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Women's Decision in Agriculture and Climate Change Variables: Implications on Average Seasonal Harvest of Smallholder Corn Farmers

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Abstract:- The effects of climate change on agriculture have long been the subject of several agricultural research. The challenges it brings to agricultural management, decision-making, and adaptability have long been a source of worry. The study sought to connect the average seasonal harvest of smallholder corn farmers in Bansud, Oriental Mindoro, to women's engagement in decision-making activities related to farming and the farmers' degree of awareness of climate change. It was revealed through the use of the descriptive-correlational study technique and the Pearson Product Moment Correlation Coefficient that there is a substantial positive association between the level of women's engagement in decision-making regarding livelihood and climate change adaptation activities and the knowledge of farmers regarding climate change. Furthermore, it was found that women's decision-making participation in agricultural activities and knowledge of climate change are both significantly correlated with the average seasonal harvest of corn, particularly during the dry season, using responses from 59 randomly selected smallholder farmers. Therefore, it is crucial that farmers are informed about climate change and given the capacity to participate in agricultural decision-making. The study also examined the impact of climate variability on farmers' decision-making processes and identified common farmer adaptation strategies for dealing with climate change. The paper gives a clear view of the importance of giving women equal opportunity in agricultural decision making specially on climate change adaptation practices and how this contributes to the average seasonal harvest.

Keywords:- *Women's Participation, Agricultural Decision-Making, Adaptation, Seasonal Harvest, Climate Change.*

I. INTRODUCTION

In addition to altering seasonal patterns and a rise in the frequency of extreme weather events, climate change is predicted to cause rainfall to become more irregular and variable, both in terms of timing and quantity. It is defined as aberrations from the typical condition of the atmosphere brought on by both natural and man-made factors, such as the rotation of the globe, volcanic activity, and crustal movements [1]. As a result, it is generally agreed that agriculture will be significantly impacted by climate change. Because their economies are largely based on weather-sensitive agricultural development systems, many emerging nations are especially vulnerable to climate change [2][3]. However, how effectively farmers adapt to changing climates will decide how much of a disruption there will be [4].

Farmers use aboriginal cultural expertise to predict and forecast weather patterns. Understanding how a new category of climate information could be embraced begins with understanding such conventional knowledge [5]. The most popular cultural environmental markers were beliefs that the color of the sky, the volume and color of cloud formations, and wind directions would predict when the next season would be rainy or dry. The color of the sky is reddish, there are few clouds in the sky, and the wind is flowing from west to east, all of which indicate that the next cropping season will be dry [6]. These has been accepted as one of the many ways farmers predict climate change.

Climate change signs have been reported in different ways by farmers, including a rise in temperature, a reduction in precipitation, and an increase in climate-related diseases and pests for crops used in agriculture which positive correlates to their socio-economic and agricultural characteristics [7]. This seems to confirm that many farmers are aware of climate change and its effect in agriculture, especially the effect of climatic instability but lack knowledge of adaptability [8][9], especially in corn production. Farmers, despite being knowledgeable and practicing adaptation, may not have a comprehensive understanding of climate change and variability [10]. Thus, individual behavioral responses must therefore be taken into account in climate risk studies [11].

Knowledge on adaptability to climate variability is obviously important for farmer to protect and increase their production [12]. Adaptation refers to changes in average climate patterns as a result of actual or predicted climate fluctuations, which may help to mitigate damage and maximize benefits [13]. According to the findings of a quantitative study, farmers who think they should change their activities to shield their farm from the detrimental effects of increased weather fluctuations, as part of adaptation process, are more likely to benefit from their land [14]. According to the econometric model, schooling, family size, gender, age, livestock ownership, farming experience, frequency of communication with extension agents, farm size, access to market, access to climate knowledge, and income were the most important factors influencing farmers' adaptation practices [15].

Adaptation includes decision-making activities. In the past years, it has been observed in the Philippines that majority of the farming decisions were dominated by men or husbands. Document-wise, compared to men, women have lesser access to capital and credit, information, land and other inputs [16]. Many countries' agriculture and rural economies are underperforming, in part because women, who are also a vital resource in agriculture and the rural economy, face constraints that limit their productivity and continuous to be underestimated in many ways [17] [18].

The study determined the relationship of women's level of agricultural decision making participation, farmer's level of understanding of climate change and climate change's influence on farmer's decision making processes to the average seasonal harvest of smallholder corn farmer in Bansud, Philippines. It further described the agro-economic profile and the common climate change adaptation practices of the respondents.

II. LITERATURE REVIEW

A. Climate Change and Small Holders Farming

The effects of climate change are already being felt by the world's smallholder farmers. Despite being a worldwide issue, climate change will have varied consequences in different parts of the world. On the front lines of this catastrophe, which affects every aspect of their daily life, are smallholder farmers [19] [20].

There are five ways that climate change is affecting the livelihoods of these farmers: Higher temperatures result in lower crop yields; more frequent and severe climate change events; the emergence of new and more prevalent plant diseases and pests; decreased livestock production and consequently lower profits; and increased post-harvest crop losses [21]. Climate shocks can increase the risks to smallholder livelihoods by interacting with other stressors such as infectious illnesses, nutritional inadequacies, resource degradation, and unstable land tenure [22].

Smallholder farmers are at serious risk from climate change, which also poses a danger to global efforts toward eradicating poverty, ensuring food security, and fostering sustainable development [20]. Despite mounting evidence of smallholder farmers' susceptibility to climate change and rising interest in maintaining food security in the face of it, adaptation efforts are still constrained by a dearth of knowledge on how smallholder farmers are coping with and adapting to the shift [19].

The dearth of knowledge on how smallholder farmers are coping with and adapting to climate change hinders attempts to help farmer adaptation. More knowledge is required on how various smallholder farmer types perceive and react to climate change differently, as well as how to adapt programs to varied smallholder farmer contexts [19]. Nevertheless, smallholder farmers have a wide range of adaptive abilities, including information, networks, and management techniques that have long helped smallholder systems adjust to environmental and socioeconomic change in response to a changing climate [22].

B. Women on Agriculture

Growing economies and eradicating poverty may both be significantly fueled by agriculture [23]. Although women are frequently a vital resource in agriculture and the rural economy, they frequently face barriers that hinder their productivity. Women make essential contributions to the agricultural and rural economies in all developing countries, but the sector is underperforming in many countries. In developing countries, women make up roughly 43% of the agricultural labor force, although this percentage hides wide variations by age and socioeconomic status between regions and within nations. In many African and Asian nations, the proportion of women working in agriculture is at least 50%, while in some, it is significantly lower [17]. However, these numbers did not speak for the notion that women are the world's primary producers but only claimed to demonstrate the importance of women's role in agriculture [16].

Even while the number of women working in agriculture has decreased, they still make up a sizable share of the industry, and their contributions vary depending on socio-cultural and agricultural production methods [24]. There is no doubt that women significantly contribute to food and agricultural output. However, because agriculture is often a household-wide endeavor and requires a variety of resources and inputs that cannot be easily assigned based on gender, it is challenging to objectively verify the proportion generated by women [25].

III. METHODS

The study utilized descriptive method of research. Mean, percentage and rank were used to describe the variables of the study. To test the magnitude of correlation between and among the indicators, bivariate correlation analysis using Pearson Product Moment Correlation Coefficient was utilized. The study was conducted at Bansud, Oriental Mindoro, Philippines. This is distinguished as one of the top corn producers in the province. The respondents were the fifty-nine (59) farmers randomly selected from the list of smallholder corn farmers provided by the Municipal Agriculture Office. The main instrument of the study is a researcher - structured questionnaire composing of 5 parts covering the indicators of the study. Collection of data were done by enumerators using scheduled household guided survey to ensure that data collected are reliable and accurate. Questionnaires undergone the process of validity and reliability test using Cronbach's Alpha Test Retest reliability.

IV. RESULTS AND DISCUSSION

A. Women's Participation On Farm Decision-Making Activities

Table 1 shows the frequency and percentage distribution of women's extent of participation in farming decision making in terms of livelihood and climate change adaptation activities. Results show that in both livelihood and adaptation activities, women have average participation in decision making with mean of 2.03 and 1.93, respectively. Majority the responses fall under 1.67 – 2.33 described as average participation with 50.85% in livelihood activities and 42.37% in climate change

adaptation activities. It can be noted that women have lower participation in adaptation activities compared to livelihood. This is reflected by the frequency of 14 against 20 with overall percentage of 25.42 described as low participation. On the contrary, almost similar frequencies were recorded for both areas concerning women with high participation in livelihood and adaptation activities with overall percentage of 25.42%
This implies that women generally participate in decision making in some areas of livelihood like general farming activities, alternative sources of income, and procurement of necessary goods and supplies and others. Same can be concluded in terms of climate change adaptation activities. This includes participation in utilization of climate information, and adaptation and mitigation strategies. Overall, with the mean of 1.98, women's participation in farming decision making is described average.

TABLE I. FREQUENCY AND PERCENTAGE DISTRIBUTION OF WOMEN'S EXTENT OF PARTICIPATION IN FARMING DECISION MAKING IN TERMS OF LIVELIHOOD AND CLIMATE CHANGE ADAPTATION ACTIVITIES

Classes	Livelihood activities		Adaptation activities		Overall		
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*	*Description*
2.34 - 3.00	15	25.42	14	23.73	15	25.42	High
1.67 - 2.33	30	50.85	25	42.37	29	49.15	Average
1.00 - 1.66	14	23.73	20	33.90	15	25.42	Low
Mean	2.03		1.93		1.98		
Description	Average		Average		Average		

B. Agro-Economic Profile of Farmers

As shown in Table 2, majority of the farmer-respondents are owners of the land they are farming constituting 52.54% of the total respondents. The remaining 47.46% or 28 out of 59 of the respondents do not own their land. That is, some are tenants, renter or leaser. In terms of topography, majority of the respondents are upland farmers with a total of 37 constituting 62. 71% of the total population. Twenty-four (24) of them owned the land they are farming while 13 do not. However, 22 or 37.29% are lowland farmers, and 15 of them do not own the land.

On economic context, it is shown that corn farmers have better harvest during dry season whether or not they own the land averaging 1791.99 kilograms per hectare compared to 1341.28 during wet season with mean difference of 450.71 kg/ha. It is also notable that farmers who do not own the land tend to harvest a little better on both seasons. Tenants/ renters/ leasers harvest an average of 1355. 46 and 1820.64 during wet and dry season, respectively while land owner farmers harvest only 1327.46 during wet and 1763.33 during dry season.

Same can be viewed if topography is considered. Averaging 1807.37 kg/ha, yield is better during dry season compared to wet season, averaging only 1364.43 kg/ha. Comparing upland and lowland farmers, the latter have better harvest on both seasons. During wet season, lowland farmers gained an average of 1452.99 kg/ha compared to 1275.88 kg/ha of the upland farmers. On the same manner, lowland farmers gained 1868.65 kg/ha and upland farmers have an average harvest of 1746.10 during dry season.

TABLE 2: CROSS TABULATION DESCRIBING THE AGRI-ECONOMIC PROFILE OF CORN FARMERS IN BANSUD, ORIENTAL MINDORO

Indicators		Topography						Average harvest (kg/ha)	
		Upland	*%*	*Low land*	*%*	*Total/ Ave*	*%*	*Wet Season*	*Dry Season*
Type of Land Ownership	Owned	24	40.68	7	11.86	31	52.54	1327.46	1763.33
	Not owned	13	22.03	15	25.42	28	47.46	1355.10	1820.64
	Total/Average	37	62.71	22	37.29	59	100	1341.28	1791.99
Average harvest (kg/ha)	Wet Season	1275.88		1452.99		1364.43			
	Dry Season	1746.10		1868.65		1807.37			

C. Farmers' Understanding of Climate Change

It can be seen from Table 3 that farmers score on understanding the climate change ranged from 6 – 15 compared to the possible range of 0-15. With the mean score of 12.56 and standard deviation of 1.48, farmer-respondents are classified to have high understanding of what climate change is. This is evident in Table 2 showing that 96.61% or 57 out of 59 respondents scored from 11 to 15. None of them scored 0-5 with only 2 having scores from 6 to 10 classifying them of having average understanding of climate change.

TABLE 3: FREQUENCY AND PERCENTAGE DISTRIBUTION OF CORN FARMERS' UNDERSTANDING OF CLIMATE CHANGE

Score	Frequency	Percentage	Description	Mean	SD

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11 to 15	57	96.61	High	12.56	1.498
6 to 10	2	3.39	Average		
0-5	0	0.00	Low		

D. Climate Change's Influence On Farmer's Decision Making

The study looked on the influence of climate change to farmers' decision making focusing on three areas namely operational, strategic and tactical. Operational aspect covers decision on activities such as scheduling, amount of fertilizer and pesticide applied, irrigation and water system, harvesting and storage. As shown in Table 4, 71.19% of the respondents viewed climate change to have very high influence on their farming decision making in terms of operation. Only 2 out of 59 respondents viewed it to have very low influence on their decisions. The rest of the responded low to high influence of climate change in their farming decision with combined frequency of 15 constituting 25.42% of the total population. In general, results show that corn farmers viewed climate change to have major influence in their operational farming decision making with mean score of 3.33 and standard deviation of 0.719.

On the same manner, climate change seems to influence the decision of farmers at a very high level in terms of strategic area with mean score of 3.42 and standard deviation of 1.083. Strategic area covers what crop should be planted, cropping schedule and budget allocation. As shown, 66.10% of the respondents viewed that these things are influenced by climate change at a very high level. The other 39.80% responded that climate change has very low to high influence in their decision making when farming strategy is concerned.

In terms of tactical decision making, it is notable that this area is influenced by climate change at high level with 3.17 and 0.557 mean score and standard deviation, respectively. livelihood alternatives for the current season as affected by climate change. Specifically, Tactical decision covers land use, use of different cropping methods and consideration of, data revealed that 76.27% of the famers see climate change as high influencer in tactical decision making. 10 and 4 of the 59 participants responded low and very low, respectively.

Overall, with the standard deviation of 0.557 and mean of 3.17, corn farmers in Bansud, Oriental Mindoro regarded climate change to have high influence in their general farming decision making.

TABLE 4: FREQUENCY, PERCENTAGE AND MEAN DISTRIBUTION OF FARM DECISION MAKING AS INFLUENCED BY CLIMATE CHANGE

Classes	**Operational**		**Strategic**		**Tactical**		**Overall**		**Description**
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*	*Frequency*	*%*	
3.26 - 4.00	42	71.19	39	66.10	0	0.00	31	52.54	Very High
2.51 - 3.25	9	15.25	7	11.86	45	76.27	15	25.42	High
1.76 - 2.50	6	10.17	5	8.47	10	16.95	10	16.95	Low
1.00 - 1.75	2	3.39	8	13.56	4	6.78	3	5.08	Very Low
Mean/ SD	3.33	0.719	3.42	1.083	2.77	0.472	3.17	0.557	
Description	Very High		Very High		High		High		

E. Climate Change Adaptation Strategy

The farmer-respondents were asked which among the following adaptation measures they use to deal climate change. Among the items, item 2 ranked 1 gaining the highest frequency of 47 or 79.66% of the population. This means that corn farmers generally resort to changing the planting schedule when they are affected by climate change. Second in rank is the "use of cropping calendar" with 35 responses. This is followed by "replacement of planted crop or variety" with 35 responses on rank 3. Close to 4th and 5th rank are items "transition from farming to animal husbandry" and "purchase of crop insurance" with 31 and 30 responses, respectively. Other adaptation measures lesser utilized by the farmers as reflected by the percentage below 50% of the total possible responses are "8 finding other employment on a farm other than one's own farm", "adding budget for purchase of inputs and other equipment", "moving the planting area", "land management (maintain yields and soil fertility)" and "leasing of land" ranking 6th to 10th, respectively. There are other identified adaptation measures used by the farmers like improvement of irrigation system, cover cropping and terracing.

Generally, it can be viewed that farmers still prioritize planting -related strategies before they resort to other ways to adapt to climate change.

TABLE 5: FREQUENCY, PERCENTAGE AND RANK DISTRIBUTION OF CORN FARMERS' ADAPTATION MEASURES IN COPING WITH CLIMATE CHANGE

Adaptation Measures	**Frequency**	**Percentage**	**Rank**
#2 changing the planting schedule	47	79.66	1
#4 use of cropping calendar	35	59.32	2
#1 replacement of planted crop or variety	34	57.63	3
#7 transition from farming to animal husbandry	31	52.54	4
#5 purchase of crop insurance	30	50.85	5

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#8 finding other employment on a farm other than one's own farm	26	44.07	6
#6 adding budget for purchase of inputs and other equipment	25	42.37	7
#3 looking for alternative planting area	23	38.98	8
#10 land management (maintain yields and soil fertility)	23	38.98	9
#9 leasing of land	19	32.20	10
#11 Others	16	27.12	11

F. Correlates of average seasonal harvest

Table 6 shows the bivariate correlation analysis results between and among the variable of the study. It can be viewed from the study that the level of understanding about climate of the farmers positively correlates to the average farm harvest during dry season as reflected by the r value of 0.298 at 5% level of significance. This implies that the higher the understanding of the farmers about climate change the higher the harvest during dry season. Moreover, the r^2 value of 0.89 implies that 8.9% of the total variances in the average harvest during dry season can be attributed to the farmers' level of understanding of climate change. On the contrary, understanding of climate change failed to significantly correlate with the average harvest during wet season as reflected by the r value of 0.33 at 95% confidence level. This implies that farmer's knowledge on climate change has no significant effect on the average wet season harvest. This is revealed by the r value 0.243 at 5% level of significance.

TABLE 6: BIVARIATE CORRELATION ANALYSIS AMONG INDICATORS OF THE STUDY

Indicators		**Average harvest during wet season**	**Average harvest during dry season**	**Overall harvest**	**Women's participation in decision making in livelihood activities**	**Women's participation in decision making in adaptation activities**	**Women's overall participation in farming decision making**
Understanding of Climate Change	*r*	.033	0.298*	.243	0.462**	0.459**	0.482**
	r^2	.001	.089	.059	.213	.211	.232
	p	.806	.022	.064	.000	.000	.000
Climate Change's Influence on farmer's decision	*r*	-.061	-.219	-.228	-.185	-.129	-.165
	r^2	.004	.048	.052	.034	.017	.027
	p	.646	.096	.082	.162	.330	.213
Women's participation in decision making in livelihood activities	*r*	.083	.119	.095	* correlation is significant at 5% level		
	r^2	.007	.014	.009	** correlation is significant at 1% level		
	p	.993	.014	.044			
Women's participation in decision making in adaptation activities	*r*	.001	0.319*	0.264*			
	r^2	.000	.102	.070			
	p	.993	.014	.044			
Women's overall participation in farming decision making	*r*	.045	.227	.185			
	r^2	.002	.051	.034			
	p	.734	.084	.160			

On one hand, when matched with women's participation in farming decision making, understanding of climate change significantly correlates at 5% level of significance with r value of 0.462, 0.495 and 0.482 for participation in livelihood, adaptation and overall farming decision making, respectively. This implies that the higher the understanding of the farmer in climate change the higher they let their wife or the women participate in farming decision making be it livelihood or climate change adaptation. Moreover, the r^2 value of 0.213, 0.211 and 0.232 for livelihood, adaptation and overall farming decision participation, respectively, denoting that at least 20% of the total variances in the women's participation to farming activities can be attributed to the farmers' understanding of climate change.

In the context of women's participation in farming decision making, it can be noted that only participation in climate change adaptation significantly correlates with the average farm harvest during dry season but not during wet season. This is reflected by the r value of 0.319 and 0.001 for dry and wet season, respectively, at 5% level of significance. This implies that the higher the participation of women in climate change adaptation activities the higher the harvest during dry season will be. It can also be gleamed from the

result that 10.2% of the total variances in average harvest during dry season can be associated by women's level of participation in climate change adaptation activities.

In similar manner, women's participation significantly positively correlates with the overall farm harvest with r value 0.264 at 5% level of significance. This can only show that women's participation in climate change adaptation play a role on the overall average farm harvest.

On the other hand, women's level of participation in livelihood activities fail to significantly correlate with the overall average harvest both wet and dry season at 5% level of significance. Same can be concluded for climate change's influence on farmers' decision making. It does not significantly correlate to any of the average harvest, both wet and dry season, and women's level of participation in farming decision making activities, both livelihood and adaptation.

V. CONCLUSION AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that majority of the corn farmers in Bansud, Philippines are upland farmers and owned the land they are working. They tend to have better harvest during dry season. It can also be concluded from the results that farmers have a good understanding of what climate change is and that climate change affects their farming decision making at a very high extent concerning operational and strategic decision activities. They use these knowledge of climate change in making decisions including adaptation strategies. The top 5 climate change adaptation strategy of smallholder corn farmers are changing planting schedule, utilization of cropping calendar, replacement of corn variety or crop, resorting to animal husbandry from farming and purchasing crop insurance. Women participates in some of the farming activities such as livelihood and climate adaptation activities. In general, farmers understanding of climate change and women's participation in climate change adaptation activities are bases of average seasonal harvest of smallholder corn farmers especially during dry season. It is imperative that smallholder farmers be knowledgeable enough of climate change including how this affect their farming decisions and adaptation measures if they tend to increase their seasonal harvest. Interventions from outside agencies like Local Government Units (LGUs), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Department of Science and Technology (DOST) and other climate-related agencies may be considered to increase farmer's knowledge of climate change such as intensive symposia, seminars and the likes. Women should also be empowered in terms of decision making. They may be given opportunity to participate at full extent in farming decision making to increase seasonal harvest.

REFERENCES

[1]. Attri, S. D., & Rathore, L. S. (2003). The Impact of Climate Change on the Agricultural Sector: Implications of the Agro-Industry for Low Carbon, Green Growth Strategy and Roadmap for the East Asian Region Table of Contents. International Journal of Climatology, 23, 693-705.
[2]. Kurukulasuriya, P., & Mendelsohn, R. (2007). A Ricardian analysis of the impact of climate change on African cropland. The World Bank.
[3]. Seo, S. N., & Mendelsohn, R. (2008). Measuring impacts and adaptations to climate change: a structural Ricardian model of African livestock management 1. Agricultural economics, 38(2), 151-165.
[4]. Mendelsohn, R., Dinar, A., & Dalfelt, A. (2000). Climate change impacts on African agriculture. Preliminary analysis prepared for the World Bank, Washington, District of Columbia, 25.
[5]. Eakin, H. (1999). Seasonal climate forecasting and the relevance of local knowledge. Physical Geography, 20(6), 447-460.
[6]. Mengistu, D. K. (2011). Farmers' perception and knowledge on climate change and their coping strategies to the related hazards: case study from Adiha, central Tigray, Ethiopia. Agricultural Sciences, 2(02), 138.
[7]. Paudel, B., Zhang, Y., Yan, J., Rai, R., Li, L., Wu, X., ... & Khanal, N. R. (2020). Farmers' understanding of climate change in Nepal Himalayas: important determinants and implications for developing adaptation strategies. Climatic Change, 158(3), 485-502.
[8]. Bhandari, G. S., Thapa, R. B., Giri, Y. P., Manandhar, H. K., & Jha, P. K. (2019). Farmers 'perception on climate change and maize cultivation in relation to insect diversity across the altitudinal gradient of Nepal. Journal of Agriculture and Forestry University, 3, 85.
[9]. Islam, M. S., Kabir, M. H., Ali, M. S., Sultana, M. S., & Mahasin, M. (2019). Farmers' knowledge on climate change effects in agriculture. Agricultural Sciences, 10(03), 386.
[10]. Elia, E. (2017). Farmers' awareness and understanding of climate change and variability in central semi-arid Tanzania. University of Dar es Salaam Library Journal, 12(2), 124-138.
[11]. Seo, S. N. (2012). Decision making under climate risks: an analysis of sub-Saharan farmers' adaptation behaviors. Weather, Climate, and Society, 4(4), 285-299.
[12]. Smit, B., Burton, I., Klein, R. J., & Wandel, J. (2000). An anatomy of adaptation to climate change and variability. In Societal adaptation to climate variability and change (pp. 223-251). Springer, Dordrecht.
[13]. Asfaw, S., & Lipper, L. (2011). Economics of PGRFA management for adaptation to climate change: a review of selected literature. Commission on Genetic Resources for Food and Agriculture. FAO, Rome, Italy.
[14]. Roesch-Mcnally, G. E. (2016). Agricultural transformations: climate change adaptation and farmer decision making.
[15]. Belay, A., Recha, J. W., Woldeamanuel, T., & Morton, J. F. (2017). Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. Agriculture & Food Security, 6(1), 1-13.

[16]. Doss, C., Meinzen-Dick, R., Quisumbing, A., & Theis, S. (2018). Women in agriculture: Four myths. Global food security, 16, 69-74.
[17]. Raney, T., Anríquez, G., Croppenstedt, A., Gerosa, S., Lowder, S. K., Matuschke, I., & Skoet, J. (2011). The role of women in agriculture.
[18]. Ogunlela, Y. I., & Mukhtar, A. A. (2009). Gender issues in agriculture and rural development in Nigeria: The role of women. Humanity & social sciences Journal, 4(1), 19-30.
[19]. Harvey, C. A., Saborio-Rodríguez, M., Martinez-Rodríguez, M. R., Viguera, B., Chain-Guadarrama, A., Vignola, R., & Alpizar, F. (2018). Climate change impacts and adaptation among smallholder farmers in Central America. Agriculture & Food Security, 7(1), 1-20.
[20]. Lipper, L., Thornton, P., Campbell, B. M., Baedeker, T., Braimoh, A., Bwalya, M., ... & Torquebiau, E. F. (2014). Climate-smart agriculture for food security. Nature climate change, 4(12), 1068-1072.
[21]. Technoserve (August 23, 2022). 5 Ways Climate Change is Threatening the Livelihoods of Smallholder Farmers. https://url24.top/YbkHT
[22]. Cohn, A. S., Newton, P., Gil, J. D., Kuhl, L., Samberg, L., Ricciardi, V., ... & Northrop, S. (2017). Smallholder agriculture and climate change. Annual Review of Environment and Resources, 42(1), 347-375.
[23]. World Bank. 2007. World Development Report 2008: Agriculture for Development. Washington, D.C.: World Bank Publications. https://tinyurl.com/57jt77d2
[24]. Patil, B., & Babus, V. S. (2018). Role of women in agriculture. Int J Applied Res, 4(12), 109-114.
[25]. Nelson, S., Sisto, I., Crowley, E., & Villarreal, M. (2012). Women in Agriculture: Closing the Gender Gap for Development1. Feeding a Thirsty World, 25.