

Determinants of Peoples' Adaptation Strategies against Climate Change Impact on Agricultural Activities in Nepal

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Abstract

Climate change has become more than an abstract problem to be discussed among academia at a global level. This problem has threatened human civilization in many ways. This study has aimed to analyze the determinants of peoples' adaptation strategies against climate change impact on agricultural activities in Nepal. It utilized the data generated from nationally representative samples of *the National Climate Change Impact Survey, 2016* conducted by *the Central Bureau of Statistics (CBS)*. The total sample size of this survey was 5060 households. The results of binary logistic regression analysis revealed that people in later ages as compared with their younger counterparts; people living in subtropical and temperate climatic zones are more likely to adapt different agricultural strategies against climate change impact as compared with the tropical region. Similarly, people who do not utilize agricultural mechanization are more likely to adapt to various adaptation strategies as compared with the people who utilize farm mechanization. It is; therefore, the age of people, climatic zone, and farm mechanization are the determining factors for adapting different agriculture strategies against climate change impact in Nepal.

Keywords: *Adaptation, agriculture, climate change*

Introduction

The scientific evidence has shown that climate change is a global challenge facing humans and their socio-economic activities, health, livelihood, and food security (Romieu et al., 2010; Amjath-Babu et al., 2016). Climate change is expected to significantly reduce agricultural productivity especially in tropical and subtropical regions (Knox et al., 2012; Jones and Thornton, 2003). The loss of yield for major crops that account for 80.0 percent of production in Africa and South Asia may reach 8.0 percent by the middle of this century (Knox et al., 2012). Nepal's temperature has increased by 1.8°C during the last 32 years. In Nepal average temperature increase was recorded as 0.06°C per year and that in Terai and Himalayas was 0.04°C and 0.08°C/year respectively (Shrestha et al., 1999). Agriculture is one of the main

economic activities of Nepal and about two-thirds of the population employs it (CBS, 2017). Among the agricultural population, more than half (51.5%) holds less than 0.5 hector land; the land is fragmented and no land management, while poorest population are involved in agriculture and this section of the population are getting about 59.0 percent income from agriculture as compared with 21.0 percent of the richest quintiles (MoAD, 2015; Sharma, 2013; Satyal, 2010).

Adaptation to climate change seems to be the most appropriate means for farmers to minimize the negative impact of climate change. Adaptation strategies such as; changing crop types, changing crops varieties, tree planting, soil and water conservation, changing planting date, fertilizer application and crop diversification are in practice (Tesfaye and Seifu, 2016; Ubisi Nomcebo et al., 2017, Akthar and Erenstein, 2016) at the other parts of the globe. The main objective of this study is to identify the determinants of people's adaptation strategies against climate change impact on agriculture activities in Nepal.

Data and Methods

Data generated from nationally representative samples of the National Climate Change Impact Survey (NCCIS) 2016 conducted by the Central Bureau of Statistics (CBS). This was the first survey ever conducted in Nepal for measuring the perception of people towards the impact of climate change at the household level. The survey attempts to understand the impacts and effects of climate change on social, economic, and environmental dynamics at the national level. Although the total sample size of this survey was 5060, this study has used 4175 samples for analytical purposes. The sample selection strategy adopted for the NCCIS was done in three stages

- I stage: a selection of the districts
- II Stage: a selection of primary sampling unit (PSU) 253 PSUs from all 16 analytical domains
- III Stage: a selection of households.

The unit of analysis is household which had the respondent aged 45 or more and residing in that locality for 25 years at the time of the survey. The survey has collected the data on various adaptation strategies (more than seven areas) but this analysis is based on the overall adaptation strategy adapted by the people. A composite index for measuring the overall adaptation strategy has been constructed. The reliability and validity of the research instrument were strictly controlled by the team of researchers of the Central Bureau of Statistics, Nepal. Binary Logistic regression model has been used to identify the determinants associated with adaptation strategies. Bivariate analyses using the Chi-Square test were performed and only those variables which were statistically significant ($p < 0.05$) were included in multivariate analysis. SPSS v.23 has been used to analyze the data.

Hypotheses

Hypothesis 1: Adaptation strategy towards agricultural activities is statistically significantly related to the age of the farmers.

Hypothesis 2: There is a statistically significant relationship between adaptation strategy and different climatic zones

Hypothesis 3: There is a statistically significant relation between adaptation strategy and farm mechanization.

Results and Discussion

More than two-thirds (67.3%) are male. Nearly 71.0 percent of respondents are between 45 and 65 years (with mean 58.4 ± 10.4 (SD) years). More than 45.0 percent of the respondents are illiterate, followed by 21.3 percent had informal education. About 22.0 percent of respondents fall in the lowest quintiles (I quintile) while only 14.9 percent fall in the highest (V quintile). In terms of the climatic zone, more than half of the respondents are from tropical and less than five percent from the sub-alpine area of the country. Only one in five respondents had received service from the proximate agriculture center. Less than half of the respondents had engaged in any type of community organization.

Table 1: Respondents Classified According to Selected Background Characteristics

Characteristics	Number	Percent
Age		
45-54	1710	41.0
55-64	1277	30.5
65-74	847	20.3
75 and above	341	8.2
Mean=58.4 years and SD=10.4 years		
Sex		
Male	2804	67.2
Female	1371	32.8
Education		
Illiterate	1895	45.4
Literate	888	21.3
Basic	1012	24.2
Higher Secondary and above	380	9.1
Wealth Quintiles		
First quintile	942	22.6
Second quintile	897	21.5
Third quintile	924	22.1
Fourth quintile	789	18.9
Fifth quintile	623	14.9
Climate Zone		
Tropical	2205	52.8
Sub-Tropical	1509	36.1
Temperate	285	6.8
Sub-Alpine	176	4.2
Agriculture Experience		
No	247	5.9
Yes	3928	94.1
Mean=38.9 years and SD= 15.8 years		
Farm Mechanization*		
No	2931	76.1
Yes	921	23.9

Receive any agriculture service		
No	3237	77.5
Yes	938	22.5

Note: *323 samples are missing (no response from the respondents)

Nearly all the respondents (more than 94.0 percent) respondents have agriculture experience, one in every four respondents has mechanized the farming method and only 22.5 percent of farmers have received the support of agriculture services from government and non-governmental organizations.

The findings as shown in Table 2 shows that the age of people, climatic zone, and farm mechanization are the key determinants of adaptation strategies adopted by the farmers in Nepal. Thus, as hypothesized in hypothesis 1, it is validated that the people in later ages as compared with their younger counterparts are more likely to adapt various adaptation strategies.

Table 2. Odds ratios from Binary Logistic Regression Models of People's Adaptation Strategies against Climate Change on Agriculture Sector, Nepal

Characteristics	Odds Ratios	Significance
Education		
Illiterate(R)	1	
Literate	1.104	.436
Basic Education	1.082	.563
Secondary Education	1.088	.616
Higher Education	0.620	.106
Receiving any agriculture service (R)	1	
Not Receiving any agriculture service	0.224	.001
Years of experience in Agriculture	1.064	.001
Male(R)	1	
Female	0.781	.05
Farm mechanization		
Yes	1	Ref
No	6.308	0.001
Wealth Quintiles		
First Quintile (Lowest) (R)	1	
Second Quintile	0.925	.587
Third Quintile	1.025	.864
Fourth Quintile	0.345	.001
Fifth Quintile (Highest)	0.849	.316
Climatic Zone		
Tropical(R)	1	
Sub-Tropical	0.294	.001

Temperate	0.355	.001
Sub-Alpine	0.085	.001
-2loglikelihood=4148, Cox-Snell R Square is 0.32 and N= 4175		

Similarly, the validation of hypothesis 2 implies that people living in subtropical and temperate climatic zones are more likely to adapt different agricultural strategies against climate change impact as compared with the tropical region. The third factor considered in hypothesis 3 validates that people who do not utilize agricultural mechanization are more likely to adapt various adaptation strategies as compared with the people who utilize farm/agricultural mechanization.

Discussion

Nielsen & Reenberg (2010) suggested that climate change is a heterogeneous process departing from an extant approach to this discourse where mainly economic and technological development have been considered as key factors. Factors such as class, gender, and culture have been suggested to play a larger role in adaptation strategies and the phenomenon is actual local rather than national or regional or global. However, how age groups impact climate change and related adaptation strategies in Nepalese contexts has not been the main focus of the extant literature to our knowledge. People may opt for migration as job seekers, which is a major phenomenon in the Nepalese context, may work for development projects, may opt for gardening, and the women may take an engaging role in economic activities.

Somboonsuke, Phitthayaphinant, Sdoodee, & Kongmanee (2018) suggested that climatic variability and the farmer's perception towards it has an impact on agricultural and adaptation strategies. However, the studies to understand whether farmers in different climatic zones adapt different adaptation strategies have not been dealt with in earlier studies in an explicit manner. Adaptation strategies may include 1) enhancement of capacity in impact assessment, 2) prevention and avoidance of negative impacts, 3) mitigation of negative impacts, 4) reduction of loss from negative impacts and 5) rehabilitation of devastated areas and other losses. Depending on the nature of the climatic zones farmers may opt for different adaptation strategies.

Kakumanu et al. (2016) suggest that smallholder farmers are vulnerable due to a changing climate. Thus, technical, institutional, and policy interventions are crucial for coping and adaptation strategies. As the risk premium is higher for farm mechanization compared to supplemental irrigation, people who have not utilized agricultural mechanization opt for adaptation strategies. This implies that there is a need for an awareness program to make sure that farm mechanization and adaptation strategies work for all.

Conclusion

This paper reveals that sex, climate zone, years of experience in agriculture, and receiving services agriculture service are the major determining factors for the adaptation strategies against the climate change impact on agricultural activities.

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