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Perception of and Adaptation to Climate Change by Farmers: Case Study in Highland and Lowland Agro-Ecology in Buleleng Regency of Bali Province

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Abstract
This study aims to explore the farmer's perception of climate change, adaptation strategies are implemented by farmers, and the factors that influencing it. Ninety-seven respondents in Pancasari and Panji Anom village, Buleleng regency of Bali Province were interviewed based on a questionnaire. Both villages are considered as representative highland and lowland agro-ecological areas. The size of respondents in each ecological area were determined proportionately. These respondents were selected by accidental sampling technique. The data collected were about farmer's socioeconomic and demographic characteristics, infrastructure related to agricultural activities, technology and institutions that were accessible by farmers, the right of property by farmers, the farmer's perception on climate change, and the adaptation strategies adopted. Data profile and perceptions of farmers were presented with descriptive statistics, whereas, the factors that influence farmer's perception and their strategies employed to adapt were analyzed by econometric approach using binary logistic regression. The results showed that climate change has been felt by most of farmers. It was shown by the majority of respondents (73.2%) said that there has been rising in temperature, 28.87% said it has been the uncertain rainfall patterns, and 36.08% of the farmers have a perception that climate change as a result of natural factors and humans. The result also showed farmer's perception of climate change were significantly related to education, income, and agro-ecology. However, experience, income, irrigation conditions, access to credit, access technologies, and ecological areas were factors that significantly influencing adaptation strategies of farmers.
Keywords: Farmer, climate change, perception, adaptation

1. Introduction

Agriculture is the sector most vulnerable to climate change (IPCC 2001). Climate change may cause climatic anomalies such as the El-Nino and La-Nina (decrease and increase the intensity of extreme precipitation). Agency for Agricultural Research and Development, Indonesian Ministry of Agriculture (2011) reported that the incidence of rainfall throughout the year or extreme climatic La-Nina has resulted in an increase in agriculture area prone to flooding, from range 0.75 to 2.68%, to 0.97 to 2.99%; and an increase in the total area of agricultural production failed due to flooding, from range 0.24 to 0.73%, to 8.7 to 13.8%. In aggregate, it is estimated that climate change has brought down the national production of 2.45 to 5.0% to more than 10%. The same source also mentioned, during the 2010, La Nina has caused a drop in production of various horticultural commodities, both quantity or quality. Production of mangoes, apples, bananas, and oranges declined around 20 - 25%, mangosteen 15 - 20%, some types of vegetables 20 - 25%, and the decorative plants are very diverse. In contrast to the El-Nino in the period 1989-2006, more than 2,000 ha per district in the northern coast of Western Java, especially the Indramayu district, most of the northern coast of Nanggroe Aceh Darussalam, Lampung, East Kalimantan, West Sulawesi, South Kalimantan, and Lombok failure harvest. The frequency of occurrence of drought on crops, especially rice paddy fields in Java, three times in four years and the generally increased sharply in the year of El Nino (Boer et al. 2009).

These conditions indicated that, there is a need for the design of policies and programs of adaptation strategies to climate change in the agricultural sector. According to the IPCC (2001) adaptation to reduce the negative impact of climate change requires the involvement of local communities. Zhao et al. (2014) suggest to adapt the warm and dry climate, optimization of agricultural arrangement and adjustment of planting structure have been carried out. Recently, Indonesian's agriculture sector has established a series of policy on agriculture to adapt to climate change especially for food crop agriculture and horticulture. It were the improvement of water management, including irrigation and networks systems; development of water harvesting technology (ponds, dam) and the efficiency of water use such as drip irrigation and mulching; development of species and varieties of plants that are tolerant to environmental stresses such as rising temperatures, drought, inundation (flooding), and salinity; development of land and crop management technologies to improve the adaptability of plants; and the development of farm protection system of failure due to climate change or weather crop insurance (DNPI 2011). The government's policy to promote adaptation to climate change is apparently still a gap between the rate at which climate is changing and the response by farmers. According to Sumaryanto (2012), it is as the results of (1) problems, situations, and conditions of food farmers in Indonesia are very diverse, (2) the characteristics of the

adaptive capacity traditionally are locally specific, and (3) the strategic environment faced by farmers diverse and dynamic.

The phenomenon also occurs in Bali Province, especially in Buleleng District. Government efforts have not been in line with the needs of farmers. This is because of the low support for data and information on the results of research and empirical studies. Dumenu and Obeng (2016) highlighted the importance of local-level climate change vulnerability assessment and demonstrate the need for local area-specific actions/policies to reducing vulnerability and enhancing adaptation in rural communities. In this, the effectiveness of adaptation strategy policy, should be base on farmer's characteristics. Smit and Pilifosofa (2001) and Asante et al. (2012) classified the factors that influence the decision of farmers to adopt adaptation strategy into three major components: the characteristics social and economic of farmers, technological and institutional (including information) which could be accessed by farmer, and infrastructure. Yegbemey et al. (2013) explored the influencing factors that determine the adaptation techniques among farmers to climate change by focusing on their property rights of farming land. Akponikpe et al. (2010) compared the farmers' perception to climate change from various countries in Africa. Dumenu and Obeng (2016) stated that rural communities are the most vulnerable to climate change. They confirmed socio-economic factors such as high illiteracy level, heavy dependence on climate-sensitive livelihoods, less diversification of income sources and limited access to climate change information contributed to the high vulnerability level of the rural communities.

The study therefore explored the farmer's perception of climate change, adaptation strategies are implemented by farmers, and the influencing factors that determine it. The study was conducted at the rural communities in Buleleng. The study approach are useful as a basis for enhancing the adaptive capacity of farmers to climate change, thus government support on adaptation to climate change to be more effective.

2. Methodology

The study was carried out in the village of Pancasari and Panji Anom, located in Buleleng District, Bali Province. The rationale for selecting the study areas are that the both areas are characterized by Pancasari as highland area with a focus on horticultural crops and Panji Anom as lowland area with dominance of food crops each represent two of the most dominant agricultural zone in Buleleng. Based on the data on the "District of Sukasada in Figures" Panji Anom is an area of 890 ha with the largest land use for agriculture. It is consist of 312 ha of paddy fields, dry land 264 ha, 186 ha plantation, and 34 ha yard, and the remain is other land use. This area is located at the height of 320 m above sea level with warm temperatures between 28-31°C. It is suitable for farming rice plants and crops (cassava, maize, and sweet potato). Most of the population in this village works in the field of food agriculture. The total resident in Panji Anom village who works in agricultural sector and food crops horticulture reached 2,044 farm households. The Pancasari area is 1280 ha, including for field area of 486.40 ha, plantations 182.00 ha, 35.00 ha yard, and the remind for other land use. Most of the village area surrounded by state forests 432.60 ha. These areas are fertile soil with the height of 850 m above sea level and cold temperature between 19 - 22°C. It is suitable for vegetable farming plateau. Pancasari villages have no paddy fields, the majority of the people work in the business field of horticulture crops. Pancasari village residents who work in the horticultural sector reached 1,279 farm households (BPS 2014).

Sample size is determined proportionally to each of the ecological area by using Slovin approach (in Siregar, 2013: 61).

$$n = N/(\mathrm{N}\mathrm{d}^2 + 1)$$

Where:

n = number of samples, N = Number of population, and d = precision (set at 10% with 95% confidence level).

In this, the appropriate sample size for the survey of farmers in the study area are 97 farmer households. Then, using data on the number of farm households for each village, the number of samples taken from each village are determined proportionally, so that each sample size for the village Pancasari and Panji Anom were define 37 and 60 farm household. These respondents were selected by accidental sampling technique.

2.1 Data Collection

This study was conducted by survey methods using structured interviews base on a questionnaire. The data collected were about farmers' socioeconomic and demographic characteristics, infrastructure related to agricultural activities, technology and institutions that were accessible by farmers, the right of property (land) of farmers, the farmers' perception on climate change, and the adaptation strategies adopted..

2.2 Variables

The dependent variables in this study are perception and adaptation. A little knowledge on climate change that farmers perceived, were investigated, whether farmers had noticed long-term changes in temperature and rainfall over the past 20 years and the source of the causes of climate change. To find out factors that determine to choice of adaptation strategies, ten adaptation strategies that are considered in this study are selecting new varieties,

cultivate other agricultural crops (crop diversification), change the time of planting, digging wells, adjusting the management of crops, involved in off-farm job, switching on activities outside of agriculture, adjusting the quantity of land, cultivate timber plant (agroforestry), and using pesticides and herbicides were determined as the dependent variable. It is binary choice because there are two options for each farmer. This binary choice is dummied as 1 if a farmer chooses once adaptation strategy in response to climate change and 0 otherwise (Bryan et al. 2011; Mabe et al. 2014). In this, binary logit biner was employed in analyzing the determinants of farmers' decision to choose a particular adaptation strategy. Each adaptation strategy analysis was done separately and independently to eliminate the effects of the choice of one adaptation strategy on the other (Mabe et la. 2014).

The dependent variable was regressed on a set of explanatory. The explanatory variables for the analysis of the objectives are chosen in conformity with literature (Ndambiri et al. 2012; Asante, et al.,2012; Mabe et al. 2014; Yogbemey, et al. 2013). These factors as indicated by Smit and Pilifosova (2003) include various social and economic characteristics of farmers, technological and institutional factors as well as information and infrastructural access that are likely to impact on the capacity of farmers to adapt. Table 1 shown below depicts the explanatory variables and how they are measured.

Table 1 Explanatory variables were considered in the model.

No	Variable	Modalities
1	Age	0 = not more than 35 years, 1=more than 35 years
2	Education level	0 = graduated up to secondary school, 1=graduated more than secondary school
3	Experience in agriculture	0 = not more than 10 years, 1=more than10 years
4	Income from farming	0 = not more than 30 million, 1=more than 30 million
5	Other income	0 = does not have any other income, 1= have any other income
6	Irrigation Condition	0 = inadequate, 1=adequate
7	Involvement in farmer groups	0 = not involved in farmer groups, 1= involved in farmer groups
8	Access to counseling	0 = do not get counseling, 1= obtain counseling
9	Access to credit	0 = does not have access to credit, 1=have access to credit
10	Access to technology	0 = does not have access to technology, 1=have access to technology
11	Land of inheritance	0 = did not manage to land inheritance, 1=manage to land inheritance
12	Ownership	0 = did not manage to ownership land, 1= manage ownership land
13	sharecroppers	0 = not sharecroppers, 1= sharecroppers
14	Renting/land contract	0 = do not manage renting land, 1=manage renting land
15	Combine land	0 = manage single categorical of land rights,1=manage more than one categorical land of rights
16	Perception on temperature	0 = do not perceived increase in temperature, 1=perceived increase in temperature
17	Perception on rainfall	0 = do not perceived erratic in rainfall, 1=perceived erratic in rainfall
18	Agro-ecology	0 = highland area of agro-ecology (Pancasari),1 = lowland area of agro-ecology (Panji Anom)

2.3 Data Analysis

Descriptive statistics were used to identify the farmers' profile and perceptions to climate change. Econometric method based on binary logistic regression was used to analyze factors that determine farmers' perception and adaptation techniques. Data were computed and analyzed with SPSS 17.

3. Results and Discussion

3.1 Farmers' Profile

Farmer's profile were identified based on demographic and socioeconomic characteristics, access to infrastructure and institutions, as well as the status of the land managed. Table 2 showed, in Panji Anom village, farmers income less than fifteen millions a year reached 90%, and only 3.33% with income of more than thirty millions a year, the remaining 6.67% of farmers with income between fifteen and thirty millions rupiah. This condition is very different from the farmers in Pancasari village. In this highland ecology area, only 35.14% of farmers with an income of less than fifteen million a year, 16.22% between fifteen and thirty million, and the remaining 48.65% more than thirty million a year. This can be explained by the advantage of location and types of plants that can be cultivated. Pancasari as highland area with fertile soil and environmental conditions which strongly supports a favorable growth for the various types of horticulture crops. In addition, Pancasari also part of a cluster of Bedugul tourist area, so that close with the market access and easier to reach. In this area, farmers take an advantageous position by engaging in non-agricultural activities such as trading in agricultural products. It is also supported by the right of the land managed by farmers. In Pancasari 75 % farmers manage the land of their heritage, whereas 58% of

farmers in Panji Anom also as sharecropper other than the ownership and inheritance land. Although the average land size were managed by farmers in the two villages are relatively the same, but there were different management status so that net income are different too.

Regarding from the aspect of infrastructure and institutional related to agricultural management, 55% of farmers in Panji Anom that having access to extension services, while in Pancasari reached 83.78%. It is supported by the involvement of farmers in farmer groups. Farmers in Panji Anom only 40% who are part of farmer group while in Pancasari has reached 75.68%. Similarly, in such matters, 81.08%; 100%; 91.89% farmers in Pancasari have access to credit, media, and technology respectively. On the other hand 46.67%; 37%; 85% of farmers in Panji Anom have access to credit, media and technology respectively. Table 2 shown farmer's profile in study area.

Table 2. Farmer's Profile

Variable		Area Agro-Ecology				Total (%)
		Panji Anom (n=60)		Pancasari (n=37)		
		Respondent	%	Respondent	%	
Sex	Man	54	90	31	83.78	87.63
	Women	6	10	6	16.22	12.37
Age	<35	8	13.33	6	16.22	14.43
	35-65	46	76.67	28	75.68	76.29
	>65	6	10.00	3	8.11	9.28
Education	No graduation from Elementary School	16	26.67	5	13.51	21.65
	Elementary School	26	43.33	14	37.84	41.24
	Junior High School	9	15.00	4	10.81	13.40
	Senior High School	7	11.67	9	24.32	16.50
	University	2	3.34	5	13.51	7.22
Experience	<30 years	34	56.67	26	70.27	61.86
	>30 years	26	43.33	11	29.70	38.14
Income per year	≤ 15 million	54	90.00	13	35.14	69.07
	15<p≤30 million	4	6.67	6	16.22	10.31
	≥30 million	2	3.33	18	48.65	10.31
Source of income	Farming	16	26.67	16	43.24	32.99
	Others	44	73.33	21	56.76	67.01
Wide of land farming	≤0,25 ha	20	33.33	14	37.84	30.05
	0,25<k≤0,5 ha	19	31.67	16	43.24	36.08
	0,5<k≤1 ha	19	31.67	6	16.22	25.77
	>1 ha	2	3.33	1	2.70	3.09
Irrigation	Available	41	68.33	24	64.87	67.01
	Not available	19	31.77	13	35.13	33.99

3.2 Farmers' Perception of Climate Change

Differences in baseline characteristics such as age, education, resources, experience, and geographical conditions influence the way respondents view on climate change. For example, farmers with better income have better access to sources of information on climate change that they have the potential to improve their perception. Conceptually, farming experience, age, and education levels are also believed to play an important role in the perception of climate change (Gunamantha et.al. 2015).

In order to understand farmer's perception of climate change in both ecological areas, respondents were asked related to the knowledge of the parameters of climate change temperature and rainfall in the last twenty years. According to Ndambiri et al. (2012), respondents were asked to determine whether or not they had noted: (1) increase in temperature (2) no change in temperature (3) decrease in temperature (4) do not know (5) increase in rainfall (6) no change in rainfall (7) decrease in rainfall (8) erratic rainfall, and (9) do not know Gunamantha et al. (2015). Results of this analysis are presented below and furthermore in Table 3.

The study found out, farmers with longer experience who perceive that climate was changing. On the other hand, farmers with lower incomes are even more sensitive to the temperature rise in recent decades. In relation to the farming experience, the study found out that 28.33% of farmer in lowland agro-ecology area with high farming experience (above 10 years) who perceived that decrease in rainfall and 21.67% perceived erratic rainfall. In highland area, 25% of farmers with farming experience above 10 years indicated to have noticed erratic

in rainfall. Overall, the study established that 54.64% of farmers with farming experience more than 10 years noted an increase in rainfall. With regards to farmers' income, 35% of farmers in lowland area with an income of less than 30 million per year noted decrease in rainfall, whereas, in highland area, 25% of farmers with an income of more than 30 million per year noticed erratic rainfall. Overall 27.84% of the farmers with the income category of less than 30 million per year noted decrease in rainfall.

Table 3. Farmers' Perception of Climate Change.

Question	Answer	Agro-Ecology		Total (%)
		Panji Anom (%)	Pancasari (%)	
Have you heard of the word "climate change" before?	yes	40	75.68	53.61
	No	60	24.32	46.39
Do you know what climate change is?	yes	21.7	13	38.14
	No	78.3	35.1	61.86
What do you think is the cause of climate change?	Human activity	6.67	14.3	8.25
	Natural process	40	10.7	27.84
	Both of human activity and natural process	17	89	36.08
	God's will	20	7.1	14.43
	I don't know	16.7	10.7	13.40
From which source you heard about climate change?	Television	83.33	81.3	47.42
	Radio	8.33	3.13	3.09
	Newspaper	4.17	3.13	2.06
	School/University	8.33	9.38	5.15
	Government official	4.17	3.13	2.06
	Others	8.33	0	2.06

Source: Gunamantha et al. (2015)

3.3 Econometric Analysis

3.3.1 Factors Influencing Farmer's Perceptions

As reported in Gunamantha et al. (2015), the binary logistic regression analysis was carried out to assess factors influencing farmer's perceptions of climate change. Farmers were asked the causing of climate change. The analysis revealed that 36.08%% of farmers in study area had a perception that climate was caused by natural and human factors. A binary variable which representing whether or not a farmer has knowledge on caused of climate change. It were considered who noted by affecting of natural and human activities. The independent variable as presented in Table 1. Only results that were statistically significant at 10 percent level or greater are reported.

The results indicated that education, farming income, and agro-ecology area influenced the possibility of a farmer to perceive climate change (Table 4). The significant influence on education is made possible due to the higher education it is possible to obtain more information, including that related to climate change. In addition, through education, allowing an increase in the ability of farmers to accept, understand, and analyze relevant information for responding to climate change. With respect to farming income, it showed also a positive sign of the marginal effects. It means that farmer with higher income were also more likely perceive climate change than with low income. This is possible with a better income will be the availability of facilities or the media as a source of information. Unlike the case with education and income, Table 4 confirmed that there was a negative sign of the marginal effects between the area of ecology with farmers' perceptions. Agro-ecological areas were considered in this analysis as a binary variable to assign a value of 0 to the highland area and 1 for lowland area. Thus, the results of this study confirmed that farmers in highland area had more better understanding of the climate change. It is quite possible, given the Pancasari village as appreciation of highland area is part of a tourist resort area, then, making it possible for farmers to obtain more extensive information.

Table 4. Econometric Analysis for Farmers Perception

Independent Variable	Coefficient	S.E.	Wald	df	Sig.	Exp.(B)
Education	0.990	0.308	10.354	1	0.001	2.691
Experience	-0.131	0.680	0.037	1	0.847	0.877
Income from farming	0.782	0.439	3.170	1	0.075	2.185
Access to counseling	-.734	0.891	0.679	1	0.410	0.480
Involved in farmers group	0.922	0.837	1.212	1	0.271	2.514
Agro-Ecology	-1.770	0.695	6.492	1	0.011	0.170
Constant	-3.263	1.131	8.321	1	0.004	0.038

3.3.2 Factors Affecting Adaptation Strategy

Regarding to factors affecting adaptation strategies on climate change were employed by farmer, only five of ten options strategy adaptation that has been chosen. These fifth options: choosing new varieties, cultivate other agricultural plant species, change the time of planting, adjust crop management, and engage in activities outside of agriculture. Therefore, to eliminate the possibility of interactions among the adaptation decisions of farmers, five different binary logit regression models were ran for each adaptation strategy. The results of analysis are coefficient values (marginal effect), sig, and the odds ratio (Exp.) of independent variables on the probability of each adaptation option are presented in Table 5.

From Table 5 only two factors were found to significantly affect in selecting new varieties (strategy 1). These variables are level of income and agro-ecological area. However, it does not mean other variables are not influenced (zero ratio), but their effect were very small. It could be for other research results will be significant. The analysis indicated the negative sign on income variables but indicated the positive sign with agro-ecological area. Therefore, based on the value odds ratio we can interpret that the farmer with higher income have low probability to adapt the adaptation strategy of using new varieties and vice versa farmers who are in the lowlands agro-ecology area tend to implement a strategy with select new varieties in dealing with climate problems. The odds ratio for income 0.174, it means the tendency of farmers with higher income did not adopt this strategy, 0.174 times than farmers with lower incomes. Similarly, the odds ratio values for agro-ecological area 3.88, it means the trend of farmers in lowland area adopted this strategy 3.88 times than farmers in highland are.

Table 5. Econometric Analysis for Adaptation Strategy Adopted by Farmers

Independent Variable	Adaptation Strategy were Adopted by Farmers									
	selecting new varieties		cultivate other agricultural crops		change the time of planting		adjusting the management of crops		involved in off-farm job	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Age	0.724	0.361	0.681	0.388	-0.079	0.917	-1.068	0.163	-1.026	0.466
Education	0.191	0.782	0.368	0.618	0.251	0.722	0.367	0.587	2.149	0.083
Experience	-0.078	0.897	-0.265	0.659	-0.076	0.893	0.419	0.464	-0.175	0.832
Income as farmer	-1.750	0.071	-1.720	0.062	-1.557	0.117	-0.279	0.753	-0.806	0.569
Other income	-0.392	0.542	0.107	0.869	-0.759	0.231	-0.057	0.923	-0.023	0.977
Irrigation Condition	-.166	0.778	0.094	0.880	0.543	0.331	0.730	0.209	-1.684	0.044
Involvement in farmer groups	-0.420	0.570	0.087	0.904	-1.037	0.138	0.011	0.988	1.062	0.350
Access to counseling	0.389	0.632	0.486	0.541	-0.026	0.971	0.356	0.649	-0.894	0.444
Access to credit	0.705	0.294	0.755	0.261	1.046	0.089	-2.150	0.002	-3.028	0.005
Access to technology	0.178	0.847	0.326	0.718	-0.079	0.916	0.634	0.427	2.488	0.052
Land of inheritance	-21.041	0.999	-20.724	0.999	1.035	0.557	0.513	0.741	0.547	0.924
Ownership	-20.956	0.999	-20.505	0.999	1.038	0.571	-0.149	0.927	0.285	0.961
sharecroppers	-21.450	0.999	-20.097	0.999	0.301	0.867	0.171	0.915	1.674	0.773
Renting/land contract	-20.048	0.999	-40.497	0.999	-.405	0.853	1.730	0.385	1.731	0.776
Combine land	-21.356	0.999	-21.596	0.999	0.183	0.932	1.433	0.497	3.411	0.601
Temperature	0.152	0.817	0.959	0.170	0.821	0.157	-.189	0.745	0.998	0.264
Rainfall	0.954	0.121	0.372	0.552	0.780	0.210	-.358	0.556	0.294	0.738
Agro-ecology	1.356	0.081	0.177	0.798	-0.538	0.382	-.463	0.474	-1.438	0.213
Constant	19.544	0.999	18.633	0.999	-0.013	0.995	0.010	0.996	-3.183	0.602

Only level of income of the prospective factors that significantly influenced farmers' decisions in

cultivating other agricultural crops (strategy 2) as an adoption strategy to climate change. It was identified a negative sign of the coefficient this variable. Base on the odds value, we can interpret it that farmers with more higher of income have low probability to implement a diversification strategy than farmers with lower level of income. The odds ratio 0.179, It means the tendency of farmers with higher incomes did not adopt this strategy, 0.179 times than farmers with lower incomes. This likely due to the richer farmers are not interested in cultivating other agricultural crops.

Access to credit was the only one variable that significantly affected the changing cropping calendar (strategy 3) as farmer's adaptation strategy. In this case, identified a negative relationship between adopted of strategy 3 with access to credit. It means that by gaining access to credit, the tendency of farmers to implement a strategy to change their planting date in low probability. The odds ratio 2.486 asserted that the probability of farmers with access to credit did not adopt changing cropping calendar as their strategy, 2.486 times the farmers had not access to credit.

Access to credit is also the only variable that significantly influenced farmers' decisions in selecting adaptation strategy 4 (adjust the cropping management). Base on the value of odds ratio, we can interpret that farmers who access to credit have a higher probability to adopt adjusting of cropping management strategies. The odds ratio for credit access by 0.117 asserted that the farmers gained access to credit adopting strategy 4, 0.117 times the farmers who did not get access to credit.

Education, availability of irrigation, access to credit, and access to technology are the variables that significantly influenced farmers' decisions in adopting adaptation strategy 5 (involved in off-farm job). Positive sign of the marginal effects were shown by variable education and access to technology weapons but a negative sign of the marginal effects were shown by availability of irrigation and access to credit. Therefore, based on the odds ratio value, we can interpret that the farmers with higher education and having access to technology were more likely to adopt the strategy involved in off-farm job. Otherwise, with adequate irrigation conditions and accessibility to credit from financial institutions, the farmers were less likely to adopt the strategy involved in off-farm job. The odds ratio for education 8.580 asserted that the tendency of farmers with higher education to adopt the strategy 5, 8.580 times the farmers with lower education. Farmers who face adequate irrigation conditions tended not to adopt this strategy. It is shown from the negative sign on the coefficient value. This probability reached 0.186 times than the farmers who face inadequate irrigation conditions. Farmers who gain access to credit also tended not to apply this strategy as demonstrated from the negative sign on the coefficient. This trend reached 0,048 times from those who did not get access to credit. However, farmers who have access to technology tend to implement this strategy as shown from the positive sign on the coefficient. This trend reached 12.043 times than the farmers who did not have access to technology.

5. Conclusion

The study was conducted to analyze farmer profile, perception, and adaptation strategy adopted. Most of farmers have been felt the climate change and it is impact. This was shown by the majority of respondents (73.2%) said that there has been a rise in temperature, 28.87% said it has been the uncertain rainfall patterns, and 36.08% of the farmers have a perception that climate change as a result of natural factors and humans. The result also showed farmer's perception of climate change was significantly related to education, income, and agro-ecology. However, experience, income, irrigation conditions, access to credit, access technologies, and ecological areas were factors that significantly influenced farmer's strategies employed to adapt.

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