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# Determinants of Households' Participation in Degraded Land Rehabilitation around Dire-Dawa City Administration

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***Abstract:****This study was conducted to analyses determinants of households' participation in degraded land rehabilitation around in Dire Dawa city administration. To meet these objectives both primary and secondary data were collected. The primary data were collected from 350 sample households randomly selected from eight kebeles with in 38 kebeles of the administration. Descriptive statistics such as mean, standard deviation, t-test and chi-test were used to describe socio-economic and institutional characteristics of the sample households, plot characteristics, and the extent of soil conservation practices in the study areas. Logit model was used to analyze factors that affect households to participate in soil and water rehabilitation at plot land and as well as communal level activities. A total of 13 explanatory variables were included in the model of ten were found to be significant at less than 10% probability level for participating in rehabilitation of degraded land. The major rehabilitation activities or practices used to control land degradation in the administration include soil bund, stone bund, hill side terraces, gabion check dam, and other physical and to some extent biological conservation methods. The level of adult education, income, attitudes towards of rehabilitation activities, and awareness of environmental protection should be improved to increase their level of participation. In addition to this, rehabilitation of degraded land needs the participation of different stakeholders, such as the governmental, non-governmental organizations and the farmers.*

***Key words****: Degraded land, Rehabilitation, logit model.*

## 1. INTRODUCTION

Ethiopia is the second largest country in Africa in terms of population size with about 80% of the population live in rural areas by obtaining their livelihood from agriculture and local environmental resources [1, 2]. Agriculture sector is still characterized by small-scale rain-fed and hand to mouths production system which accounts for over 90% of the total agricultural output in the country [3]. Agricultural land expansion and high dependence on firewood energy are the two most important direct drivers of land degradation in country. Between 2000 and 2008, agricultural land is expanded around 4 million hectares. By 2030, demand for agricultural land is expected to increase from 15 million ha to 34 million ha, which is expected to come from conversion of forestlands, woodlands, and shrub lands [4].

Land degradation is a result of naturally and human activities that temporary or permanent decline in productive capacity. It also considers the reduction and loss of biological economic productivity and complexity of crop lands, pasture, and woodland forest [5]. It is one of the major causes for low and declining agricultural productivity, food insecurity and rural poverty [6, 7]. As rapid human pressure through agricultural land expansion, poor farming practices, unbalanced crop and livestock production causes the problems of soil erosion, deforestation, overgrazing, harvesting of fuel energy resource and, which leads to the loss of productivity of natural resources [8]. This is the most environmental problem in Ethiopia.

Environmental concern has become the prime agenda for the global economy and politics. Environmental issues, such as global warming, frequent drought, pollution, flood and outbreak of diseases resulted in as the consequence of environmental degradation and industrialization. The problems became severe in sub Saharan countries, including Ethiopia [6, 9-11]. Nowadays, land degradation is given increasing attention for local community-based rehabilitation as an innovative response for meeting the conflicting goals of livelihood improvement and sustainable land management. Such community based rehabilitation activities have often included the promotion of the establishment of plantations and the introduction of sustainable farming systems, trees grown together with crops in order to reduce

the pressure on land and to avoid further degradation of the land [12].

In the successive national development plans, the Ethiopian government has put sustainable natural resource management among the top priority development agenda. The commitment of the government to address the root causes of degradation, strengthening land tenure security, building local capacity in community-based approaches to watershed management, scaling-up of successful models for watershed management and strengthening natural resource information management through public programs, such as PSNP and Managing Environmental Resources to Enable Transitions to sustainable Livelihood (MERET) supported by various development partners of the country are the major approaches [13]

Degraded land rehabilitation has been implemented in Dire Dawa administration rural kebeles where pastoral and agrarian households were involved in the programs. The approach and the technologies have been primarily developed through the community-based participatory watershed development intervention known as MERET which has been implemented by Sustainable Land Management framework of the then Minister of Agriculture at different levels and in collaboration with World Food Program. The programs have been utilizing food-for-work to link short-term food assistance with the creation of long-term opportunities for sustainable local development and improved livelihoods through rehabilitation of degraded lands and sustainable utilization of local resources [13, 14].

While the various empirical studies extensively examined in various areas of the country show that soil and water management practices on both cultivated and uncultivated lands involve various physical SWC measures combined with biological measures, soil fertility management practices, soil moisture management practices, gully rehabilitation using different kinds of check dams, combined with gulley reshaping, runoff diversion and gulley re-vegetation and utilization arrangements among communities, reveals that these developmental works have brought changes for the environment [15-17]. However, these studies restricted their analysis to specific bunds, yet households apply different conservation measures to different cultivated and uncultivated land. Moreover, the studies are limited in their coverage of different situations in the country (Amhara, Tigray and Highlands of West Harerghe zone).

Dire Dawa Administration (DDA) has been involving its rural residents to implement different public development strategies such as Productive Safety Net Program (PSNP) and Managing Environmental Resources to Enable Transitions to sustainable livelihoods (MERET) to rehabilitate degraded land within its province. Rehabilitation of degraded land activities has been practiced in Dire Dawa Administration rural kebeles through community participation for the last five years. Such participation is widely recognized as a key element of any development strategy as the nation development strategies consider the involvement of huge number of labor force. Sustainable and active participation of households with the essence of ownership has paramount importance in the realization of sustainable natural resource conservation and rehabilitation. Nearly twenty seven thousand households have been participating in degraded land rehabilitation activities through safety net program and mobilized community participation [31]. These developmental efforts should be assisted by studies which address its challenges, hindrances and best experiences for sustainability as well as progressive improvement. Therefore, this study was aimed to analysis households' participation degraded land rehabilitation in the study area. The objectives of this study was to assess households' participation in integrated soil and water conservation activities and to investigate the determinants of households' participation in integrated soil and water conservation activities.

## 2. Materials and Methods

### 2.1. Method of Data Collection and Sampling Design

The study was conducted around rural Dire-Dawa city administration. The rural administration has four woreda and 38 kebeles. The research was conducted in February and March 2016. A structured questionnaire, interviews and personal observation and survey was used for collected the relevant quantitative and qualitative data. Two-stage sampling technique was used in sampling process. First stage out of total 38 kebeles of the administration eight kebels were selected based on systematic random sampling techniques. Second stage a total 350 respondents were selected randomly from the selected kebeles that was proportional to kebeles household size (see Table 1).

Table 1: Number of households and sample size

| Kebeles | Total number of households | sample households |
|---|---|---|
| 1. Dujuma | 443 | 39 |
| 2. Koriso | 345 | 30 |
| 3. Bishan behe | 849 | 75 |
| 4. Legebira | 319 | 28 |
| 5. Hulahulul | 684 | 60 |
| 6. Gendeneser | 317 | 28 |
| 7. Mudi aneno | 363 | 32 |
| 8. Melka kero | 648 | 58 |
| TOTAL | 3968 | 350 |

## 2.2. Analytical Tools

This study employed both descriptive statistics and econometric methods to analyze the data collected from the sample respondents. Descriptive statistics was used to describe the households' characteristics on problems related to rehabilitation of land degradation activities.

## 2.3. Model Specification

The purpose of this study was to analyses which of the hypothesized independent variables are related to the households' participation in integrate degraded land rehabilitation practices in their farm land and at communal level based. The dependent variable in this case was a dummy (binary) variable which take the value zero or one depending on whether or not households were to participate in integrated land rehabilitation activities in farm land as well as communal level.

Logit model:- for this study the logit model was selected because it is simpler to work with and interpretation of the parameter estimates. Logit model has advantage over other in the analysis of dichotomous outcome variable in that it is extremely flexible and easily used function from mathematical point of view subjects itself to meaningful interpretation. Following, [18], the functional form of logit model is specified as follows: The logistic regression model is econometrically specified as follows where *pi* donates the probability to participate in integrated land rehabilitation activities in farm land as well as communal level households that is *Yi*= 1 and exp ($Z_i$) stands for the irrational number *e* to the power of $Z_i$.

The model can be written as:

$$p_i = E(y = \frac{1}{x}) \frac{1}{1+e^{-(\beta_0+\beta_1 x_1)}} \quad (1)$$

For the case of explanation we write (1) as;

$$p_i = \frac{1}{1+e^{-z_i}} \quad (2)$$

The probability that a given households were to participate in integrated land rehabilitation activities in farm land as well as communal level was expressed by (2) while the probability of not participated is;

$$1 - p_i = \frac{1}{1+e^{z_i}} \quad (3)$$

Therefore, we can write;

$$\frac{p_i}{1-p_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} \quad (4)$$

$P_i$/1-Pi is simply the odds ratios in favor of households were to participate in integrated land rehabilitation activities in farm land as well as communal level. The ratio of the probability that households were to participate in integrated land rehabilitation activities in farm land as well as communal level to the probability of that he/she will not.

Finally, taking the natural log of equation (4) we obtain:

$$p_i = \ln\left(\frac{p_i}{1-p_i}\right) = z_i = \beta_{0+}\beta_1 x_{1+}\beta_2 x_2 + \cdots + \beta_n x_n \quad (5)$$

Where Pi = is a probability of participate in integrated land rehabilitation activities in farm land as well as communal level ranges from 0 to 1

$Z_i$ = is a function of n explanatory variables (x)

$\beta_0$, =is an intercept

$\beta_1, \beta_2, \ldots\ldots\ldots, \beta_n$ are slopes of the equation in the model

$L_i$ = is log of the odds ratio, which is linear in the parameters.

$X_i$ = is vector of relevant household characteristics

If the disturbance term ($U_i$) is introduced, the logit model becomes

$$z_i = \beta_{0+}\beta_1 x_{1+}\beta_2 x_2 + \cdots + \beta_n x_n \quad (6)$$

The marginal effect on y (the observed variable) of a change in explanatory variable *x* differs from the value of the *β* coefficient in the censored regression model. The marginal effects are a function of the *x* values, and are given by:

$$\partial E\left(\frac{\frac{y_i}{x_i}}{\partial x_i}\right) = \beta.\emptyset\frac{\beta' x_i}{\delta} \quad (7)$$

Where *Φ* is the cumulative normal distribution function, often these marginal effects are calculated and reported at the mean values for the vector *x*,

although in principle they could be calculated for individual households.

## 2.4. Multicollinearity and goodness of fit of the model

In this analysis before estimating the model, it is necessary to check the existence of Multicollinearity among the hypothesized variables. This is to test the multicollinearity problem among the potential independent variables. If multicoliniarity problem exists among the variables, then one variable obscures the effect of the other. As a result, existence of multicollinearity is checked and tested for all dummy/discrete and continuous variables. In order to measure the existence of multicollinearity problems among the explanatory variables, commonly used measure of multicollinearity is used. That means, Variance Inflation Factor (VIF) for continuous explanatory variables and contingency coefficient for dummy/discrete variables were employed. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity [18], if VIF of a variable exceed 10.

The presence of hetroscedasticity (when variances of all observations are not the same) which leads to consistent but inefficient parameter estimates is also checked. The Breusch- Pagen test (hettest) in STATA is used to test for hetroscedasticity. In the present study, robust standard errors were used to correct the problem of hetroscedasticity problem. STATA software version 12 is used to analyze the data.

## 3. Result and Discussion

### 3.1. Demographic characteristics of sample households

The level of household's participation in the study area has been measured using of improved soil and water rehabilitation technologies practices. Such as Soil bound, Stone bound Organic manure and Area closing. Out of the total sample households taken 65 % were used in integrated soil and water rehabilitation activities on plot lands. There was a statistically significant difference at 5 percent among used and non- used in integrated soil and water rehabilitation activities of households in terms of sex of composition sample household heads.

Table .2: Sex Composition of the sample households

| No | Sex | Used | | Non-used | | Total | | $\chi^2$ |
|---|---|---|---|---|---|---|---|---|
| | | No | % | No | % | No | % | |
| 1 | Female | 63 | 67.74 | 30 | 32.26 | 93 | 27 | 5.852** |
| 2 | Male | 160 | 64.00 | 93 | 36 | 253 | 73 | |
| 3 | Total | 223 | 65.00 | 123 | 35 | 346 | 100 | |

**, Statistically significant at 5 %, probability level

The mean age of the sample household heads was 44.68 years with the minimum and maximum ages of 28 and 78 years. The average age of soil and water conservation program participating household heads was 45.47 years compared to 43.12 years for non-used households. However, there was no statistically significant difference between the two groups in terms of age within households. Education is one of the most important variables; educated farmers are able to understand about the cause and consequence of land degradation and used different ways of soil and water conservation practice, traditional and introduced soil conserving better technologies. The survey results showed that the majority of household heads (60.3%) were not attended formal education (illiterate) while the remains about 39.7% have attended at least primary education. There was a statistically significant percentage difference at 1 percent among used and non-used households in terms of education of the household heads

Table 3: Demographic characteristics of sample households (continuous variables)

| Variables | Total sample (N=346) | | Used N=223) | | Non-used (N=123) | | t-value |
|---|---|---|---|---|---|---|---|
| | Mean | STD | Mean | STD | Mean | STD | |
| Age | 44.68 | 10.74 | 45.47 | 9.85 | 43.13 | 10.98 | 1.57 |
| Education | 1.54 | 0.13 | 1.62 | 0.17 | 1.59 | 0.24 | 6.85*** |
| Family size | 5.74 | 0.14 | 5.76 | 0.16 | 5.68 | 0.23 | 38.05*** |
| Economically active labor force | 0.23 | 0.01 | 0.22 | 0.01 | 0.23 | 0.02 | 15.42*** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Dependency ratio | 3.24 | 0.06 | 3.25 | 0.08 | 3.22 | 0.09 | 1.25 |

***, Statistically significant at 1 %, probability level

The mean family size of the total sample households was 5.74 persons ranging from 3 to 13, which is higher than the national average of 5 persons as stated in (CSA, 2007). On average, soil and water conservation used households have relatively larger family sizes (5.76) than non- used households (5.68) with mean difference being statistically significant at 1 percent significance level. There was statistically significant difference between the two groups in terms of economically active members within a given household (15 to 64 years) with significant mean difference at 1 percent significance level. The dependency ratio also with the mean values of 3.24 and 3.22 for soil and water conservation used and non-used households, respectively. However, there was no statistically significant difference between the two groups in terms of dependency ratio.

## 3.2. Land holding and cropping pattern

Land in the study area is scarce mainly due to bare land and population pressure. Farm land that is owned by sample households ranges from 0.25 to 2 hectares. The average landholding is 0.57 hectare, which is less than the national average of 0.86ha per household. The mean land holding owned by the sampled program participants and non-participant households was 0.54 ha and 0.62 ha, respectively with a statistically significant mean difference at 10 percent probability level. The major occupations of most household heads were both mixed-farming (crop production and animal husbandry) and pastoralist way of living.

Households, who have farm lands in areas more prone such as steep to very steep slopes, are expected to experience more soil erosion. In line with this idea, the slope of each farm plots is classified by the households as flat, gentle slope and steep slope and mountainous. As to the farmers' view, their farm plots, 21.68 percent, 45.66 percent and 32.66 percent of the plots were located on flat, gentle slopes and steep slopes and mountainous, respectively. The average time required to travel from the dwelling of the households to the plots was 30.17 walking minutes (36.6 minutes for program participant and 42 .26 minutes for non-participant households). There was statistically significant difference between the two groups in terms of plot distance (minutes) within a given household with significant mean difference at 1 percent significance level.

Table 4: Socio-economic characteristics of sample households

| Variables | Total sample (N=346) | | Used N=223) | | Non-used (N=123) | | t-value |
|---|---|---|---|---|---|---|---|
| | Mean | STD | Mean | STD | Mean | STD | |
| Land holding (ha) | 0.57 | 0.014 | 0.54 | 0.02 | 0.62 | 0.03 | 2.38* |
| Plot distance (minutes) | 30.17 | 0.69 | 28.01 | 0.64 | 34.11 | 1.51 | 42.26*** |
| Oxen owned | 1.26 | 0.04 | 1.29 | 0.05 | 1.21 | 0.07 | 12.92*** |
| Livestock (TLU) | 6.39 | 0.15 | 6.81 | 0.19 | 5.65 | 0.22 | 40.11*** |

***, *, Statistically significant at 1 %, and 10% probability level, respectively

## 3.3. Analysis of household income

The sources of income for sample households come from both farm and non-farm activities. Farm income consists from sales of fruit & vegetation, sales of livestock and livestock products and sales of cash crop such as *khat* and coffee. However, there are also other sources of cash income for the households to support their livelihood though it is a limited amount. Generally, when we look at the structure of the household income for the surveyed household's, all of the respondents earn income from non -farming activities such as selling of fire wood and charcoal, trade, labour hire- out and transportation (cart). The majority of the people in study areas support their life by selling wood and charcoal.

Table 5: Sources of income (Birr) for the sample household heads

| Variables | Total sample (N=346) | | Used N=223) | | Non-used (N=123) | | t-value |
|---|---|---|---|---|---|---|---|
| | Mean | STD | Mean | STD | Mean | STD | |
| Trade | 88.62 | 64.52 | 198.11 | 82.66 | 172.13 | 103.25 | 1.512 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Selling Fire &Charcoal | 3871.94 | 169.45 | 4379.09 | 241.13 | 2990.65 | 173.34 | 22.66*** |
| Labour Hire Out | 289.52 | 42.26 | 432.55 | 62.09 | 40.98 | 31.12 | 7.48*** |
| Transportation (cart) | 32.63 | 12.82 | 34.91 | 16.46 | 28.68 | 20.41 | 2.49* |
| Fruit &Vegetation | 2046.25 | 118.45 | 2112.5 | 157.32 | 1931.14 | 174.73 | 17.48*** |
| *khat* | 3023.35 | 171.16 | 2617.45 | 204.77 | 3728.68 | 295.27 | 17.77*** |
| Coffee | 4263.56 | 180.03 | 4581.27 | 219.34 | 3711.47 | 307.3 | 24.05** |
| Remittance | 971.55 | 140.41 | 589.62 | 102.53 | 1635.24 | 333.08 | 4.99** |
| Livestock | 10195.54 | 311.37 | 10570.57 | 381.72 | 9543.85 | 532.38 | 33.07*** |

***, ** and * means significant at the 1% 5% and 10%probability levels, respectively

## 3.4. Institutional support services

Out of the total household surveyed about 41.33 % of farmers had contact with extension agents. There was statistically significant difference between the participants and non-participants households in terms of extension contact. On the other hand, among the respondents 18.79% have got trainings on soil and water conservation measures. There was no statistically significant difference between the participants and non-participants households in terms of got trainings on soil and water conservation measures. Among the respondents only 36.7% of the households reported to have access to credit service. Moreover, 71.7% of the respondents indicated that household heads or family members engaged in safety net program. There is a statistically significant difference between the participants and non-participants household heads with respect to the variables contact with extension agent, access to credit service and household heads or family members engaged in safety net program.

Table 6: Institutional characteristics of sample households

| No | Variable | Total sample (N=346) | | Used N=223) | | Non-used (N=123) | | $\chi^2$ |
|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | n | % | |
| 1 | EXTEN | | | | | | | |
| | Yes | 143 | 41.33 | 97 | 43.5 | 46 | 37.4 | 14.169*** |
| | No | 203 | 58.67 | 126 | 56.5 | 77 | 62.6 | |
| 2 | Training | | | | | | | |
| | Yes | 65 | 18.79 | 43 | 19.3 | 22 | 17.9 | 1.105 |
| | No | 281 | 81.21 | 180 | 80.7 | 101 | 82.1 | |
| 3 | CREDIT | | | | | | | |
| | Yes | 127 | 36.7 | 92 | 41.3 | 35 | 28.5 | 19.092*** |
| | No | 219 | 63.3 | 131 | 58.7 | 88 | 71.5 | |
| 4 | SAFTNET | | | | | | | |
| | Yes | 248 | 71.7 | 172 | 77.1 | 76 | 61.8 | 9.191** |
| | No | 98 | 28.3 | 51 | 22.9 | 47 | 38.2 | |

EXTEN = access to extension sevice, CREDIT= access to credit and SAFTNET= household heads or family members engaged in safety net program

***, **, Statistically significant at 1 %, and 5 % probability level, respectively

## 3.5. Practices on Rehabilitation of degraded land

The sample households indicated that used conservation measures in their farm plots and common land for the purpose of conserving soil and water. The sample households (64.45%) indicated that used conservation measures in their farm plots for the purpose of conserving soil and water. Various major soil and water conservation practices (*traditional* and improved) have been identified by the local development agent in the study area within the previous five years. Before the intervention through the Productive Safety Net Program (PSNP), farmers in the area were exclusively practicing in traditional ways.

Farmers in the study area have been participating in physical (but not actively participate in biological) methods of soil and water conservation practices, such as stone bund, soil bund, hill side terrace, closure of farm land, and organic manure. Field observation showed that much of the soil conservation structures that were constructed in both cultivated and uncultivated land were mostly destructed partially or totally. Most farmers did not maintain and did not use the structure on sustainable bases. The causes that

identified for the destruction of improved soil conservation structure were poor quality during construction, inconveniency or difficulty during ploughing and farmers consider soil conservation activities as a means of income source.

Hillside terraces, area closure, gully treatment, water harvesting structures, soil bund, stone bund, and organic manure were the main interventions of the soil and water conservation activities in the area. Of these, the most widely and intensively used improved soil and water conservation measures by the participants were soil bund, stone bund, area closure and organic manure. As well, majority (56.05 %) of these households adopted stone bunds and soil bound (21.08 %). Participates were using a single conservation strategy as well as combinations of two and more conservation strategies on their plots.

Table 7: Improved soil and water conservation technologies used by participants

| SWC technologies | Number of household heads (%) |
|---|---|
| Soil bound | 47 (21.08) |
| Stone bound | 125 (56.05) |
| Organic manure | 16 (7.18) |
| Area closing | 35 (15.69) |

Some farmers were agreed that if conservation measures cannot be taken, there is a reduction in crop production and soil productivity, and loss of farmland and degradation will be aggravated. According to focus group, there should be active community participation and farmers should focus on long term benefits than short term benefits to sustainably fix land degradation. In order to control land degradation problem, different measures has been introduced with the aims of improving the livelihood of farmers, including combating resource degradation, and rehabilitating the degraded area. About 56.57% of the respondents agreed to control land degradation problem.

Table 8: households' response on their level of actively participation agreement in communal level

| level of agreement | Number of household heads (%) |
|---|---|
| Agree | 198(56.57) |
| Disagree | 152(43.43) |

## 3.6. Determinants of households to participate in integrated rehabilitation of degraded land activities in the study area

In this part the results of factors that affect the level of participation of households in integrated rehabilitation of degraded farm land and as well as communal land sustainable resource management in the study area. The results obtained in the previous analysis to examine whether the participation affected at predicted level, and to screen out the most significant predictors of participation. The logit model was employed to analysis the significant explanatory variables. Before running the econometric model, the independent variables were tested for the presence of multicollinearity. The value for Contingency Coefficient(CC) for the dummy variables were less than 0.75 and the value of Variance Inflation Factor (VIF) for the continuous variables were less than 10; which are obviously the indicators for the absence of multicollinearity. Correlation analysis showed that only variables suffered from significant multi-collinearity among the set of discrete predictor variables chosen for regression analysis at 5% confidence interval. The analysis omitted the variable of perception for degraded land because of collinearity problem.

Table 9: Result of logit model

| Variable | Coefficient. | Std. Err. | Z | Sig .level | Odds ratio |
|---|---|---|---|---|---|
| CONS | -4.513593 | 1.122891 | -4.02 | 0.000*** | 0.010959 |
| SEXHH | 0.567306 | 0.3318452 | 1.83 | 0.068* | 0.1159725 |
| ONFAINCOM | 0.1775509 | 0.0331191 | 4.95 | 0.000*** | 1.194289 |
| EDUHH | 0.7661104 | 0.3938734 | 2.08 | 0.037** | 2.151382 |
| FAMSIHH | 0.276602 | 0.0816404 | 3.25 | 0.001*** | 1.318641 |
| LABFOR | 5.884636 | 2.768154 | 2.23 | 0.026** | 359.472 |
| PLOTSZ | -0.9205895 | 1.038193 | -0.88 | 0.376 | 0.398284 |

| | | | | | |
|---|---|---|---|---|---|
| TLU | -0.1391012 | 0.059126 | -2.21 | 0.027** | 0.87014 |
| OFINCOM | -0.1240446 | 0.0246645 | -4.95 | 0.000*** | 0.883341 |
| SAFNET | 2.198535 | 0.7761986 | 2.83 | 0.005*** | 9.011798 |
| DIMKT | -0.0006856 | 0.0022553 | -0.29 | 0.769 | 0.999315 |
| EXTECON | 0.7889877 | 0.3411195 | 2.4 | 0.016** | 0.454305 |
| ACCECRED | 1.085281 | 0.4372311 | 2.37 | 0.018** | 2.960271 |
| IRRG | -0.0132709 | 0.2929323 | -0.05 | 0.964 | 0.986817 |
| LR $chi^2(12)$ | | = 137.14 | | | |
| Prob > $chi^2$ | | = 0.0000 | | | |
| Log likelihood | | = -166.02989 | | | |
| Pseudo $R^2$ | | = 0.2923 | | | |
| Number of Obs | | = 346 | | | |

Note: ***, ** and * = Significant at 1%, 5% and 10%probability levels respectively

Sex of the household head (SEXHH):- the result of the model showed that Sex of the household head affected the participation in soil and water rehabilitation practices positively and significantly at 10 % significant level. Male headed households have better access to information and labor required to implement soil and water rehabilitation technologies than female headed households. The result is in agreement with the findings of earlier researchers of [19]. The results of the odd ratio 0.1159725 indicates that, holding other variables constant, the odd ratio in favor of households to participate in rehabilitation of degraded farm land communal activities increases by factor of 0.1159725 as on sex of sampled household increases by one birr.

Level of on farm income (INCOME): Respondents are getting their incomes from different on farm activities, such as fruit, vegetation, coffee, chat and livestock income sources. The model output also supports the hypothesis and showed that income has affected the participation of households in rehabilitation activities positively and significantly at 1% significant level. The earlier findings [20] have also indicated that on farm income activities positive and significant influence on rehabilitation activities. Therefore, the variable of income has been a positive and significant relationship with the dependent variable that is farmers' participation in rehabilitation activities. The odd ratio of 1.33189 indicates, other thing being constant, the odd ratio in favor of households to participate in rehabilitation activities increases by factor of 1.33189 as on farm income of sampled household increases by one birr.

Education level (EDUHH): educated households that increases their understanding of knowledge and skill of the surrounding environments. The model output also reveals that education is positively and significantly related with the dependent variable at 5% significant level. Similar results also reported by [20-22] indicated that education levels have a bearing on household's access to improved farm techniques and effective use of information available on technologies. The odd ratio of 2.23 indicates that, under constant condition, the odd ratio in favor of households to participate in rehabilitation activities increases by a factor of 2.23 as the education status of household head increases by one year of schooling.

Access to Extension Contacts (EXTCON): As indicated that access to extension contact activities has a positive and significant influence on household heads active participation and contributes for rehabilitation activities has positive and significant effect at 1 % significant level. The possible explanation for these is households who get extension message in rehabilitation of degraded land from development agent will be more encouraged to use SWC practice on their farm plots and environment. Similarly, [21, 23, 20] reported the same results that households with access to extension services and information have better understanding of the land degradation problem and soil conservation practices. The odds ratio of 5.153019 indicates that under constant assumption, the odd ratio in favor of farmers to participate in rehabilitation activities increases by a factor of 5.153019 as member of a household contact with extension agents.

Family size (FAMSIHH): The result showed that family size has positively and significantly relation to the households to participate in rehabilitation activities at 1 % significant level. Rehabilitation of degraded land activities are labor intensive activities. The existence of large numbers of family members increases availability of long-run labor farces that leads to control land degradation through integrated soil and water practices. Similar results also reported by [24-27]. The odds ratio of 1.318641 indicates that under constant assumption the odd ratio in favor of households to participate in rehabilitation activities increases by factor of 1.318641 as the number of family member increases by one unit.

Economically active Labor force (LABFOR): The result showed that economically active labor force has positively and significantly related to the households to participate in rehabilitation activities at 5 % significant level. This is because families with relatively high active labor forces are highly active to participate in rehabilitation activities. The earlier findings of [27-29] also confirmed that economically active labor force is considered as availability of labor force, which makes participate in rehabilitation of degraded land technologies more feasible. The odds ratio of 73.38479 indicates that under all other things constant, the odd ratio in favor of households to participate in rehabilitation activities increases by factor of 73.38479 as the number of family member of economically active labor force increases by one unit.

Off-farming income activities (OFFINCOM): the result of the model showed that off-farming income has a negative influence on the probability of actively to participate in the rehabilitation of degraded land strategy and was significant at 1% significant level. The result implies that in the study area there is scarcity of farm land due to large population and unsuitable area for farming land. The earlier findings [28, 29] have also indicated that Off-farming income activities negative and significant influence on rehabilitation activities. As a reason most households and their families participate in off-farming activities specially collecting of fire wood and charcoal for selling and labor here out to generate their subsistence income. One household head or family members participate in off- farming activities, they have no time to participate in rehabilitation activities. The odd ratio of 0.883138 indicates, other thing being constant, the odd ratio in favor of farmers to participate in rehabilitation activities decreases by factor of 0.883138 as off- farm income of sampled household increases by one birr.

Tropical livestock unit (TLU): the result of the model showed that Tropical livestock unit has been found to relate to the probability of participate in the rehabilitation activities negatively and significantly at 1% probability level. In the study area, most farmers gave more attention for their livestock feeding moves from places to places than rehabilitation of their environment. The numbers of livestock holding in tropical livestock unit increase the level of farmer's participation in rehabilitation activities decrease. The earlier findings of [25] also showed negative relationship between tropical livestock unit and participation in community based rehabilitation practices. The odds ratio of 0.663774 for livestock holdings indicates that other thing being constant, the odd ratio in favor of households to participate in rehabilitation activities decreases by a factor of 0.663774 as livestock holding increases by one unit.

Access to credit service (ACCECRED): As indicated that access to credit service has a positive and significant influence on household heads to participate in integrated soil and water rehabilitation activities. Access to credit service has a positively and significant effect at 5 % significant level. Similarly, [23, 28] reported the same results that households with access to credit services and information have better investment in soil conservation practices. The odds ratio of 2.21338 for availability credit service implies that, other things being constant, the odd ratio in favor of farmers to participate in rehabilitation activities increases by a factor of 2.21338 as credit access increases by one unit

Safety net program (SAFET): the variable safety net program, household head or whose family engaged in safety net program expected to have a positive and significant influence on community based rehabilitation of degraded land. As the model result showed that household head engaged in safety net program that influenced their participation positively and significantly at 10 % significant level. The possible reason for this may be household head or whose family members participate in safety net program activities that the household income highly increased. Safety net Program to provide households has enough income to protect their assets from depletion, to build community assets to contribute to addressing root causes of food insecurity and reduction in environmental degradation. Earlier studies of [30] support this finding. The odds ratio of 1.543549 for household head or whose family members engaged in safety net program implies that, other things being constant, the odd ratio in favor of farmers to participate in rehabilitation activities increases by a factor of 1.543549 as household head or whose family members engaged in safety net program increases by one unit

## 4. Conclusions

The study was conducted in Dire Dawa Administration rural kebeles with the emphasis of determinants of households' participation in degraded land rehabilitation at plot land and communal level around Dire-Dawa city administration. Based on the analysis we can summarize that all sampled farmers in the study area perceived about the causes and consequences of land degradation. They agreed rapid population growth is the major causes of land degradation and they led to deforestation and of soil erosion. They also perceived that decline in agricultural product, poverty, landlessness; drought, famine, desertification are some of the consequences of land degradation. They are aware of the different practices of the soil and water conservations and

means of replenishing soil fertility like organic manure, terracing, area closures, forestations and reforestations. And they have strong perception about the problems of land degradation can be controlled. Even though most of them are illiterate, their perception is appreciable.

The result of logit model procedure was employed to analyses the determinants of household's participation in rehabilitation of degraded land activities. Results from the logit model showed that total livestock unit and off-farm activities negatively and significantly related to the probability of the household to participate in rehabilitation of degraded land. On the other hand, sex of household head, on-farm income, education level of household head, family size, economically active labor force, and access to credit, extension service and safety net program were positively and significantly related to the probability of the households to participate in rehabilitation of degraded land

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