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Soniya Rishi

Ph.D. Research Scholar,
Department of Extension
Education, RCA, MPUAT,
Udaipur, Rajasthan, India

Dr. KC Meena

Associate Professor & HOD,
Department of Agricultural
Extension and Communication
College of Agriculture, Kota
Rajasthan, India

Nitesh Kumar Tanwar

Ph.D. Research Scholar,
Department of Extension
Education, RCA, MPUAT,
Udaipur, Rajasthan, India

Krishna Kumari Purbia

Ph.D. Research Scholar,
Department of Extension
Education, RCA, MPUAT,
Udaipur, Rajasthan, India

Corresponding Author:

Soniya Rishi

Ph.D. Research Scholar,
Department of Extension
Education, RCA, MPUAT,
Udaipur, Rajasthan, India

Socio-economic factors affecting the adaptive capacity of farmers towards climate change

Soniya Rishi, Dr. KC Meena, Nitesh Kumar Tanwar and Krishna Kumari Purbia

Abstract

Climate Change is pressing global challenge with minor implications particularly for agricultural communities. Farmers as frontline stakeholders face increasing exposure to climate – related risks. The adaptive capacity of farmers is very important for developing influential strategies to mitigate and adapt to these challenges. The Socio – economic position of farmers plays an important role in shaping their helpful activities. Various socio-economics factors including education, age, social participation, income, mass media exposure, land ownership and its nature influence their responded to climate change. The finding of the study also revealed that education, access to climate information, social participation, farming experience years, access to extension contact, mass media exposure, off farm income, operational land holding, area under irrigation and level of knowledge about climate changes level were found positive and significantly associated with adaptive capacity of farmers towards climate change.

Keywords: Climate change, factors affecting, adoptive capacity, farmers

Introduction

Climate change stands as one of the most pressing issues in our contemporary world, significantly reshaping and presently modification the Earth's ecosystems. While climate change has been an ongoing natural process, particularly in recent times over the last century, the pace of these alterations has accelerated exponentially. Human activities, primarily the emission of greenhouse gases (GHG_s), have led to an approximate 0.9 °C increase in the average global temperature since the nineteenth century. Projections indicates that this increase could reach 1.5 °C or more by 2050 due to ongoing deforestation, escalating GHG emissions and pollution of soil, water bodies and the atmosphere. The Consequences of climate change manifest in alarming rates of land degradation, contributing to increased desertification and the depletion of vital nutrients n soils. This degradation fuels widespread migrations, a situation underscored by a 2017 report from the United Nations Environmental Programme, revealing the abandonment of 500 million hectares of farmland due to drought and desertification, imposing substantial social and environmental challenges. Adaptive Capacity refers near the ability of a system or group of people to adjust changing condition such as those brought about by climate change. Farmers in particular face significant challenges due to climate change and several factors influence their adaptive capacity. Knowledge and Awareness, Access to Information and Technology, Financial Resources and Access to Credit, Social Networks and Support Systems, Infrastructure and Technology Development, Policy and Institutional Support, Land Tenure and Property Rights, Education and Training, Market Dynamics and Access to Markets, Climate Variability and Past Experience, Physical Vulnerability and Location: These factors, governments, NGOs, and agricultural organizations can work to improve the adaptive capacity of farmer's and promote climate-resilient agricultural practices. Education plays an important role as a valuable source of knowledge for managing farm operations effectively. This knowledge is acquired through various channels, including formal education from agricultural colleges and informal learning through extension services, as well as interactions with progressive farmers in the neighborhood. The health of the labor force significantly influences the capacity to engage in various farming activities. A healthy labor force enables households to undertake diverse farming tasks, including adjusting crop and livestock management practices to adapt to changing climatic conditions. Limited market access can hinder farm-level adaptation potential. Farmers with access to both input and output markets are better positioned to implement adaptation measures.

Input markets facilitate the acquisition of essential farming resources such as different seed varieties and fertilizers, irrigation technologies. Conversely, access to output markets motivates farmers to cultivate cash crops, enhancing their resource base and ability to respond to climate change. Mano *et al.*, (2003) [7] Cooper *et al.*, (2008) [11] assessed farmers' adaptive capacity by considering various livelihood assets: social, human, physical and financial capital. A diversified asset base enhances people's adaptive capacity, ensuring greater livelihood security and sustainability in the face of changing climatic conditions. Jones *et al.*, (2010) [3] noted that local adaptive capacity is influenced not only by the available resources for climate change adaptation but also by how these resources are utilized and managed.

Understanding the existing farm-level adaptation strategies and farmers' perceptions of potential future adaptation strategies is vital for formulating additional adaptation initiatives and fostering social learning among farmers to effectively cope with future climate risks. The connection between farmers' perception, learning processes and their decisions to embrace or resist adaptation strategies in agriculture remains a debated topic in the literature. There is limited empirical research exploring both the understanding of farmers' adaptive capacity and the motivations that drive their actions or inactions in response to climate change. This study aims to identify the socio-economic factors that impact farmers' adaptive capacity to climate change.

Methodology

The present study was conducted in Bundi district of Rajasthan, India. Bundi district is selected purposively for the study as the district is the agri-dominant region with ample opportunities for agriculture having black fertile alluvial soils, strong irrigation infrastructure, advanced farming practices adopted by the farmers and productivity higher than that of the state and in some cases, higher than that of the average of the country. A multi-stage sampling design was used to select the samples farmers as respondents. Based on Agro Ecological Situations, the district divided into three clusters namely, i. Command area with assured irrigation and heavy soils, ii. Command area with un assured irrigation and medium soils and iii. Non command area with medium soils and well irrigation. In second stage, two representative villages from each Agro Ecological were selected. Finally at last stage, 175 farmers from six selected village were selected as respondents of present study.

An interview schedule consisting of measuring devices of dependents and independents variables along with the face data of farmers was used for collecting responses of the respondents. Data were collected by personally interviewing the respondents with the help of pretested structural schedule. The collected data were tabulated properly. Mean and standard deviation, coefficient of correlation method of statistics were used for interpretation of data. Measurement mechanism followed for the independent variables for this study were described as;

- a) **Age:** Age refers to the sequential age of the respondents in years in whole number. Modified scale developed by (Trivedi, 1963) [8] was used and scoring was done as per scale.
- b) **Education:** It refers to the number of years of formal education attained by the respondents. Scores of different educational levels were given according to scale developed by (Trivedi, 1963) [8].

- c) **Access to climate information:** Access to information of the individual farmer about Climate Change was measured through a scale developed by (Jaishi *et al.*, 2018) [9] with some modification as per requirement of the study.
- d) **Social participation:** Modified scale developed by (Trivedi, 1963) [8] was used and scoring was done as per scale.
- e) **Farming experience years:** It was the number of years of experience of the individual farmer. In this study, this was considered as the total number of years a farmer has actual involvement in farming. Later the respondents were categorized as low, medium and high experienced based on mean and standard deviation as a measure of check.
- f) **Access to extension contact:** It had been operationalized as the degree of contact of respondents with extension personnel. This was measured with the help of a schedule developed for the purpose. The total score of a respondent for all questions was computed and arranged in an array.
- g) **Mass media exposure:** Mass media coverage had been operationalized as the degree to which a respondent was exposed to mass media (Radio, Television, Exhibition/Kisan Meals, Farm Magazines and Newspapers) for obtaining information concerning agricultural technology. It was measured in terms of listening to farm broadcast (radio and television), reading of farm literature, and visit to Kisan Meals etc. during the last one year. Exposure of respondents to farm broadcast through radio, television and farm literature was given the scores of 4, 3, 2, 1 and 0 for daily, weekly, fortnightly, seldom and never, respectively. Besides, the score of one each to correct name of farm magazine, name of radio and television farm programmer and their times of broadcast indicated by the respondents were assigned. The respondent's visits to Kisan Mela during past three constant years were taken into account. The scores so obtained by the respondents for all questions were summated in order to arrive at their final mass media exposure scores.
- h) **Off farm income:** It was the per annum gross income of a farmer derived from non-farming sources like service, business etc. It was expressed in thousands of rupees per annum. The respondents were categorized into several income classes.
- i) **Operational land holdings:** It refers to the cultivated land in hectare possessed by the respondents. Modified scale developed by (Trivedi, 1963) [8] was used and scoring was done as per scale.
- j) **Area under irrigation:** It refers to the cultivated land in hectare irrigated by any sources of irrigation. Modified scale developed by (Trivedi, 1963) [8] was used and scoring was done as per scale.
- k) **Knowledge about climate change:** Knowledge of the individual farmer about Climate Change was measured through a scale developed by (Jaishi *et al.*, 2018) [9] with some modification as per requirement of the study.

Results and Discussion

The socio-economic status of farmers plays a key role in creative activities. Socio-economic parameters such as education, age structure, education, social participation, income and mass media exposure, size and nature of

ownership of land holding influence their response to climate change. Studies on these variables attempted not only to explain the overall socio-economic conditions of the farmers, but also identified the factors inhibiting the realization of the full potential of agriculture and the appropriate area for government intervention (Sathiadhas and Panikkar, 1988) [10]. The interactions of personnel, psychological and situational factors always influence strategies and adoption of the improved agricultural production practices. Hence, socioeconomic profile of the respondents is important to establish and explain the possible relationships among different socio-economic variables with adoptive capacity of framers towards climate change.

Age

Age was measured as the number of years completed by the respondent at the time of data collection. The respondents were categorized into three groups of young, middle aged and old and the results are presented in the Table1. It was evident that majority of the respondents belonged to old age group (41.14%) followed by middle age group (36.57%) and young age group (22.29%).

Table1: Distributions of respondents according to their age

Age Group	Respondents	
	Number	Percent
Young (below 35 years)	39	22.29
Middle (35-50 years)	64	36.57
Old (More than 50 years)	72	41.14
Total	175	100.00

Education

Education builds the ability of an individual to seek knowledge, understand and adoption things efficiently. Education also has an effect on irrigation, insurance and marketing network in adaptive capacity to climate change. Experience helps in thinking in a better way and makes a person more mature to take right decision. They were categorized into five categories and presented in the following table 2. It was evident that majority of the respondents 28 per cent were educated up to middle, followed by secondary 21.15 per cent, primary 20.57 per cent, while illiterate 16.57 per cent and graduate and above belonged to 13.71 per cent. This low level of literacy could be due to poor financial conditions, lack of good education facilities of the rural areas, lack of awareness among the farmers about the importance and need of education and also of inevitable necessity in the family to help their parents in farming instead of ongoing school due to financial problems. Most of the marginal and small farmers who were poor could not go for higher education. As most of the higher educational facilities were available far away from the village, school dropout is still the problem especially after the middle school level.

Table 2: Distribution of respondents according to their education

Education	Respondents	
	Number	Percent
Illiterate	29	16.57
Primary	36	20.57
Middle	49	28.00
Secondary	37	21.15
Graduate and above	24	13.71
Total	175	100.00

Access to climate information

It revealed from Table 3 that majority of respondents 42.29 per cent had low access to information related to climate change and related issues. Further, 40.00 per cent respondents had medium whereas, only 17.71 per cent respondents had high access to climate information. It was heartening to note that major group of farmers had low access to climate information.

Table 3: Distribution of respondents according to access to climate information

Extent of climate information	Respondents	
	Number	Percent
Low	74	42.29
Medium	70	40.00
High	31	17.71
Total	175	100.00

Social participation

It evident in Table 4 that majority nearly 50 per cent the respondents has low level of social participation. However, only small segment of respondent 21.71 per cent had higher level of social participation.

Table 4: Distribution of respondents according to their social participation

Extent of social participation	Respondents	
	Number	Percent
Low	88	50.29
Medium	49	28.00
High	38	21.71
Total	175	100.00

Farming experience years

Farming experience is directly associated with the sequential age of the respondents. Old aged may have more experiences than younger one. Experience help in thinking in a better way and makes a person more mature to take right decision. The respondents were categorized into three categories based on classed interval method and presented in the Table 5. It was clearly indicates that, majority of respondents 83.43 per cent had more than 20 years of farming experience. Further 10.29 per cent of respondents had 10 to 20 years of farming experience whereas, nearly 6 per cent of respondents had farming experience less than 10 years. This was probably due to the fact that majority of the farmers in the districts belong to middle and old age group.

Table 5: Distribution of respondents according to Farming experience years

Extent of farming experience	Respondents	
	Number	Percent
Low (<10 years)	11	6.28
Medium (10-20 years)	18	10.29
High (>20 years)	146	83.43
Total	175	100.00

Access to extension contact

The data presented in the table6 clearly reveals that majority respondents 49.14 per cent had access to extension contact whereas 36.57 per cent had moderate access to extension contact and 14.29 per cent had high access to extension contact.

Table 6: Distribution of respondents according to access to extension contact

Extent of extension contact	Respondents	
	Number	Percent
Low	86	49.14
Medium	64	36.57
High	25	14.29
Total	175	100.00

Mass media exposure

Mass media appears to play a signification role in creating

awareness among the farming community. Mass media exposure is the degree of exposure that each respondent had to print media (newspapers and farm magazines) radio and television. The respondents were classified into three groups of low, medium and high of mass media exposure and the results are presented in Table 7. It was revealed that 60.00 per cent respondents was in the low exposure category, while those in medium level of mass media exposure and in the high exposure category were 23.43 per cent and 16.57 per cent respectively. This clearly reveals the highly skewed nature of distribution.

Table 7: Distribution of respondents according to use of mass media

Extent of use mass media	Respondents	
	Number	Percent
Low	105	60.00
Medium	41	23.43
High	29	16.57
Total	175	100.00

Off farm income

Off farm income data presented in Table 8. It was found that majority of the respondents 45.71 per cent had Rs 50,000 to 2,00,000 lakhs annual off farm. Nearly 23.00 per cent of respondents had annual off farm between Rs. 2,00,000 to 5,00,000 lakhs. Further, 12.57 per cent of respondents had annual off farm more than rupees 5,00,000 lakhs whereas 18.86 per cent of respondents had annual off farm less than Rs 50,000.

Table 8: Distribution of respondents according to their off-farm income

Off farm income	Respondents	
	Number	Percent
up to 50,000	33	18.86
50,000 – 200000	80	45.71
200000-500000	40	22.86
more than 500000	22	12.57
Total	175	100.00

Operational Land Holdings

The frequency distribution of farmers on operational land holdings in the data presented Table 9. A cursory look at the table reveals that majority of respondents were possessing small 40.00 per cent to medium 40.57 per cent sized operational holding and 12 per cent of respondents were possessing marginal sized land holding.

Table 9: Distribution of respondents according to operational holding

Operational land holding	Respondents	
	Number	Percent
Marginal (less than 1 hectare)	21	12.00
Small (1-2 hectare)	70	40.00
Medium (2- 10 hectare)	71	40.57
Large (more than 10 hectare)	13	7.43
Total	175	100.00

Area under irrigation

Based on the number of standard hectares of farming land under irrigation possessed by the farmers they were categorized into three categories and presented in the following Table 10. A clearly indicates that majority of respondents 36.57 per cent had land under assured

irrigation followed by partial irrigation 33.14 per cent and rainfed irrigation 30.29 per cent.

Table 10: Distribution of respondents according to area under irrigation

Area under irrigation	Respondents	
	Number	Percent
Assured irrigation	64	36.57
Partial irrigation	58	33.14
Rainfed irrigation	53	30.29
Total	175	100.00

Knowledge about climate change

It was revealed from Table 11 that nearly 75 per cent respondents had low to medium level of knowledge about climate related aspects. While, only 26.29 per cent of the was possessing high level of knowledge. This might also be due to the fact that majority of farmers had medium to higher experience in cultivation and also, they had medium to high farmers to farmers information exchange. These two characteristics are very important in improving their knowledge particularly to understand about the climate change.

Table 11: Distribution of respondents according to knowledge about climate Chang

Extent of knowledge	Respondents	
	Number	Percent
Low	60	34.28
Medium	69	39.43
High	46	26.29
Total	175	100.00

Conclusion

Factors collectively will not only enhance the adaptive capacity of farmers but also contribute to building a more resilient agricultural sector capable of withstanding the challenges posed by climate change. The findings of the study also revealed that the education, access to climate information, social participation, farming experience years, access to extension contact, mass media exposure, off farm income, operational land holding, area under irrigation and level of knowledge about climate change were found positive and significantly associated with the adaptive capacity of

farmers toward climate change.

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