Women's Response Methods to the Consequences of Climate Change – A Survey Study in Dubti, Afar, Ethiopia

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Abstract

The majority Ethiopian women are largely engaged in the agricultural sector, which is highly vulnerable to climate changes. This study, aims at analyzing the determinants of women's response measures of climate change in the Dubti Woreda. This article designed as a cross-sectional research design and employed qualitative and quantitative research approaches. Data was obtained from primary and secondary sources. Moreover, both the probability and non probability sampling techniques were employed. Accordingly, this article found that five major response mechanism to the consequence of climate change. The result from the binary logistic model reveals that age, access to training, farming experience, access to credit service, radio and mobile services determines women's response methods to the consequence of climate changes. Finally, the article recommends for greater investment in women education and training to address the above mentioned challenges.

Keywords: Climate change, Response Strategy, Binary Logistic Regression Model.

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INTRODUCTION

Background of the Study

The impact of climate change is increasing from time to time. Climate change causes for floods, droughts, cyclones and desertification processes and this put the population of the world, especially developing countries at high risk and can undermine the development efforts to reduce poverty (Anne, 2009).

The poor are the most vulnerable to climate change and women are among the greatest number share of the poor, because women constitute more than 70% of the overall worldwide population living below the poverty line, and this implies how many women are more vulnerable to the effects of climate change compared to other groups (**Ulrike, 2006).**

Societies have a long evidence of adapting to the consequence of climate change through different sorts of practice, such as crop diversification, irrigation, water management, disaster risk management, and insurance, but climate change adversely attacks these coping mechanisms due to drought, heat waves and hurricane intensity (Adger, *et al*., 2007).

Nhemachena and Hassan (2007) identified the important determinants of response to climate change in South Africa, Zambia and Zimbabwe to be access to credit and extension, and also women's consciousness about climate change, as such, that the study suggested enhancing access to credit and information about climate and agronomy so as to boost women's response to the consequence of climate change.

Ethiopia's overall vulnerability to climate change was ranked 10th of 233 countries (Center for Global Development (CGD), 2012) and climate change are considered a significant threat to the development of the country (ACCRA, 2011). As a result, Ethiopia's development and growth potential have been held back by climate variability, uncertainty and change (Dinku et al., 2011).

To this end, the article deems that, the present Ethiopian government has been drafting policies and strategies and applying a lot of response mechanisms to tackle the impact of climate change. However, the policies and strategies and these response mechanisms are not gender sensitive which means does not recognize the role of women in the environmental protection process.

Statement of the Problem

Climate change has gender-specific implications in terms of response and there are structural differences between men and women through, for example, gender-specific roles in society, work and domestic life (Cutter, 1995; Denton, 2002; Enarson, 2002). These differences affect the decision of women to give response to the consequence of climate change (Dankelman, 2002).

Response strategies are uneven across and within societies. In relation to this, there are individuals and groups within all societies that have an insufficient decision to response of climate change, for example, in most African countries women in subsistence farming communities are disproportionately burdened with the costs of recovery and coping with drought (Adger, *et al*., 2007).

The decision to response is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology (Ibid).

Furthermore, women in Sub-Saharan Africa have lower levels of education; they have smaller farms, less access to markets, credit and other inputs which also might be a factor limiting their response strategies to the consequence of climate change (Blackden and Wodon, 2006).

In recent times, a significant number of people in Ethiopia are being affected chronically by drought and/or flooding, leading to the deaths of people and loss of assets and this problem is very serious in the arid and semi-arid areas (Yohannes & Mebratu, 2009).

According the data of the Woreda Dubti is one of the arid and partially drought affected areas. As a result, the livelihoods of several women are endangered and limited their decisions to employ response strategies to climate change due to lack of rainfall and other climatic change problem. Though, there is insufficient of empirical analysis carried out to elucidate the specific factors that influence women's decision to adopt response strategies to climate change. Therefore, the general objective of this article is to examine the determinant factors of women's response strategies to climate change in Dubti Woreda, Ethiopia. More specifically, this article has two research questions:

- What are the existing women response strategies to the consequence of climate change?
- What are the factors that affect women response strategies to the consequence of climate change?

RESEARCH METHODOLOGY
Description of the Study Area

Dubti is one of the Woredas in the Afar Region of Ethiopia. Part of the Administrative Zone 1, Dubti is bordered on the south by the Somali Region, on the southwest by Mille, on the west by Chifra, on the northwest by the Administrative Zone 4, on the north by Kori, on the northeast by Elidar, on the east by Asayita, and on the southeast by Afambo. Towns in Dubti include Dubti, Logiya, and Semera.

The average elevation in this woreda is 503 meters above sea level; the highest point in Dubti is Mount Manda Hararo 600 meters (Hailu Ejara, 2008). Rivers include the Awash River, which splits the Woreda into northern and southern parts, and its tributary the Logiya. Alongside the Awash are the Dubti Marshes, which cover an area 34 by 12 kilometers, and whose dominant vegetation is *Phragmites* (Robert Mepham, R. H. Hughes, and J. S. Hughes, 1992). These marshes are under encroachment by the Tendaho Cotton Plantation, whose fields surround the town of Dubti. As of 2008, Dubti has 314 kilometers of all-weather gravel road; about 22.33% of the total population has access to drinking water (Hailu Ejara, 2008).

Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this Woreda has a total population of 65,342, of whom 34,893 are men and 30,449 women; 32,940 or 50.41% are urban inhabitants; 88.01% of the population were Muslim, and 11.46% were Orthodox Christians (Afar Census, 2007). A sample enumeration performed by the CSA in 2001 interviewed 1676 farmers in this woreda, who held an average of 0.72 hectares of land. Of the 1.21 square kilometers of private land surveyed, 28.15% were under cultivation, 64.53% fallow, 3.46% was devoted to other uses (AgSE, 2007). For the land under cultivation in this woreda, 27.9% in planted in cereals like maize; none of the land was planted in pulses and vegetables. All of the farmers reporting only raised livestock. For land tenure in this woreda, 94% own their land; (Ibid).

Figure 1: Location of Dubti Woreda, Afar

Source: Dubti weather forecast.com, (2017)

Research Design

This article designed as a cross-sectional research design and survey study. This is because the cross-sectional research design allows data to be collected at one point in time (Mbwambo, 2007). The design also has a greater degree of accuracy in social science studies than other design (Casley and Kumar, 1998).

Research Approach

This article employed qualitative and quantitative research approaches. Qualitative approaches to research are concerned with the subjective assessment of attitudes, opinion and behaviour while quantitative research is based on the measurement of quantity or amount which is applicable to phenomena that can be expressed in terms of quantity (Kothari, 2004).

Data Types and Sources

As a way to collect a reliable and relevant data the researcher has employed both primary and secondary sources of data. Accordingly, primary data were collected from women residing in Dubti Woreda and from Kebelle chairpersons as the main source of data. Moreover, the article has also employed secondary sources of data in order to triangulate the primary data analysis.

Sampling Techniques

There are 3 Kebelles in Dubti Woreda. Therefore, the researcher selected two Kebelles by employing a non-probability sampling particularly a purposive sampling. The main reason for the researcher to select the two Kebelles is the degree of vulnerability to climate change, drought and the presence of a large number of women. The women who are living in the selected Kebelles are the target population of the article and for particular selection the article employed a probability sampling design. More specifically, the article employed systematic random sampling. Wherein, the researcher initially obtained the whole list of women from the Woreda administration and then selected the samples using the nth interval, in which the first unit of the sample selected at random and the subsequent units are selected in a systematic way.

For the selection of key informants a judgmental (non-probability) sampling method was employed. In this regard, the specific individuals considered as key informants in the study were selected by the researcher because the researcher believes that these informants are well experienced and can give detailed information.

Regarding the quantitative data collection, the article employed the formula provided by Yamane (1967) as simplified formula to calculate sample sizes and to minimize sampling error. This formula considers a 95% confidence level and ±8% precision to calculate the sample size.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n= is the sample size,

N= is the population size, and

e= is the level of precision.

$$n = \frac{224}{1 + 224(0.08)^2}$$

$$n = \frac{224}{1 + 224(0.0064)}$$

$$n = \underline{\mathbf{92}}$$

Therefore, the 92 women were the sample size of this article. Hence, the article used the proportional allocation of respondents for each selected Kebelles.

Table 1. Sampled Kebelles, Number of women and Sample Size

Number	Name of Kebelles	Number of women	Number of sample respondents
1	01	130	53
2	03	94	39
Total		224	92

Source: Own Survey, 2017

Data Collection Instruments

There are several ways of collecting appropriate data which differ considerably in the context of money costs, time and other resources at the disposal of the researcher Kothari (2004). Accordingly, the article has employed structured questionnaire, key informant interviews and focus group discussion (Conducted with two groups and consists 7 members in each group) as data collection methods.

Methods of Data processing and Analysis

Generally speaking, descriptive statistics and econometric model were used to analyze the collected data.

Descriptive statistics

In analyzing the data, the article employed both qualitative and quantitative data analysis techniques. The collected data through various sources were analyzed systematically in order to increase their reliability, credibility and validity. As a result, the qualitative data were analyzed by making use of descriptions, interpretations and more importantly by making summarization of the data. The quantitative data were also analyzed by using descriptive statistical tools such as (the percentages, table and bar graph) to characterize various response measures being adopted by women and Statistical Package for Social Science (SPSS) version 20.0 was also employed as the tool of analysis.

Econometric Model

An econometric model was used to identify the major response determinant factors to climate change. The assumption behind the econometric model is that women's decision on adopting of any response strategies is influenced by a variety of socioeconomic factors. Models normally used for examining relationships between qualitative dependent variables and mixed independent variables are qualitative response regression models. In this regard, linear probability, logit and probit models are the possible alternatives. Linear probability model (LPM), however, it has a number of shortcomings. For such reasons, the linear model is becoming less frequently used except as a basis for comparison to some other more appropriate models (Green, 2003). Logistic models guarantee the estimated probability increases and never cross the range of 0 to 1, and are the most commonly and widely applied qualitative response models. Therefore, Linear Probability Model (LPM) and probit models were rejected in favour of a logit model formulation (Gujarati, 2003).

In addition, under such kind of condition and binary logistic regression model would be preferred to binary probit regression since its coefficients are comparatively simple to interpret and this would be important to analyze the effect of the predictor variables on the predicted variable.

Because of the nature of the study, women were not provided with different response options for a single or rank choice, rather they were asked with open-ended questions, to report response strategy(s) they employed in 2009 E.C in response to the consequence of climate change. The researcher found out that numerous response methods adopted simultaneously by a single respondent.

Specification of Binary Logistic Model

A binary logistic model specification is employed to model climate change response strategies of women involving dummy dependent variables with binary choices. According to Gujarati (2003), the logistic distribution function for the decision on adopting of response measures to climate change can be stated as:

$$P_i = \left(\frac{1}{1 + e^{-z(i)}} \right) \quad\text{... (1)}$$

Where $P(i)$ is a probability of deciding to adopt an response strategies for i^{th} women and $Z(i)$ is a function of M explanatory variables (X_i) and $Z(i)$ is expressed as;

$$Z(i) = B_0 + B_1 X_1 + B_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + B_m X_m \ldots\ldots \text{ (2)}$$

Where, B_0 is the intercept and B_i are the slope parameter in the intercept model

$$\text{But } (1 - P_i) = \left(\frac{1}{1 + e^{-z(i)}} \right) \quad\text{... (3)}$$

$$\text{Therefore, } \left(\frac{P_i}{1 - P_i} \right) = \left(\frac{1 + e^{z(i)}}{1 + e^{-z(i)}} \right) = e^{Z_i} \quad\text{.............................. (4)}$$

$$\left(\frac{Pi}{1-Pi}\right) = \left(\frac{1+e^{z(i)}}{1+e^{-z(i)}}\right) = e^{Zi} = e^{\beta_0} + \sum_{i}^{m} = 1 \; \beta_i \, Y_i \; \dots\dots\dots\dots\dots \; (5)$$

Taking the natural logarithms of the odds ratio of the equation (5) will result in what is called the logistic model as indicated below.

$$\text{In} \left(\frac{Pi}{1-Pi}\right) = \text{In} \left(e^{\beta_0} + \sum_{i}^{m} = 1 \; \beta_i \, Y_i\right) = Z \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \; (6)$$

If the disturbance term U_i is taken into account the logistic model becomes;

$$Z_i = \beta_0 + \sum \beta_i \, X_i + U_i \; \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \; (7)$$

As a result, the specification of the model is described below:

$$P_i = F(Y_i) = F\left[\beta_0 + \sum_{i=1}^{n} \beta_i X_i\right] = \left[\frac{1}{1 + e^{-(\beta_0 + \sum \beta_i X_i)}}\right] = \left[\frac{e^{Yi}}{1 + e^{Yi}}\right] \; \dots\dots \; (9)$$

Where: P_i = the probability i^{th}, X_i variables
          F = the cumulative distribution function [   ]
          X_i = the predictor variables, i = 1, 2, 3 …   n $F(u_i) = \dfrac{e^{u_i}}{1 + e^{u_i}}$
          Y_i = a linear function of n predictor variables ($\beta_0 + \beta_i X_i$)
          e = the base of natural logarithms (e= 2.718)
          β_0 and β_i are regression parameters will be estimated, where β_0 is an intercept and β_i are the slope coefficients of the predictor variables.

Description of the Model Variables for Binary Logistic Model
The dependent variable of the model: response strategy is a dependent dummy-variable in the data. The dummy was determined by assigning a value of 1 for women who indicated that they had adopted response measures to climate change and a value of 0 for women who indicated they did not adopt any response measures at all to climate change. For example, if a woman adopted at least one coping strategy to adopt climate change, then that woman is considered to have "adapted" (1). During the enumeration of the survey, respondents were presented with a scripted explanation of practices and behaviours vis-à-vis climate change response strategies, then presented with a simple dichotomy ("yes/no" response) question about whether or not they had adopted any of these behaviours due to changing climate in the region, making results here self-reported.

      The explanatory/ independent variables: The independent variables that are hypothesised to affect the women adopted of response strategies are combined effects of various factors such as household characteristics, socioeconomic characteristics and institutional characteristics in which women operate. Based on the review of adopting and response strategy literature, and past research findings 15 potential explanatory variables were considered in this article and examined for their effect in women's adopting of response measures to climate change. The explanatory variables included in the analysis and the hypotheses for each explanatory variable are presented below:

Table2. Explanatory variables included in the analysis

Variables	Variable type and Description	Valued in/as	Expected Sign
1. Age (AGE)	Continuous, Age of the woman in years	Years	Positive (-)
2. Education level of the household heads (EDLEVH)	Categorical, number of years of formal schooling attained by the head of the household:	1= Illiterate 2= Read and Write 3= Grade 1-4 4= Grade 5-8 5= Grade 9-12	Positive (+)
3. Family size (FAMSI)	Continuous, number of family	Number	Cannot be signed priori (+ or -)
4. Access to radio or mobile (ACCRMOB)	Dummy, if the woman has an access to radio or mobile	1=Yes, 0= otherwise	Positive(+)
5. On farm income (ONFARMI)	Continuous, Generating income from on farm activity	ETB (Ethiopian birr)	Positive (+)
6. Access to training (ACCSTRA)	Dummy, obtained training by the woman	1= Yes, 0= otherwise	Positive (+)
7. Saving money (SAVMONY)	Dummy, saving money by the woman Continuous, size of farm owned by the woman	1= Yes, 0= otherwise	Positive (+)
8. Farm size (FARMSZ)		Years	Positive (+)
9. Farming experience (FARMEXP)	Continuous, number of years of farming experience for the woman:	1=Yes, 0= otherwise	Positive (+)
10. Access to credit service (ACCRDS)	Dummy, if a woman is a costumer to credit service from any source.	Kilometers	Positive (+)
11. Distance to main market (DISMMAR)	Continuous, distance between a woman's house and the nearest market.	1= Yes, 0= otherwise	Positive (+)
12. Access to ox plough (ACCOXP)		Number	
13. Livestock ownership (LIVOWNP)	Dummy, if the woman has an access to Ox plough. Continuous, number of livestock possessed by the woman	1= Yes, 0= otherwise	Positive (+)
14. Access to formal/informal groups (ACCFIG)	Dummy, if the woman has an access to radio/mobile.	1= Yes, 0= otherwise	Positive (+)
15. Participation in decision making (ACCDECM)	Dummy, if the woman participated in climate related decision making processes.		

RESULTS AND DISCUSSIONS

Existing Response Strategies of Climate Changes

The poor women can employ different response methods to climate change by changing planting dates; diversifying crops, practicing soil and water conservation measures, planting trees and etc, and this can be possible if government provides them with the necessary support (Gbetibouo, 2009; and Yesuf et al., 2008).

This article was found the respondents employed various response strategies to climate change effects. Accordingly, based on the response of the respondents the researcher has ranked the existing response strategies by using the Likert scale method. Using the Likert scales is the popular methods of collecting data for the survey (Zikmund, 2003).

Finally, a Likert scale was used in this article which asked respondents to best describe which existing response strategies employed in their farmlands in advance as: 1 strongly agree, 2 agree, 3 neutral, 4 disagree and 5 strongly disagree. Therefore, the article analyzed only the five major existing women's response strategies to climate changes based on their rank results.

Figure 2: Existing response methods used by women (N92)
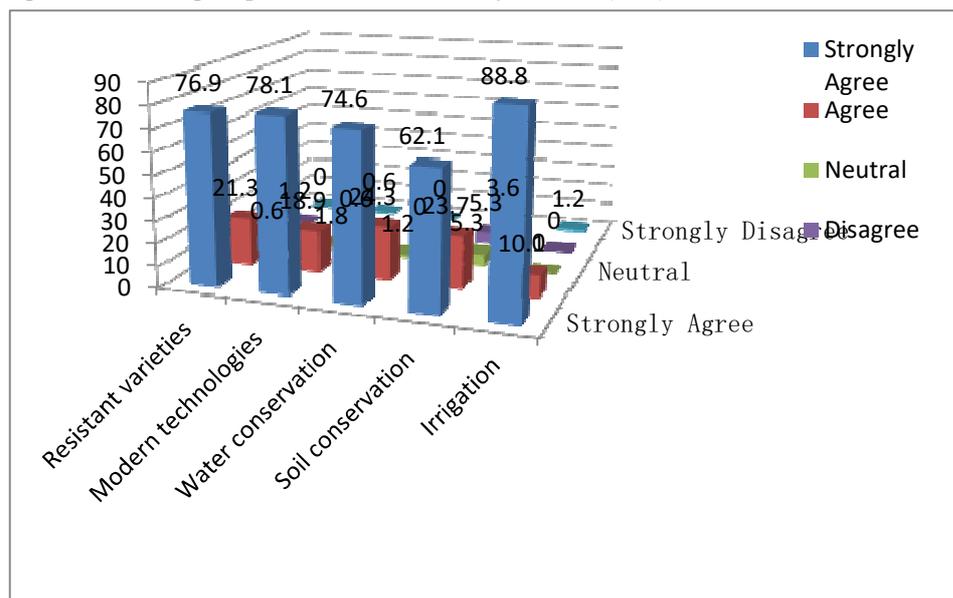
Source: Own survey, 2017

1. Use of Irrigation

As the above figure indicates that the majority respondents, 88.8% from both Kebelles reported that they used frequently in this type of response practice on their farmland. This was also consolidated by the focus group discussions and key informant interviews.

2. Use of Modern Agricultural Technologies

This refers to use of new agricultural technologies such as plant varieties and animal breeds resistant to drought and heat. From the above figure, results show that about 78.1% respondents have strongly agreed. Accordingly, almost all respondents were using modern technology as response strategies to climate change.

3. Use of Drought Resistant Varieties

In confirming the use of drought-resistant varieties in both Kebelles, as stated in the above figure the majority number about 76.9% respondents were strongly agreed in using of drought-resistant varieties.

Furthermore, as the data obtained from focus group discussion women were used drought-resistant varieties in their farmland like Maize, Barley, Potatoes and different local cereals. But, there were different diseases which affected these different varieties. One participant in the focus group discussion consolidated the above finding by saying that:

> "It well knows, during this drought period, we applied different drought resistant crops in our farm land to adapt changes in climate. However, there are several local diseases was an outbreak, which affected these crops. Thus, this led to crop failure in our Kebelle."

Thus, the use of drought resistant varieties as an response strategies are important for women as a source of income during drought time by selling these different drought resistant crops to the market.

4. Water Conservation/Harvesting

Shortage of water is directly affecting women because it is their responsibility to take care of the water needs. Thus, water harvesting methods, including water ponds, hand-dug wells and constructed water storage tanks connected to the roofs of houses are important for women to conserve water.

Thus, according to the above figure implied that 74.6% strongly agreed. The implication of this data is almost all women in both Kebelles were used, these varied water conservation techniques as response strategies to climate changes.

5. Soil Conservation Practices

Soil conservation practices, including terracing, mulching, contour plough and use of organic manner. Terracing is mainly done on the mountain slopes. In addition, mulching is done to maintain moisture in the soil by covering it with grass. As shown in the above Figure, about 62.1% respondents have strongly agreed in the participation of soil conservation practices. However, most respondents have applied frequently terracing (the traditional way). Thus, there is a problem regard to this, they can only use on certain soil types and are not constructed on fields with sandy soils.

Determinants of Women's Response Strategies

In general, women's decision behaviors to the different response strategies to climate change effects, especially in low-income countries, is influenced by a complex set of socioeconomic, demographic, technical, institutional

and biophysical factors (Feder et. al, 1985).

To count the impact of various explanatory factors affecting women's adopt of response methods, a binary logistic regression model was used in this article. In the following sub-sections, the results of logistic regression analysis performed to identify determinants of women's adoption of response strategies in the study areas are presented below. The coefficients of logistic regression that tell us about the direction of effect of independent variables are presented below.

Response strategy dummy dependent variable Y = 1 if a respondent reported have adopted response methods to climate change; Y = 0 if a respondent does not. The final model (based on equation 2) having 15 independent variables that fitted to the data are given by

$$logit(p) = \beta o + \beta 1 X1 + \beta 2 X2 + ... + \beta 15 X15$$

Where β0 is constant; $X1$ is respondent age; $X2$ is respondent education; $X3$ is total family size; $X4$ is access to training; $X5$ is farm size; $X6$ is farm experience; $X7$ is saving money; $X8$ is on farm income (in quintal); $X9$ is access to credit service; $X10$ is distance to the main market; $X11$ is access to radio or mobile; $X12$ is access to oxen plough; $X13$ is livestock ownership in number, X14 is access to formal or informal group and $X15$ access to decision-making.

The outcome in table 3 below presents logistic estimates of the determinants of women's response strategies to climate change. The probability of the model *Wald chi-square* (X^2 (15) = 143.373 df = 18, at p-value 0.000) less than the level of significant at 0.01 (i.e. P<0.001) suggesting that there was a significant association between observed individual household variables related to adopting response strategies and model prediction. The p-value=0.001 implying a well-fitting model is significant at the 1% level, hence, our p-value is in the acceptable value signifying a good fit i.e., the model is accurate. The main coefficients showed that significantly effect at 95% and 90% confidence intervals. And also the strength of the model was tested using Cox and Snell 0.572 and Nagelkerke 0.769 suggesting that between 57.2% and 76.9% is explained by the set of variables used in the model and also correctly classified 87.0% of cases.

A logistic regression was performed to ascertain the effects of the 15 variables considered in the model, five were found to have a significant impact in determining adoption of response strategies to climate change and the finding is consistent with other findings. The logistic regression coefficients give the change in the log odds of the outcome of a one-unit increase in the predictor variable. Thus, analyses of specific statistically significant explanatory variables are discussed below;

Table 3 Odds ratio from binary logit model determinants to adopt response strategies

Variables	Coef. (β)	Std. Err. (β)	P-value	Odds Ratios = Exp(β)	95% Conf. Interval	
AGE	**0.151*** **	**0.043**	**0.000**	**1.163**	**1.069**	**1.264**
EDLEH(cat)			0.571			
EDLEH(1)	1.705	1.011	0.092	5.503	0.758	39.937
EDLEH(2)	0.912	1.259	0.469	2.488	0.211	29.321
EDLEH(3)	0.241	1.555	0.877	1.273	0.060	26.798
EDLEH(4)	18.86970	40192.970	1.000	156589171.684	0.000	.
FAMSZ	0.088	0.171	0.608	1.091	0.781	1.525
ACCTRA	**6.509*** **	**1.310**	**0.000**	**671.430**	**51.551**	**8745.123**
FARMSZ	0.371	0.755	0.624	1.449	0.330	6.364
FARMEXP	**0.095** **	**0.047**	**0.045**	**1.099**	**1.002**	**1.206**
SAVMONY	-0.886	0.669	0.185	0.412	0.111	1.530
ONFARMI	0.015	0.121	0.903	1.015	0.800	1.287
ACCRDS	**1.774** **	**0.704**	**0.012**	**5.896**	**1.483**	**23.438**
DISMMAR	-0.195	0.152	0.200	0.823	0.610	1.109
ACCRMOB	**2.825*** **	**0.927**	**0.002**	**16.866**	**2.743**	**103.709**
ACCOXP	0.761	0.881	0.388	2.141	0.381	12.042
LIVOWNP	0.019	0.042	0.659	1.019	0.938	1.107
ACCFIG	0.766	0.983	0.436	2.151	0.314	14.755
ACCDECM	-1.105	0.802	0.168	0.331	0.069	1.594
_CONST	-10.736		2.901	0.000	-7.66	-1.15

Source: own survey, 2017

Note: *** significant at 1% level and ** significant at 5% level respectively;

Observations = 92

Wald chi2 (15) = 143.373

Prob > chi2 = 0.000

Log likelihood = 86.578

Pseudo R2 = Cox and Snell 0.572; Nagelkerke = 0.769

Age

The above table shows that the odds of adopted response strategies (versus not adopted response strategies) are 1.163 times greater for every one unit change in age and the other variables in the model kept constant. Thus, increasing age was associated with an increased likelihood of adopting response strategies.

Likewise, the coefficient of age has a significant and positive correlation with adopting of response strategies to climate change. This indicates a positive relationship between age and the possibility of adopting response methods to climate change. According to the results in table 3 above, one unit of change in the age of respondent significantly increases the probability of adopting response methods to climate change by a factor of 0.151 and significant at the 1 % level (P- value 0.000***).

The reason for this result, older women are more experienced and knowledgeable about past climatic events which mean that they are able to use their past farming experience to outfit the current conditions. This finding is consistent with the FAO, (2005) noted that an adult woman with experience in farming activities was able to adopt different response methods to climate change than younger women with less experience. In addition, the same result was found by (Dolisca et al. 2006), have indicated that age has positive significance in influencing women's to adopt of response measures to climate change effects. Thus, the finding of this study has a consistency with the above findings.

Access to training

According to, the result of the above table shows that the odds of adopted response strategies are 671.430 times higher for having access to training compared to do not have access to training. Other factors remained constant. Thus, having access to training was associated with an increased likelihood of adopting response strategies.

Alike, the coefficient of this variable was found to be a key determinant factor in adopting response strategies to climate change in the two study areas. This indicates there was a positive relationship between access to training and the possibility of adopting response methods to climate change. Accordingly, having access to training significantly increases the probability of adopting response measures to climate change by a factor of 6.509 and significant at the 1% level (P value 0.000***). The possible reason, providing climate-related training for women is very important in developing the capacity to adapt climate changes. For instance, when women generated different training in relation to the mechanisms of response simply they can adopt several response strategies to climate change on their farmland. In addition, this result is similar with UNFPA, 2009; access to training is having a positive and significant relationship with women's response strategies to climate change.

Farming experience in years

As indicated in the above table the odds ratio of adopted response strategies (versus not adopted response strategies) is 1.099 times greater for every one unit change in years of farming experience. Thus, having enough experiences in farming was associated with an increased likelihood of adopting response strategies to climate change.

In regards to the coefficient of this variable, there was a significant and positive relationship found to exist between farming experience in years and adopting response methods to climate change. For instance, the probability of adopting response strategies would increase when the year of farming experience increases. Therefore, the probability coefficient of farming experience in the year was increase by a factor of 0.095 and significant at the 5 % level (P value 0.045**) in the study areas. The possible reason is experienced women are likely to have more information and knowledge on changes in climatic conditions and crop and livestock management practices and other factors held constant.

The results of the article are consistent with those from Maddison (2007) and Nhemachena and Hassan (2007) which also found a positive relationship between years of farming experience and adopt of response measures to climate change. Thus, the researcher concluded that women with greater farming experience are likely to be more aware of past climate events and better judge how to adapt their farming to extreme weather events.

Access to credit service

As pointed out in the above table, the odds ratio of adopted response strategies is 5.896 times higher for having access to credit service opposed to do not have access to credit service. Thus, having access to credit service was associated with an increased likelihood of adopting response strategies to climate change.

Furthermore, the coefficient of this variable has a significant and positive relationship with adopting response measures and found that this was a very important factor in adopting response strategies to climate change effects. Accordingly, as the results indicate in table 3 above, having access to credit service significantly increases the probability of adopting response methods to climate change by a factor of 1.774 and significant at the 5 % level (p-value 0.012**). Other factors remained constant. The reason behind this access to credit is

assumed to be an important factor to introduce new technology, to buy modern crop, fertilizer, oxen etc.

This result was in agreement with the findings of Nhemachena and Hassan (2007), who stated that; women's access to credit services increases their ability to meet transaction costs associated with various adaptive strategies they might want to take like obtaining fertilizers, insecticides which may increase yields and enhance productivity. Additionally, Gbetibouo (2009) suggested that the major factor restraining farmers' response to climate change is inadequate access to credit.

Access to radio or mobile
This is another key determinant factor for adopting response methods to climate change. As depicts in the above table the odds ratio of adopted response strategies is 16.866 times higher for having access to radio or mobile unlike to do not have access to radio or mobile. Thus, having access to radio or mobile has associated with an increased likelihood of adopting response strategies to climate change.

Moreover, in the study areas, access to a radio or a mobile phone was statistically significant and positively correlated with adopting of response techniques to climate change. This indicates that with access to radio or mobile, the probability of women adopting response methods in their farming land increases by a factor of 2.825 compared to these do not have access to radio or mobile and this was significant at the 1% level (p-value 0.002***). Other factors held constant. Because radio or mobile are the best electronic materials for women to get information about what is going on in regards to how to adopt climate change and to transmit meteorological information simply to women about the change in temperature and rainfall. Thus, this is important for women to take necessary measures before and after the change in climate on their farm land in the study areas.

This result is consistent with the findings of UNFPA, (2009) that access to radio or mobile would have important to get early warning and climate relate information which help women to take appropriate actions in a timely manner depending on expected weather conditions. Additionally, the result of Nhemachena and Hassan (2007) come across that access to information about climate change forecasting, response options and other agriculture activities remain important factors determining the use of various climate change response methods.

SUMMARY AND CONCLUSION
The article intends to analyze the determinants of women's strategies to climate change. In order to achieve this general purpose, both quantitative and qualitative data have been used. The article predominantly depends upon survey data, and accordingly data have been collected from women through questionnaire survey in the study areas.

The article reveals that there are different existing response strategies that have been adopted by women in the study areas. These response strategies of climate changes that have used are drought resistant varieties, use of modern technologies, water conservation, soil conservation practices and irrigation. Therefore, the implication of this result ensured that these different response measures have created an opportunity for women to adapt climate change in a better way and minimized the severity of drought in their areas.

Another important issue that this article addressed is assessing the key determinants of women adopting of response strategies to climate changes. To this end, there are 15 independent variables are considered as factors to determine the women's response methods to climate changes. In relation to this, the result of the binary logistic regression shows that from these 15 independent variables this article found that only 5 variables have a positive relationship and statistically significant. These are age, access to training, farming experience, access to credit service and access to radio or mobile of the women; which are significant at the 1% level, 1% level, 5% level, 5%level and 1% level respectively. Therefore, the implication of this data shows that these major independent variables have an influence on the decision of women to use different response methods on their farmland to adapt climate change.

RECOMMENDATION AND POLICY IMPLICATION
In response to the finding of this article, the following recommendations and policy implications are given below:

- The result of this article shows that there are different existing response strategies employed by women in the study areas. However, the adopters believed that the response measures they employed are not enough to reduce the impact of current climate change. Hence, designing policies with the aim of improving these mechanisms will improve farm level response strategies the climate changes. Accordingly, the government should revisit and reform policies regarding the issues so that they become important tools to enhance individual response strategies to climate changes.

- The result of binary logistic model highlights that age, access to training, farming experience, access to credit service and access to radio or mobile are positively and significantly related to women adopting response strategies to climate change. Therefore, the government should design, revisit and reform policies in improving these factors and also non-governmental organizations should be the focus on improving these factors via providing climate-related training and credit service for women in the study

area. In addition, marking and modelling such women is important in promoting, adopting response methods to other women who do not have such experience and are not yet adopting response measures to adapt changing climatic conditions.

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Appendices
Appendix- Tests of Multicollinearity (VIF and CC)
Table 1: Co linearity statistics Variance inflation factor (VIF) for continuous variables

Variable	Tolerance	VIF
Age of household head (Age)	0.763	1.311
Family Size (FAMSI)	0.890	1.124
Farm size (FARMSZ)	0.765	1.308
Farming experience (FARMEXP)	0.788	1.269
On farm income (ONFARMI)	0.915	1.093
Distance to main market (DISMMAR)	0.886	1.128
Livestock ownership (LIVOWNP)	0.853	1.172

Source: Own survey, 2017

Table 2: Contingency Coefficients (CC) for discrete variables

	EDLEH	ACCRMOB	ACCSTRA	SAVMONY	ACCRDS	ACCOXPC	ACCFIG	ACCDECM
EDLEH								
ACCRMOB	.115							
ACCSTRA	.130	.309						
SAVMONY	.252	.186	.285					
ACCRDS	.165	.087	.305	.304				
ACCOXPC	.155	.279	.238	.060	.141			
ACCFIG	.165	.014	.131	.112	.097	.049		
ACCDECM	.244	.134	.250	.248	.089	.105	.357	

Source: Own survey, 2017