



Socio-economic Factors Influencing the Adoption of Coping Mechanism to Climate Change by the Farmers

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Authors' contributions

This work was carried out in collaboration between all authors. Author CV is the student researcher who conducted the research. Authors SS and MS are the chairman and member of the advisory committee who laid out the plan of the research. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried out to examine the factors that influence the adoption of coping mechanisms by the farmers to mitigate the adverse impacts of the climate change. The study employed ex-post facto research design with quantitative data. The study was conducted in Chitradurga district of Karnataka state in 2017. In Chitradurga district, ten villages were selected from two taluks Challekere and Molakalmuru. 15 respondents were interviewed from each village following a simple random sampling procedure, thus constituting a total sample size of 150. The pertinent data were analyzed with statistical techniques like Karl Pearson's Co-efficient of correlation, frequency and percentage using Software Statistical Package for Social Sciences (SPSS) and Microsoft Excel. It was found that the majority of the farmers adopted technologies like installation of drip irrigation, initiating intercropping and change in cropping pattern. The techniques

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like the change in date of sowing, change in variety and protected cultivation was least adopted by the farmers. The results showed that adoption of a technology is influenced by the factors such as age, education, family size, size of land holding, irrigation potential, mass media participation, information seeking behavior, preparedness for adoption and change resistance.

Keywords: Climate change; coping mechanisms; change resistance; adaptation.

1. INTRODUCTION

Climate change and variability are concerns of the human being. The recurrent droughts and floods threaten seriously the livelihood of billions of people who depend on land for most of their needs. The global economy is adversely being influenced very frequently due to extreme events such as droughts and floods, cold and heat waves, forest fires, landslips etc. Climate-related disasters have brought widespread misery and large economic losses to India, while adversely affecting public health, food security, agriculture, water resources and biodiversity. The country recently felt changes in precipitation pattern and temperature. The late arrival of monsoon and erratic behaviour of precipitation have already drawn the eye of national media as over eighty percent farmers rely upon arrival of monsoon to start out cultivation. All these changes cause a significant threat to agriculture, and thus to the country's economy and food security [1]. So global climate change is and will progressively have dramatic impacts on ecological and social systems.

Climate change is a global phenomenon, and now there is a need to implement adaptation strategies to cope up with the changing climate. Adaptation and coping mechanism should be initiated that contribute to poverty reduction. At the same time, it must benefit the most vulnerable communities without harming the environment. Informing about climate change impacts, vulnerability patterns, coping and adaptive capacity as well as facilitating location specific adaptation and coping mechanism are of central concern. Adaptation has the potential to significantly contribute to reductions in negative impacts from changes in climatic conditions as well as other changing socioeconomic conditions, such as volatile short-term changes in local and international markets [2]. With this background, the present study was conducted to analyse the farmers' adaptation to the climate change in Chitradurga district. This investigation

was conceived with the objective of studying the association between the profile characteristics of the farmers with their knowledge on climate change and adaptation mechanisms adopted to combat the adverse effects of climate change.

Knowledge of climate change is inferred as the awareness, familiarity or information about climate change and its consequences gained by experience or learning.

2. MATERIALS AND METHODS

The investigation was conducted in Chitradurga district of Karnataka state. Further, Challekere and Molakalmuru taluks were selected. The Chitradurga district was purposively selected for the investigation based on the intensity of the climate vulnerability experienced. The study was planned to involve two categories of respondent's viz., Adopter farmers and Non-adopter farmers. Adopter farmers are those who have adopted the suitable coping mechanism to combat the effects of climate change and non-adopter farmers are those who have not adopted any coping mechanism to mitigate the impact of climate change. One hundred and twenty adopter farmers and thirty non-adopter farmers were selected from the study area by following a simple random sampling procedure. Thirty non-adopter farmers were selected in order to compare with the adopter farmers as a check.

The structured interview schedule was developed to elicit the response from the farmers. The interview schedule was pretested in the non-sample area. The data collected from the respondents were subjected to statistical analysis including frequency, percentage, Karl Pearson's Correlation coefficient using the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software. The results were expressed in frequency and percentages.

3. RESULTS AND DISCUSSION

3.1 Personal, Socio-economic, Psychological and Communication Characteristics of the Farmers

3.1.1 Personal characteristics of the farmers

3.1.1.1 Age

It could be observed from Table 1 that majority of the adopter farmers belonged to the middle (80.00%) and young (13.33%) age category and the majority of the non-adopter farmers belonged to middle (73.33%) and old (20.00%) age category. This revealed that the adopter farmers were young, enthusiastic, responsible and had a modern outlook to adapt to the changes in their farming. The outcome is in line with the findings of Amuge and Osewe [3].

3.1.1.2 Gender

It could be noted from the Table 1 that 66.67 percent of the non-adopter farmers and 76.67 percent of adopter farmers were male and 33.33 percent of the non-adopter farmers and 23.33 percent of adopter farmers were female. Even though the contribution of women in agriculture is notable, their participation in decision making and the process of adoption of technology was very less might be the reason. This result is similar to the results of Amol [4].

3.1.1.3 Education

In case of adopter farmers, the majority of the respondents had PUC (22.50%) education followed by middle school (17.50%) education. Whereas, the majority of the non-adopter farmers belonged to illiterate (23.33%) and read-only (36.67%) category. As middle and young aged farmers are more in adopter categories who have received formal education, because of realisation of the importance of primary education and also due to free and compulsory education scheme by the government of Karnataka. The villages in these areas had primary school might be the reason for this. The findings are in accordance with the findings of Ashok [5] (Table 1).

3.1.1.4 Farming Experience

A cursory look into the Table 1 showed that majority of the adopter (60.00%) and non-adopter (70.00%) farmers belonged to medium farming experience category. Since most of the non-adopter and adopter farmers belonged to

medium age category of 36 to 55 years and were engaged in agriculture from their young age most of them belonged to medium farming experience category. The findings are similar to that of the findings of Madhushekar [6].

3.1.2 Socio-economic characteristics of the farmers

3.1.2.1 Family size

In case of among adopter farmers, 35.83 percent belonged to the medium sized family, 33.33 percent and 30.83 percent of the farmers belonged to large and small families respectively. Whereas, the majority of the non-adopter farmers belonged to the small family (60.00%) followed by medium (36.67%) and large (3.33%) family (Table 3). This might be the outcome since the majority of the adopter farmers are big farmers with more land holdings and living together in joint families. This outcome is in line with the findings of Shashikiran [7].

3.1.2.2 Size of land holding

The results from the Table 2 conclude that majority of the adopter farmers were having medium (58.33%) sized land holding followed by big (33.33%) sized land holding and 80.00 percent of non-adopters had marginal land holdings. Since the landholding is more in case of adopters, the income is also more and thus they can afford and adopt new technology and coping mechanisms and also it favoured them to take the risk as alternatives were available to take up coping mechanism. Among non-adopters, coping mechanism do not come under economies of scale and also small and marginal farmers cannot afford to adopt coping mechanisms. The results are in line with the findings of Amuge and Osewe [3].

3.1.2.3 Irrigation potential

It is evident from Table 2 that more than half of the adopter farmers (55.83%) and non-adopter farmers (53.33%) had a medium level of irrigation potential. Water availability for irrigation is the major problem in the study area and also a major source of irrigation is bore well which help them to irrigate the crop during the critical period. There were no alternative ways for irrigation water existing in that area and there was continuous crop failure due to droughts might be the reason for the results. The results are similar to the results of Kavyashree [8].

Table 1. Personal characteristics of the farmers

Variable	Category	Criteria	Non adopters(n=30)			Adopters (n=120)		
			Frequency	Percentage		Frequency	Percentage	
Age	Young	Up to 35 years	2	6.67		16	13.33	
	Middle	36 to 55 years	22	73.33		96	80.00	
	Old	Above 55 years	6	20.00		8	6.67	
Gender	Male		20	66.67		92	76.67	
	Female		10	33.33		28	23.33	
Education	Illiterate	No formal education	7	23.33		8	6.67	
	Read only	Can only read	11	36.67		14	11.67	
	Primary school	I – IV Std	6	20.00		19	15.83	
	Middle school	V– VII Std	1	3.33		21	17.50	
	High school	VIII – X Std	4	13.33		16	13.33	
	P.U.C	10 + 2	1	3.33		27	22.50	
	Graduate	Degree and above	0	0.00		15	12.50	
		Criteria	f	%		Criteria	f	%
Farming Experience	Low (< \bar{x} -SD)	< 16.38	4	13.33		< 10.01	23	19.17
	Medium ($\bar{x} \pm$ SD)	16.38 – 36.92	21	70.00		10.01 – 28.08	72	60.00
	High (> \bar{x} +SD)	>36.92	5	16.67		>28.08	25	20.83

f – frequency; % – Percentage

Table 2. Socio-economic characteristics of the farmers

Variable	Category	Criteria	Non adopters (n=30)		Adopters (n=120)		
			Frequency	Percentage	Frequency	Percentage	
Family size	Small	< 5 members	18	60.00	37	30.83	
	Medium	5 - 6 members	11	36.67	43	35.83	
	Large	>6 members	1	3.33	40	33.33	
Land Holding	Marginal Farmers	< 2.5 acres	24	80.00	2	1.67	
	Small Farmers	2.51 – 5.00 acres	5	16.67	8	6.67	
	Medium farmers	5.01 – 10.0 acres	1	3.33	70	58.33	
	Big farmers	>10.00 acres	0	0.00	40	33.33	
		Criteria	f	%	Criteria	f	%
Irrigation Potential	Low (< \bar{x} -SD)	< 7.52	8	26.67	< 30.27	17	14.17
	Medium ($\bar{x} \pm$ SD)	7.52 – 80.09	16	53.33	30.27 – 91.79	67	55.83
	High (> \bar{x} +SD)	>80.09	6	20.00	>91.79	36	30.00
Credit Orientation	Low (< \bar{x} -SD)	< 1.83	4	13.33	<2.30	33	27.50
	Medium ($\bar{x} \pm$ SD)	1.83 - 4.17	25	83.33	2.30 - 4.84	41	34.17
	High (> \bar{x} +SD)	> 4.17	1	3.33	> 4.84	46	38.33

f – frequency; % – Percentage

3.1.2.4 Credit orientation

It was observed from Table 2 that majority of the farmers had high (38.33%) level of credit orientation and majority of the non adopter farmers had medium level (83.33%) of credit orientation. In recent days, due to continuous drought spells in the study area, farmers are experiencing loss compared to returns. To take up innovative initiatives like coping mechanisms, enterprise diversification, etc., they need initial capital. This might have made them to have higher credit orientation. These findings are in accordance with the studies conducted by Swami [9].

3.1.3 Psychological and communication characteristics of the farmers

3.1.3.1 Mass media participation

With reference to mass media participation, 52.50 percent of adopters had a medium level of mass media participation followed by high (35.83%) level of mass media participation. Majority of the non-adopters had medium (40.00%) level of mass media participation followed by low (36.67%) level of mass media participation. Coping mechanisms are new technologies and farmers have to search for the required information in various media. One of the important required aspect weather forecasting/ information is also given to the farmers through the mass media. This might have made them have a medium to high level of mass media participation. The results are in sync with the findings of Khin Maar Oo [10] and Sahana [11].

3.1.3.2 Innovativeness

According to the results in Table 3A, the majority of the adopter farmers had medium level (60.00%) level of innovativeness followed by high (22.50%) level of innovativeness. Further, 43.33 percent of non-adopter farmers had a low level of innovativeness followed by medium (36.67%) level of innovativeness. The farmers in the study area are experiencing climate change from last 10 years and they are in constant search of new technology to safeguard their crop and to get more returns from all ventures. Also, they had a good extension agency contact and cosmopolitanism may be the reason for this result. The results are in agreement with the findings of Suresh [12] and Sahana [11].

3.1.3.3 Extension agency contact

It could be inferred from the Table 3A that majority of the adopter farmers had a medium level (55.00%) of extension contact and more than one-third of the non-adopter farmers had low (43.33%) level and medium (40.00%) level of extension agency contact. Majority of the adopter farmers are progressive, and they are the farmers who are taking up a coping mechanism. Thus, they seek information from both public as well as private sector agencies to update themselves on various technologies. This result is in accordance with the outcome of Sharma et al. [13] and Kavyashree [8].

3.1.3.4 Risk orientation

It can be summarised from Table 3A that 59.17 percent of the adopter farmers had a medium level of risk orientation followed by a nearly equal number of farmers having high (21.67%) and low (19.17%) level of risk orientation. More than half of the non-adopter farmers had low (60.00%) level of risk orientation. Majority of the non-adopter farmers are resource poor farmers with fragmented land holding. They depend on farming activities completely for their survival. Thus they tend to take very minimal or no risk. On the other hand, adopter farmers are the innovators who take up ventures that are not known to them. The results from such ventures are uncertain. Also, they have good extension agency contact which may have influenced them to take more risk. The outcome is in line with the outcome of Chethan [14].

3.1.3.5 Management orientation

It could be concluded from Table 3B that both adopters (65.00%) and non-adopters (60.00%) had a medium level of management orientation. This could be attributed to the medium level of knowledge, the farming experience of the respondents. Since the study area has a scarcity of the resources, the farmers had to plan well in advance about the allocation of the resources to get more profits from available scarce resources. The results are in conformity with the finding of Chauhan and Patel [15].

3.1.3.6 Information seeking behaviour

It could be indicated from the Table 3B that more than half of the adopter farmers had a medium level (60.00%) of information seeking behaviour followed by high (23.33%) level of information

seeking behaviour respectively. Majority of the non-adopter farmers had low (53.33%) level of information seeking behaviour followed by medium (36.67%) level of information seeking behaviour. This outcome is probably due to the reason that adopter farmers had good extension agency contact, mass media participation and innovativeness that promotes farmers to seek information from various sources about the technologies that would help them to adapt to the climate change. Whereas, low educational status, low extension agency contact can be observed in the non adopters. Also, non-adopters were having a smallholding and medium irrigation potential which is enough to irrigate their land thus they might not seeking much information from any sources. The finding is in line with the finding of Pynbianglang [16].

3.1.3.7 Preparedness for adaptation

The finding of Table 3B outlines that majority of adopter farmer had medium (46.67%) preparedness for adaptation followed by high (35.00) preparedness for adaptation and majority of the non adopter farmers had low (60.00%) preparedness for adaptation followed by medium (23.33%) preparedness for adaptation. Adopters are the having good risk orientation and thus they are always ready take up the coping mechanisms to increase their returns. Also, good level of innovativeprones, extension agency contact and information seeking behaviour had made the farmers to prepare themselves to the varying climatic condition. The finding is in line with the finding of Pynbianglang [16].

3.1.3.8 Change resistance

The findings of the Table 3B outlines that 65.00 percent of the adopter farmers had medium change resistance followed by low (20.00%) change resistance. Further, majority of the non adopter farmers had high change resistance (46.67%), followed by medium (43.33%) change resistance. The adopters are more exposed to various mass media, innovators and want to take risk to adapt to the changing climate to get additional returns. Non adopters are high change resistant may be due to the reason that they have very small land holding and less risk orientation. They are concerned in fulfilling the required needs might have contributed to the above result. The finding is in line with the finding of Pynbianglang [16].

3.2 Coping Mechanisms Adopted by the Farmers to Mitigate the Change in Climatic Condition

The data in Table 4 summarises that adopting drip irrigation system (100.00%) and change in irrigation frequency (90.83%) were the widely adopted coping mechanisms. This may be due to the reason that water availability is the major problem in the study area because of monsoon failures and the farmers had to irrigate maximum possible area with the available water. Another reason may also be that the government is providing 50 to 90 percent subsidies to the farmers through various departments for installation of drip irrigation system. Change in cropping pattern (74.17%) is also followed by many of the farmers because due to changing climate and failure of rainfall farmers have shifted from water intensive crop to less water intensive crops and perennial horticultural crops that have relatively less water requirement.

3.3 Relationship between Characteristics of Farmers with their Knowledge on Climate Change

A close observation of Table 5 indicated that adopters characteristics like education, size of land holding, credit orientation and information seeking behaviour had a significant relationship with knowledge of farmers on climate change. In the case of non-adopters, only age was to be significant. The above result might be to the reason that education had a significant influence on the knowledge of the respondents. Educated farmers had more knowledge regarding climate change. Further, when land holding is more, farmers think of various ventures and thus try to gather information from various available sources. This increased their knowledge on climate change. Also, they seek credit from various institutes, might be the reason for the above results. In the case of non-adopters, the above result is probably due to the reason that farmers go on gaining the knowledge regarding climate change with their age.

3.4 Relationship between Characteristics of Farmers with their Adaptation to Climate Change

The outcomes in Table 6 showed that in case of adopter farmers, there was a significant association between adaptation to climate

Table 3A. Psychological and communication characteristics of the farmers

Variable	Category	Non adopters (n=30)			Adopters (n=120)		
		Criteria	f	%	Criteria	f	%
Mass media participation	Low ($< \bar{x} - SD$)	< 2.01	11	36.67	< 8.37	14	11.67
	Medium ($\bar{x} \pm SD$)	2.01 - 7.73	12	40.00	8.37 - 17.98	63	52.50
	High ($> \bar{x} + SD$)	> 7.73	7	23.33	> 17.98	43	35.83
Innovativeproneess	Low ($< \bar{x} - SD$)	< 13.00	13	43.33	< 8.89	21	17.50
	Medium ($\bar{x} \pm SD$)	13.00 - 21.67	11	36.67	8.89 - 20.85	72	60.00
	High ($> \bar{x} + SD$)	> 21.67	6	20.00	> 20.85	27	22.50
Extension agency contact	Low ($< \bar{x} - SD$)	< 5.01	13	43.33	< 8.03	30	25.00
	Medium ($\bar{x} \pm SD$)	5.01 - 14.52	12	40.00	8.03 - 18.75	66	55.00
	High ($> \bar{x} + SD$)	> 14.52	5	16.67	> 18.75	24	20.00
Risk orientation	Low ($< \bar{x} - SD$)	< 11.08	18	60.00	< 11.22	23	19.17
	Medium ($\bar{x} \pm SD$)	11.08 - 20.12	11	36.67	11.22 - 24.40	71	59.17
	High ($> \bar{x} + SD$)	> 20.12	1	3.33	> 24.40	26	21.67

f – frequency; % – Percentage

Table 3B. Psychological and communication characteristics of the farmers

Variable	Category	Non adopters (n=30)			Adopters (n=120)		
		Criteria	f	%	Criteria	f	%
Management Orientation	Low ($< \bar{x} - SD$)	< 28.62	5	16.67	< 37.97	21	17.50
	Medium ($\bar{x} \pm SD$)	28.62 - 52.38	18	60.00	37.97 - 68.37	78	65.00
	High ($> \bar{x} + SD$)	> 52.38	7	23.33	> 68.37	21	17.50
Information Seeking Behaviour	Low ($< \bar{x} - SD$)	< 8.09	16	53.33	< 13.32	20	16.67
	Medium ($\bar{x} \pm SD$)	8.09 - 16.85	11	36.67	13.32 - 29.52	72	60.00
	High ($> \bar{x} + SD$)	> 16.85	3	10.00	> 29.52	28	23.33
Preparedness for adaptation	Low ($< \bar{x} - SD$)	< 1.63	18	60.00	< 4.42	22	18.33
	Medium ($\bar{x} \pm SD$)	1.63 - 5.30	7	23.33	4.42 - 13.99	56	46.67
	High ($> \bar{x} + SD$)	> 5.30	5	16.67	> 13.99	42	35.00
Change Resistance	Low ($< \bar{x} - SD$)	< 8.00	3	10.00	< 8.99	24	20.00
	Medium ($\bar{x} \pm SD$)	8.00 - 15.40	17	43.33	8.99 - 20.89	78	65.00
	High ($> \bar{x} + SD$)	> 15.40	14	46.67	> 20.89	18	15.00

f – frequency; % – Percentage

Table 4. Coping mechanisms adopted by the farmers to mitigate the change in climatic condition

n = 120			
No.	Coping Mechanism	Frequency	Percentage (%)
1	Agronomic Practices		
	a. Change in Variety	27	22.50
	b. Change in date of sowing	6	5.00
	c. Change in quantity of fertilizer application	54	45.00
	d. Change in quantity of application of PPC	48	40.00
	e. Change in irrigation frequency	109	90.83
	f. Adopting intercropping	31	25.83
	g. Change in cropping pattern	89	74.17
2	Soil and Water conservation measures		
	a. Farm pond	32	26.67
	b. Mulching	45	37.50
	c. Drip Irrigation	120	100.00
3	Protected Cultivation	28	23.33
4	Enterprise Diversification	52	43.33
5	Crop insurance	78	65.00

(Includes Multiple Responses)

change and education, size of land holding, innovativeness and information seeking behaviour. This may be due to the fact that when farmers are educated they know the importance of adaptation and they try to adopt necessary coping mechanism. When the size of land holding is more, they can think of various coping mechanisms since they have opportunity to take up various crops. Since the majority of these technologies are new, the farmers must be innovators who could think and try out the pioneer initiatives in which the outcome is not

certain. The farmers, to understand more regarding all these technologies and various coping mechanisms seeks information from various formal and informal sources available around them may be the reason for these results.

Correlation coefficient for characteristics of the non adopter farmer with adaptation to climate change cannot be computed since one of the variables is constant, viz., adaptation score for non-adopters is zero.

Table 5. Relationship between characteristics of the farmer with their knowledge on climate change

No.	Independent variables	Correlation co- efficient	
		Non adopters (n = 30)	Adopters (n=120)
1.	Age	0.31*	-0.001 ^{NS}
2.	Gender	0.141 ^{NS}	0.024 ^{NS}
3.	Education	0.312 ^{NS}	0.232*
4.	Farming Experience	0.029 ^{NS}	0.091 ^{NS}
5.	Family Size	-0.176 ^{NS}	0.055 ^{NS}
6.	Size of land holding	0.122 ^{NS}	0.342*
7.	Irrigation potential	-0.213 ^{NS}	0.142 ^{NS}
8.	Credit orientation	-0.052 ^{NS}	0.47*
9.	Mass media Participation	0.116 ^{NS}	0.034 ^{NS}
10.	Innovativeness	0.073 ^{NS}	0.02 ^{NS}
11.	Extension agency contact	0.168 ^{NS}	0.093 ^{NS}
12.	Risk orientation	0.213 ^{NS}	0.165 ^{NS}
13.	Management orientation	0.193 ^{NS}	0.020 ^{NS}
14.	Information seeking behaviour	-0.266 ^{NS}	0.41*
15.	Preparedness for adaptation	-0.005 ^{NS}	0.129 ^{NS}
16.	Change resistance	-0.161 ^{NS}	-0.021 ^{NS}

** - Significant at 1% level; * - Significant at 5% level; NS - Non-Significant

Table 6. Relationship between characteristics of the farmer with adaptation to climate change

No.	Independent variables	Correlation co – efficient Adopters (n=120)
1.	Age	-0.029 ^{NS}
2.	Gender	-0.196 ^{NS}
3.	Education	0.46 [*]
4.	Farming experience	-0.06 ^{NS}
5.	Family size	0.058 ^{NS}
6.	Size of land holding	0.508 [*]
7.	Irrigation potential	0.009 ^{NS}
8.	Credit orientation	0.009 ^{NS}
9.	Mass media participation	0.112 ^{NS}
10.	Innovativeness	0.31 [*]
11.	Extension agency contact	-0.144 ^{NS}
12.	Risk orientation	0.028 ^{NS}
13.	Management orientation	-0.054 ^{NS}
14.	Information seeking behaviour	0.372 [*]
15.	Preparedness for adaptation	0.136 ^{NS}
16.	Change resistance	0.051 ^{NS}

* - Significant at 5% level; NS - Non-Significant

4. CONCLUSION

From the findings of the study, it was established that some of the socioeconomic characteristics like age, education, size of land holding, credit orientation, information seeking behavior had an impact on the knowledge of the respondents, whereas education and Innovativeness had a significant impact on the adaptation behavior. Hence, there is a need to create awareness among the farmers regarding the importance of adaptation to the climate change. The water saving technologies have to be promoted more since water is one of the scarce resources. It was recommended to promote coping mechanisms that farmers can adapt efficiently, in order to sustain the crop production under varying climatic conditions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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