is a binary or dichotomous taking two values 0 and 1 showing the probability of occurrence or otherwise of an event. Logistic regression determines the impact of multiple independent variables presented simultaneously to predict membership of one or other of the two dependent variable categories. This type of regression can be explained as follows:

Suppose we have a dependent variable assuming only two values 1 (for presence of a character of interest and 0 for the absence of the character of interest) and K explanatory variables. The conditional expectation of Y given X, E(Y=1/X) is given by:

$$\pi x = \frac{e^{\beta 0 + \beta 1 x}}{1 + e^{\beta 0 + \beta 1 x}} \quad (6)$$

Where β_0, β_1 are the coefficients.

The basic logistic regression analysis begins with logit transformation of the dependent variable through utilization of maximum likelihood estimation. This is done using what is popularly known as Odds Ratio. The odds ratio for an event is represented as the probability of the event outcome divided by one minus probability of event outcome. The odds ratio is given by:

$$Odds = \left[\frac{\pi(x)}{1 - \pi(x)}\right] = \quad (7)$$

Where *p(X)* is the probability of success if event will occur and *1 - p(x)* is the probability of failure if an event not occurring. Hence equation (7) can be transformed into an alternative form of logistic regression equation by taking the logarithmic transformation of equation (8) also called the logit transformation yields:

$$gx = ln\left[\frac{\pi(x)}{1 \quad \pi(x)}\right] = \beta_0 + \beta_1 x + \varepsilon \qquad (8)$$

For K explanatory variables $x_1, x_2, \ldots, x_K$, g(x) is given by

$$g(x) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_K x_K + \varepsilon \qquad \text{---------} (9)$$

The principles that guide an analysis using linear regression analysis was also guide as in logistic regression except that the dependent variable in logistic regression is binary and the error terms have binomial distribution (Hosmer and Lemeshow, 1989).

RESULTS AND DISCUSSIONS

The Impact of agricultural technology adoption on the Educational Status of the family

The percentage of children aged 7 years and above was taken to compare the educational statuses of the *adopter* and *non-adopter* The result shows that there are 226 adopter and 97 non- adopter of new agricultural technology having children in this age group. The mean percentage of children who had completed or were attending elementary schools at the time of the survey was found to be 69.97% and 30.03% for the adopters and non- adopters, respectively as shown in *table 2* below.

Table 3. 2 Comparison of the average percentage of children whoever completed or reached elementary school

Producers Group	Sample Size	Mean	Stand. deviation	Percentage
Techn. Non-adopters	97	30.86	34.94	30.03%
Techn. Adopters	226	41.2	40.58	69.97%

To test the significance of this difference we used the one tailed test given by (2). The calculated Z using equation (4) was found to be $Z_c = -1.96$, is less than the corresponding tabulated value -1.64, at $\alpha = 0.05$. Thus we reject the null hypothesis that there is no difference in the proportion of children who ever reached or in elementary schools between the *adopters and non- adopters* and conclude that the percentage is higher in the adopters group.

Statistical significance of the independent variables

We can test for the statistical significance of each of the independent variables. This tests whether the un standardized (or standardized) coefficients are equal to 0 (zero) in the population. If Sig. < .05, we can conclude that the coefficients are statistically significantly different to 0 (zero). The *t-value* and corresponding *Sig-value* are located in the *"t" and "Sig*." columns, respectively.

The linear regression equation characterizing the effect of Area of farm land for adoption, distance from elementary school, father's education, mother's education, number of cows, father's Age, income and mother's education on the mean total number of school aged children expressed as percentage of this analysis. We can write the equation of linear regression as follow:

$$ES = 26.61 + 3.5X_1 - 2.54X_2 + 2.1X_3 + 4.2X_4 + 3.21X_5 - 2.47X_6 + 1.5X_7 \qquad \text{------------------} (10)$$

Where, ES is the number of children who ever reached elementary school divided by the total number of school aged children expressed as percentage, X_1.is area of farm land for adoption, X_2 is distance from school, X_3 is fathers education, X_4 is mothers education, X_5 is families income and X_6 is number of cows.

Equation (10) shows that as the area allotted to adoption, father's education, income and mothers educations increases with increasing of percentages of sending children to school, where as number of cows and fathers age are increases with decreases percentages of sending children to school.

The Impact on Household's Ability to Feed the Family

This impact is seen with respect to the frequency of feeding children and the adult, and the strategies used by the household in times of food shortage. The results show that the technology adopters are better than the non-adopters in all these three criteria.

Table 3. 3 Frequency of feeding adults for non- producers and producers

Producers Group	No. of Household	Mean	Stand. deviation
Techn. Non – Adopters	97	5.35	0.76
Techn. Adopters	226	7.25	0.97
Total	323		

The average frequency of feeding the children (*see table 3.2*) is higher for the agricultural technology adopters than the non-adopters.

As the frequency of feeding the children may depend on other factors in addition to the new agricultural technology adoptions, We have tried to fit a regression model of the frequency of feeding children on the area of farmland for adoption, area of farmland allotted to cereals, father's age, mother's age, father's years of education, mother's years of education, total number of children, household head type (male or female), number of cows, number of sheep, income of the family and number of goat. The backward stepwise variable selection technique yielded

$$FF_c = 4.65 + 2.50X_1 + 1.21X_2 - 0.24X_3 + 4.23X_4 \text{--------} (11)$$

Where, FFc = frequency of feeding children, X1 = area of farmland allotted for technology adoption (in timad), X_2 = area of farmland allotted to cereals (in timad), X_3 = father's age in years, X_4 = family income

As it can be seen from equation (11) the frequency of feeding children increases by 2.50 with the increase in the area allotted for adoption by 1 unit, the increase in the area allotted to cereals by 1 unit, results in the increases in the frequency of feeding children by 1.21, The increase in the age of father by 1 unit was also found to result in the decrease in the frequency of feeding the children by 0.24.

Table 3.4 Frequency of feeding adults for non- adopters and adopters

Producers Group	Sample Size	Mean	Stand. deviation
Non – adopters	82	2.36	0.46
Adopters	200	2.56	0.62
Total	282		

The comparison of the farmers based the strategies used for tackling the problems of food shortage and crop failure is also another important point of comparison between the adopters and non-adopters. Some households were adopting different type of agricultural technology and they can save such problems. This study compared the percentage of farmers using food aid as the sole strategy or one of the strategies when such problems occur. The result shows that, using food aid as a strategy is higher among the non-adopters of agricultural technology than the adopters (*see table 3. 4 below*).

Table 3.5 Distribution of the farmers by the Strategy do you use in times of food shortage or crop failure

	Food Aid?		
Adopters Group	**NO**	**YES**	**Total**
Techn. Non – Adopters	51 (54.8%)	47 (45.2%)	98 (100%)
Technology Adopters	163 (76.9%)	54 (23.1%)	217(100%)
Total	214(70.2%)	101 (29.8%)	315 (100%)

To test whether this difference is significant, we used the Z-test for the difference of two populations' percentage. The calculated Z_c is found to be 3.95, greater than the corresponding tabulated 1.64 at $\alpha = 0.05$, we can reject the null hypothesis that the percentage of farmers using food aid as a strategy is the same for the non-adopters and adopters'; and conclude that the proportion is higher in the non-adopters group.

As it was done for other variables, determination of the factors contributing to the probability of taking food aid as one of the strategies or the sole strategy in times of food shortfalls was done using the logistic regression analysis. Area allotted for adoption, family income, area allotted to cereals, father's education, mother's year of education, number of children, household type (male or female), number of oxen, number of cows, number of sheep, number of goat, number of calves, mother's age and father's age were considered as explanatory variables.

Impact on Housing Conditions of the Household

This study considered the roofing, wall, floor, the presence of separate kitchen, and the presence of separate structure for livestock as characteristics to assess the improvements in the housing conditions of the farmers. The results of the analysis concerning the material used for roofing the houses (*table 3.5*) show that the proportion of the farmers having corrugated iron sheet roofed houses is 22.8% and 48.6% among the technology non-adopters and the technology adopters, respectively.

Table 3.6 Distribution of Farmers by Type of Materials for Constructing Roofs

	Roofing Material		
Adopters Group	**Grass**	**Corrupted iron Sheet**	**Total**
Techn. Non – adopters	69 (71.2%)	24 (22.8%)	93 (100%)
Techn. Adopters	101(48.4%)	99(48.6%)	200(100%)
Total	170(56.4%)	121 (41.6%)	293 (100%)

(Figures in parentheses indicate the percentage within the farmer group)

However, the proportion of the farmers having grass roofed houses is 71.2% and 48.4% among the technology non-adopters and the technology adopters, respectively.

In fact the farmer's having corrugated iron sheet roofed house can be a function of many factors. Attempts were also made to identify these factors, using the method of logistic regression. Area of farmland allotted to chat, area allotted to coffee, area allotted to cereals, education of father, education of mother, number of children, type of household (male or female), number of cows, number of oxen, number of sheep and number of goats were taken as explanatory variables. The backward conditional method of variable selection yielded,

$$R = - 0.45 + 0.3X_1 + 2.5 X_2 - 0.14X_3 + 0.25X_4 + 0.29X_5 + 0.08X_6 \quad \_\_\_\_\_ (12)$$

Where, R= Probability of having corrugated iron sheet, X_1 = area of farmland allotted to chat, X_2 = area of farmland allotted to cereals, X_3 = years of education of the father, X_4 = number of cows owned by the farmer, X_5 = number of goats owned by the farmer.

As it can be seen from equation (12), the probability of having corrugated iron sheet increases with increasing of area of farmland allotted to chat, area of farmland allotted to coffee, years fathers education and number of cows and goats and decreases with increases of in area of farmland allotted to cereals when the values of other explanatory variables are held constant.

The analysis of the distribution of farmers by cooking place (*table 3.6*) shows that the percentage of farmers using separate kitchens for cooking other than their living rooms is 21.2% and 38.5% for technology non-adopters and technology adopters group, respectively. However, the proportion of the farmers having using in the living room is 75.3% and 56.5% among the technology non-adopters and the technology adopters, respectively.

Table 3.7 Distribution of Farmers by Cooking Place

	Cooking Place		
Adopters Group	**In the living room**	**Separate Kitche**	**Total**
Techn. Non – Adopters	72 (75.3%)	20 (21.2%)	92 (100%)
Techn. Adopters	125 (56.5%)	85 (38.5%)	210(100%)
Total	197 (58.4%)	105 (34.5%)	302 (100%)

Figures in parentheses indicate the percentage within the farmer group

To test whether this difference is significant, we used the Z-test for the difference of two populations' percentage. The calculated Z was found to be, $Z_c = - 3.8$. This value is less than the corresponding tabulated value for $\alpha = 0.05$, which is -1.64. Thus, we can reject the null hypothesis that the percentage of farmers having separate kitchens for cooking is the same for the technology *non-adopters* and *adopters* and conclude that the proportion is higher in the adopters group. Its implication may be that adopting agricultural technology enable the farmer build separate cooking place to have clean living room. Having kitchen can be a function of many factors in addition to the economic status of the farmers.

To identify these factors logistic regression was used with cooking place as the dependent variable assuming value 1 if the farmer has separate kitchen and 0 if not. The proposed explanatory variables were area allotted to chat, area allotted to coffee, area allotted to cereals, education of the father, education of the mother, number of children, type of household (male or female), number of cows, number of oxen, number of sheep, number of goats, and number of calves. The backward conditional variable selection method results as follow:

$$K= - 0.83 + 0.23X_1 + 0.61X_2 - 0.15X_3 + 0.27X_4 + 0.15X_5 + 0.09X_6 \quad \text{----------------} (13)$$

Where, K= the probability of having separate kitchen than the living room , X_1 = area of farmland allotted to chat, X_2 = area of farmland allotted to coffee, X_3 = area of farmland allotted to cereals, X_4 = years of education of the father, X_5 = number of children, X_6 = number of goats.

As it can be seen from equation (13), the probability of having separate kitchen than the living room is significantly (P-value $0.00 < 0.05$) increase, since the slope of area of farmland allotted to chat is positive, by 0.23 per unit increase in area of farmland allotted to chat, when the values of other explanatory are held constant, the probability of having separate kitchen than the living room is expected to increases with the area of farmland allotted to coffee by 0.61 per one unit increases in area of farmland allotted to coffee, when the values of other explanatory variables are held constant.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The main objective of this study was to assess the socio-economic impact of adopting new agricultural technology on the livelihoods of the farmer with particular emphasis to education, food and housing conditions. Attempts were also made to identify the factors contributing for the changes in the livelihoods and describe the problems facing the farmers in the area.

Multistage random sampling was used to collect data from the farm households. Two mean test and regression analyses were used to analyze the data. The results of the analysis showed that the new technology adopters are better off than the agricultural non-adopters in their abilities to send children to school (to the level of elementary school), own houses roofed with corrugated iron sheet, having separate kitchens for cooking, frequency of feeding both the children and the adult, and finance the family in times of food shortage, crop failure and or other difficulties.

The number of oxen negatively affected the percentage of children to be sent to school. It may mean that the children are used for herding. However, the same variable contributed positively to the food security of the family. The probability of opting for food aid in times of food shortfalls decreases with the increase in the number of oxen. Increase in father's age resulted in the decrease in the frequency of feeding the children. This may be due to the fact that as one gets older the adopting agricultural technology decreases coupled with many responsibilities. Father's years of education affected positively the frequency of feeding the adult, the ability to own corrugated iron sheet roofed houses, ability to own separate kitchen for cooking other than the living room, and building separate structure for livestock than the rooms in which humans live. This may also be due to the fact that education can contribute to the improvements in the livelihood of a family.

In general, it can be concluded that adopting new agricultural technology enables the farmer to send children to school, have improved housing conditions, and food secured than the non-adopters. The contributions of livestock ownership, education of the parents, numbers of children and other factors to the improvements in the livelihoods of the farmers should also be emphasized.

Recommendations

Based on the results discussed above, the researchers would like to forward the following recommendations:-

1. Creating the means by which those farmers who do not adopt agricultural technology can adopt the new agricultural technology to supplement their financial needs.
2. Creating the awareness about the uses of education both among the agricultural adopters and non-adopters and facilitating conditions so that the farmers can get secondary education. This can be done by incorporating the uses of educating children the agricultural extension education and/or using religious institutions to deliver the same on their ceremonies.
3. Government should devise other mechanisms of helping the farmers other than providing food aid. The government should enable the farmers to develop the sense of independence.
4. The government should expand the access of the new agricultural technology and address to the farmers with minimum costs.

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