



STUDYING FARMERS' VIEWPOINTS ON CLIMATE CHANGE AND ADAPTATION STRATEGIES: A CASE STUDY IN BIRBHUM DISTRICT OF WEST BENGAL, INDIA

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Abstract: In Mayureswar II block of Birbhum district, West Bengal, a research project was conducted on farmers' perceived prevalence of climate change, as evidenced by phenomena like rising temperatures, fluctuating rainfall, etc., and in the areas considered agro-ecological areas. The aim of the study was to determine the extent of the farmer's opinion about the climate change and their adaptation strategies to deal with losses caused by the climate change. The farmers' perspective of climate change had a significant impact on their readiness to adjust their cultivation and production practices in response to the changing environment, as evidenced by the findings. The results demonstrated that respondents with a high level of perception on climate change were farmers. Based to the results, half of the respondents expressed optimism about their ability to deal with the effects of climate change if they received the necessary government support. Merely about 13% of farmers thought positively of the government's climate change policies. About the adaptation tactics, the majority of respondents did not adopt any strategies in this regard, whereas 40% of respondents adopted techniques to some extent.

Index Terms- Adaptation, Adaptation strategies, Climate change, Perception.

I. INTRODUCTION:

Uncertainty and insecurity are being created in many facets of the global settings that are essential to the survival of life due to the rapid changes in climate. Due to its potential harm to the environment, human health, food security, economic activity, natural resources, and physical infrastructures, climate change poses a severe danger to the country's ability to develop sustainably (Patrick et al., 2017). Floods, droughts, irregular rainfall patterns, and other extreme events are examples of how climate change is having a negative impact on agriculture and food security programs. Reduced agricultural productivity is mostly caused by climate change phenomena as drought, floods, and soil degradation (Asrat and Simane, 2017a). In addition to these factors, smallholder farmers' ability to adapt to climate change is being reduced or made more vulnerable by an increased dependence on traditional farming methods and inadequate supplementary services (marketing, credit, extension, etc.). This has a negative impact on the performance of the nation's already fragile agriculture sector (Asrat and Simane, 2017a). Only in the following situations can farmers take action to mitigate climate change: (a) they must be able to recognize that climate change is actually happening; (b) they must be able to recognize the options available to them for adaptation; and (c) they must respond to climate change adaptation in accordance with the production practices used in agriculture and related sectors (Adiyoga, 2018). Consequently, it is crucial to fully comprehend how farmers view climate change because it will determine whether or not they are willing to modify their current methods of cultivation and production in order to mitigate the effects of climate change (Das, 2009). Therefore, it is critical to comprehend the factors that influence smallholder farmers' perceptions of and responses to climate change in relation to their particular locations. This becomes useful in developing appropriate policies or strategies that take into account each location's level of sensitivity and vulnerability as well as the accessibility of available adaption choices. In this context, the current study was conducted in the West Bengali hamlet of Kanutia in the Birbhum district with the aim of determining the degree of farmers' perception regarding climate change and their adaption techniques. The Sustainable Development Goals (SDGs) are a set of 17 global goals adopted by the United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet, and ensure prosperity for all by 2030. Several of these goals are closely related to climate change and agricultural production such as - Goal 2: Zero Hunger, Goal 7: Affordable and Clean Energy, Goal 12: Responsible Consumption and Production, Goal 13: Climate Action and Goal 15: Life on Land.

II. MATERIALS AND METHODS:

The study was conducted in the Birbhum district of West Bengal, specifically in the Moyureswar II block. 30 respondents who were personally interviewed for the study were selected for using random method techniques as per the parameters in table 1. Using a slightly modified version of Kaur and Talukdar's (2007) methodology, farmers' perceptions of climate change were examined using a three-point continuum with 2, 1, and 0 scores. The responses were gathered in relation to every response category. Additionally, the results of the eighteen aspects of this variable were added up to determine each respondent's perception scores. The method described by Das (2009) was used to classify respondents into three categories based on their overall

scores: low, medium, and high. Following discussions with representatives from the Department of Agriculture and related fields, nine variables were selected: age, educational attainment, yearly income, operational land size, number of years in cultivation, exposure to training, number of cattle, exposure to the media, and communication with various departments. It was anticipated that the respondents' socioeconomic and individual characteristics would affect how they felt about climate change. Karl Pearson's Product Moment Correlation Coefficient (Narinder Kumar, 2017) was utilized to determine the association between farmers' perceptions of climate change and their socioeconomic traits. In order to determine the adaptation techniques employed by the participants, a series of questions outlined in Table 4 were formulated and answered by the respondents.

III. RESULTS AND DISCUSSION:

- **Farmers' perception about climate change:** Analyzing Table 1, it was found that 80.00 % of respondents perceived climate change to some degree, whereas 16.67 % of respondents understood it extremely well. Likewise, 50.00 percent of participants reported observing a partial decrease in the groundwater table. It was evident that all of the respondents had the same concerns over the rising annual temperature. However, only 73.33% of respondents knew that the length and timing of the seasons are changing. This is because, even during the season of seeding and transplanting seedlings, these events must wait for favorable soil and environmental conditions, which are not happening as quickly as they once were. The frequency of unpredictable and variable rainfall is rising (by 70%) as a result of both occasional dry spells that leave plants in crucial growth stages without enough water and brief periods of intense rainfall that create temporary flood-like conditions. Similarly, Asrat and Simane (2018) also found that, when it came to rainfall, roughly 55% of respondents pointed out a decreasing trend while 34% perceived an increasing trend. Over 55% of respondents perceived an increasing trend in temperature, while 42 and 25% of them perceived a stable and decreasing temperature, respectively. Calamities caused by nature are on the rise (40.00%) due to an increase in storms, hailstorms, and earthquakes over the past several years. Due to the use of excessive chemical fertilizers, soil health is declining (53.33%) which is causing a daily decline in the number of native soil organisms. These results are consistent with the research conducted by Kassie et al. (2009) and Wossen et al. (2015). Similar trends are observed in the population of weeds (46.67%), livestock illnesses (53.34%), and people's modern lifestyles (66.67%), which involve the use of various technological devices in daily life. Farmers are fully aware that excessive fertilizer and chemical use contributes to climate change and environmental pollution (63.34%). The majority of farmers, more or less, agreed that small and marginal farmers are dealing with the effects of climate change. This outcome may be explained by the respondents' educational background and socioeconomic exposure to climatic changes. Smallholder agriculture's ability to adapt to these changes is essential to reducing rural poverty and preserving the health of ecosystems. This is consistent with studies conducted by Deresa et al. (2009) and Asrat et al. (2004). In addition, it was discovered by Asrat and Simane

(2017a) that farmers adopted a two-pronged approach to climate change adaptation, first evaluating the effects of the changes and then adjusting as a response.

The respondents' scores ranged from a minimum of 2.00 to a high of 30.00, with a mean value of 18.96 and a standard deviation of 6.34. Additionally, 6.60, 36.70, and 56.70 percent of the participants have low, medium, and high perceptions of climate change, respectively. The findings demonstrate that respondents with a high level of perception on climate change are farmers (Table 2). This outcome might be the result of the farmers' real-life experiences and the difficulties they encounter, which enable them to completely understand all changes in the climate and their effects.

Table 1: Distribution of respondents based on responses on Farmers' perception about climate change (No. of respondents 30).

Sl. No.	Dimension	Response category	Frequency	%
1	Climate is changing	Perceived a great deal	5	16.67
		To some extent	24	80.00
		Not at all	1	3.33
2	Groundwater table is depleting	Perceived a great deal	6	20.00
		To some extent	15	50.00
		Not at all	9	30.00
3	Temperature is increasing	Perceived a great deal	13	43.33
		To some extent	17	56.67
		Not at all	0	0.00
4	Stubble burning is harmful for the environment	Understand a great deal	3	10.00
		To some extent	23	76.67
		Not at all	4	13.33
5	Zero tillage and other conservation method is beneficial for the environment	Understand a great deal	3	10.00
		To some extent	10	33.33
		Not at all	17	56.67
6	Duration and timing of seasons are changing	Agree a great deal to	4	13.33
		To some extent	22	73.33
		Not at all	4	13.34
7	Occurrence of irregular and erratic rainfall is increasing	Agree a great deal to	7	23.33
		To some extent	21	70.00
		Not at all	2	6.67
8	Natural calamities are increasing	Agree a great deal to	3	10.00
		To some extent	12	40.00
		Not at all	15	50.00
9	Satisfactory crop production is	Agree a great deal to	13	43.33

	becoming a challenge	To some extent	13	43.33
		Not at all	4	13.34
10	Climate change is affecting the cultivation	Agree a great deal to	13	43.33
		To some extent	14	46.67
		Not at all	3	10.00
11	Soil health is deteriorating	Perceived a great deal	8	26.67
		To some extent	16	53.33
		Not at all	6	20.00
12	Weed population is increasing	Agree a great deal to	9	30.00
		To some extent	14	46.67
		Not at all	7	23.33
13	Diseases of cattle are increasing	Agree a great deal to	4	13.33
		To some extent	16	53.34
		Not at all	10	33.33
14	Climate change is affecting our daily life	Perceived a great deal	1	3.33
		To some extent	21	70.00
		Not at all	8	26.67
15	People's modern lifestyle is responsible for climate change	Agree a great deal to	2	6.66
		To some extent	20	66.67
		Not at all	8	26.67
16	Extreme use of chemicals and fertilizers leads to environment pollution and climate change	Agree a great deal to	7	23.33
		To some extent	19	63.34
		Not at all	4	13.33
17	Small and Marginal farmers are facing the climate change problem	Agree a great deal to	9	30.00
		To some extent	14	46.67
		Not at all	7	23.33
18	Production is hampering because of climate change	Perceived a great deal	17	56.67
		To some extent	12	40.00
		Not at all	1	3.33

Table 2: Distribution of respondents depending on various perception levels about the climate change.

Category	Score range	Frequency of respondents	Mean	S.D.
Low	2-7.5	2 (6.60)	18.96	6.34
Medium	7.6-15.0	11(36.70)		
High	15.1-30.0	17(56.70)		

Table 3: Relationship between Farmers' perceptions about climate change and socio-economic characteristics of the respondents.

Sl. No.	Variables**	'r' value
1	Age	-0.421*
2	Education level	0.349*
3	Annual income	0.122
4	Size of operational land	-0.136
5	No. of years in cultivation	-0.392*
6	Training exposure	0.235*
7	No. of cattle	-0.011
8	Mass-media exposure	0.404*
9	Communication with different departments	0.264*

*Significant at 0.05 % level; ** variables have been selected based on personal and socio-economic characteristics of respondents after consulting with officials of the department of agriculture and allied sectors.

Table 4: List of Farmers' Adaptation strategies.

Adaptation strategies		Frequency (N=30)	%age
Applied adaptation strategies	Yes	12	40.00
	No	18	60.00
Different adaptation measures taken	Planting fruit tree /tree	12	40.00
	Cultivation of tolerant varieties	2	6.66
	Livestock management	5	16.66
	Re excavation of pond	-	-
Other coop up mechanism	Off farm employment	28	93.33
	Looking for government aid	30	100.00
	Reduction of consumption	21	70.00
	Use of credit services	26	86.66
	Selling assets like livestock	20	66.66
Who to solve climate problem	Government	30	100.00
	God	12	40.00
	Farmers with Government assistance	15	50.00
Heard about Government's plans on climate	Yes	4	13.33
	No	26	86.66

Can we have capacity to solve the climate problems	Yes	-	-
	No	30	100.00

The findings presented in Table 3 indicate a positive and statistically significant relationship between farmers' perceptions of climate change and their educational attainment, training exposure, exposure to mass media, and communication. This relationship may be explained by the possibility that the income from these sources gives farmers more financial resources to support mitigation efforts. According to studies by Deresa et al. (2009) and Asrat et al. (2004), education was also positively connected with farmers' views of climate change and suggestions for adaptation because educated people were better able to identify the risks associated with climate change. The results also demonstrate that farmers' perceptions of climate change are negatively but significantly connected with age and years of cultivation, suggesting that revenue from these sources may not be utilized for funding crop sector adaptation. Asrat and Simane (2018) also reported similar results. It suggests that farmers' perceptions of climate change are shaped in large part by social mobilization and education. According to Graft and Onumah (2011), farmers' perceptions of climate change were significantly improved by education. According to Sofuluwe et al. (2011), farmers' perceptions of climate change were significantly positively influenced by their family's annual income.

Regarding adaption strategies, 40% of participants reported using them to some extent, but the rest claimed not to use any at all. The respondents implemented various adaptation strategies, including planting fruit trees and other trees (40%), growing resistant types (6.6%), and managing cattle (16.6%). This result is consistent with studies by Lobell et al. (2008) and Asrat and Simane (2017b), which demonstrated that farmers could mitigate the negative effects of climate change, particularly in low-rainfall areas, by planting fruit trees or other trees that require less rainfall, raising livestock, or growing drought-tolerant varieties. Furthermore, cultivating high-value horticultural crops, such as fruit crops, is a wise adoption strategy that aims to maximize profits and make more efficient use of limited natural resources, such as land and water. Furthermore, in order for small and marginal farmers to thrive in the event of climate change, suitable methods are essential. The majority of respondents (93.3%) made an effort to adapt to the perceived effects of climate change by taking up off-farm jobs such as daily paid labor in various fields such adjacent building construction, leather, jewelry, and cloth manufacturing factories, or by moving to different states. This may be explained by the fact that the farmers were able to develop strong mental fortitude to handle the potential risks associated with climate change thanks to the easy money they made from these off-season jobs. The results fall within the area of Ansari et al. (2018)'s research findings. Regarding household consumption, around 70% of respondents attempted to mitigate the effects of climate change. The country's food security was ultimately impacted by reductions in household consumption levels, including those related to quantity and diversity of food items, as they had an impact on human health and productivity. Approximately 86% of those respondents attempted to mitigate the negative effects of climate change by using financial services. This approach might make society even more vulnerable to the effects of climate change and extend the poverty-vulnerability vicious loop. Approximately 66% of respondents stated that selling household assets,

such cattle, is a typical practice to generate more revenue and lower household expenses in the event that crops fail due to climate change-related events like droughts or floods. Asrat and Simane (2017b) and Lobell et al. (2008) also documented similar observations in their study results. Every responder anticipates that government assistance will be necessary to meet the problem. Furthermore, 40% of respondents are unsure if they would receive the same level of support from the government. According to 50% of respondents, farmers can handle the challenges posed by climate change on their own if they have the necessary government support. Just 13% of farmers were aware of the government's initiatives regarding climate change. All of the respondents believed that while we can take different actions, we are not capable of solving the climate concerns.

IV. Conclusion:

The study came to the conclusion that farmers believed that climate change was present, as evidenced by the occurrences the study stated, including rising temperatures and erratic rainfall. According to the results of the two-year trial, farmers in the agroecological zones under consideration are attempting to adjust to the effects of climate change on their means of subsistence by putting accessible and reasonably priced technologies into practice. However, we must help them take advantage of every opportunity. The results demonstrated that social mobilization and education are important factors in shaping farmers' perceptions of climate change. While the majority of respondents don't use any techniques at all, about 40% of respondents followed one or more strategies. About 70% of respondents tried to reduce household consumption in order to combat the perceived effects of climate change, whereas the majority of respondents (93.3%) tried to address the issue by adopting elsewhere employment. Addressing the challenges posed by climate change to agricultural production requires a multi-faceted approach that combines adaptation and mitigation strategies. Here are some ways to overcome this situation: Promoting Climate-Smart Agriculture (CSA), Improving Water Management, Building Resilient Crop Varieties, Soil Health Management, Enhancing Agroecosystem Diversity, Capacity Building and Knowledge Transfer, Policy Support and Institutional Frameworks and Investing in Research and Innovation. But till now we should need to improve the rate of participation of the farmers for adapting strategies of climate change.

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