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Factors Affecting the Awareness of Farmers Regarding Climate Change in Saurashtra Region of Gujarat, India

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ABSTRACT

The present study was undertaken in the Saurashtra region of Gujarat with objectives to assess farmers' awareness of climate change and to identify the key factors influencing it. A multistage sampling procedure was followed, wherein four districts—Amreli, Jamnagar, Gir Somnath, and Porbandar—were purposively selected, and a total of 240 respondents were randomly chosen across blocks and villages. Findings of the study revealed that the overall awareness level among farmers was 73.55%, with a majority (65.84%) falling in the medium awareness category. The correlation analysis indicated that factors like as education, information seeking behaviour, access to weather forecast, innovativeness, scientific orientation, preparedness for adaptation, perception regarding climate change and cropping pattern showed higher significance than other variables. Farming experience, extension participation, mass media exposure and risk orientation showed positive and moderately significant correlation with the awareness regarding the climate change. Multiple linear regression analysis revealed that out of 14 independent variables, eight variables viz. education, farming experience, information seeking behaviour, scientific orientation, preparedness for adaptation, perception regarding climate change and cropping pattern showed a significant functional relationship with the awareness regarding climate change as their p value is less than 0.05. Path analysis further delineated the direct and indirect effects of these variables. The results underscore the need for targeted interventions aimed at strengthening knowledge systems and adaptive capacities among farming communities to address the impacts of climate change more effectively. The major limitation of the study was that it was restricted to Saurashtra region only and therefore future studies can be replicated in other regions of the state as well.

Keywords: *Climate change, Multistage random sampling, Awareness, Correlation, Multiple linear regression and Path analysis.*

INTRODUCTION

Not every change is propitious or promising. There are some changes in our systems that are not deemed desirable. Climate change is one such change. It is not just an environmental problem but has now become a social problem. Since the beginning of this century, there have been a lot of debates, conferences, symposia focusing on climate change and the strategies to cope with it. United Nations Framework Convention on Climate Change (UNFCCC) has defined climate change as the change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Agriculture being a climate-dependent and climate-sensitive field, is impacted by the observed changes in the pattern of climate over the years. We have a growing literature on rural understanding of climate change [2]. Climate change may cause gains in some crops in some regions of the world, but the overall impacts of climate change on agriculture are expected to be negative [15].

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In India, for example, a study showed that the growth and incidence of weeds like *Echinochloa colona* and *Altemanthera paronychioides* increased with the elevated CO_2 levels in rice fields (experiment conducted at DWR, Jabalpur) and under similar conditions, the efficacy of herbicides *viz.* 2,4-D against *A. paronychioides* and Bispyribac sodium against *E. colona* had decreased while similar results were observed in wheat crop w.r.t the efficacy of Carfentrazole-ethyl against *Chenopodium album* and *Rumex dentatus* [13]. Now if we look at the trend of increasing CO_2 or equivalent levels, it is observed that they show an upward trend. A study on assessment of carbon dooxide trends in India by Kuttipurath *et al.* [10] reported that on an average, there is an increase in the concentration of CO_2 at the rate of 2.1 ppm/year. If we talk about the global surface average for carbon dioxide during 2021, it was 414.7 parts per million (ppm), which is an increase of 2.66 ppm over the 2020 average. This had been the 10th consecutive year that carbon dioxide had increased by more than 2 parts per million [1]. So, the situation is not very heart warming. Now since the agriculture is impacted by the variabilities in the climate, the farmers suffer the most, especially in Indian context where majority of the farmers is having small or marginal landholdings. Change in precipitation pattern may hamper timely agricultural operations leading to short term crop failure and long-term yield falloffs [4]. In developed countries, the farming population is less but have large farms, so their production decisions and related choice of

management of practices have significant implications for both emitting and sequestering the carbon emissions [5]. On the contrary, Indian farmers are small farmers and thus, do not have much control over access to sequestering carbon footprints. India is amongst the most vulnerable countries due to its large agricultural sector, vast population, rich biodiversity, long coastline, and high poverty levels [3]. Climate change is a multi-faceted problem. It manifests in four categories of primary level changes *viz.* a) Temperature changes b) Precipitation changes c) Changes in the oceans and d) Extreme events [19]. Being aware, adoptive and adaptive of such a multi-dimensional problem is a daunting task for the farmer as well as scientific community. The adoptive and adaptive behaviours of farmers are functions of their awareness levels.

The presented paper explores the farmers' level of awareness and the factors that influence their awareness levels regarding climate change in Saurashtra region of Gujarat, India. Awareness is the first stage of adoption as well as adaptation. Awareness is defined as a process when we get to know about the existence of something. Mall *et al.* [14] had listed Gujarat as one of the most vulnerable states in India w.r.t extreme events taking place as a result of climate change. A study by Singh *et al.* [22] reports that Gujarat constitutes 5.99 per cent of total geographical area of the country. The mean minimum temperature in the region is about 19.95°C while the mean maximum remains around 32.17°C. The study shows that the increase in minimum temperature has significantly lowered the yield of pearl millet, cotton, groundnut and barley which are the major crops of the state. In a study by Hiremath and Shiyani [8], it was reported that the Saurashtra region was having a greater number of years with less than average rainfall as compared to number of years with average rainfall. The awareness and knowledge of farmers regarding this issue becomes pivotal because we cannot expect them to cope with the situation unless any effort to make them aware is put across. This study is a step forward in the assessment of how aware farmers are, at the grassroots level. The major objectives of this paper are delineated as follows:

1. To assess the levels of awareness of farmers regarding climate change
2. To determine what are the factors that influence the awareness of farmers regarding climate change
3. To know the direct and indirect effects of the factors that influence awareness of farmers regarding climate change

Dhadwad [6] in his study on the climate change impact and designing of e-learning modules regarding climate change reported that the agricultural scientists and farmers possessed medium level of climate change knowledge, while extension personnel possessed low level of climate change knowledge. Furthermore, respondents from all three groups scored relatively higher on two dimensions of climate change: impacts of climate change on agriculture and adaptation and mitigation strategies in agriculture, however, their scores on scientific understanding and causes of climate change were relatively low. Raghuvanshi *et al.* [18] in their study on the farmers' awareness on climate change in Uttarakhand, found out that half of the respondents (50.00 %) displayed medium level of awareness about climate change, followed by 27.28 per cent of respondents who had low awareness level, and only 22.72 per cent of respondents having high level of awareness about climate change. Suresh *et al.* [24] on their study in Koppala District of Karnataka reported that farmers observed climate-related events in their area *viz.* frequent thunderstorms and hailstorms (42.2 %), and very rare occurrences of windstorms (57.04 %). They further reported frequent occurrence of heat waves (48.15 %), soil erosion (42.96 %), and loss of biodiversity (61.48 %) occurrence of pests and diseases to crops (67.41 %) was observed and experienced by the interviewed farmers of the study area.

RESEARCH METHODOLOGY

The study was conducted in Saurashtra region of Gujarat. Saurashtra constitutes 11 districts out of Gujarat's total 11 districts. This region was purposively selected as it is one of the most sensitive and relatively vulnerable regions in Gujarat to be impacted by changing climate. Saurashtra is being constantly hit by terrific cyclones like Taukte (2021), Biparjoy (2023) *etc.* Labban *et al.* [12] revealed that Arabian sea has been witnessing an increase in the number of pre and post monsoon cyclones. Gujarat in general and Saurashtra in particular, having located at the shores of Arabian sea become more vulnerable to these potential havocs. In Saurashtra, A multistage random sampling sampling technique was employed to select the districts, Talukas and villages. Four districts *viz.* Jamnagar, Amreli, Gir Somnath and Porbandar were selected randomly. From each district, two talukas were selected randomly and from each taluka, two villages were randomly selected. 15 farmers from each village were randomly contacted, constituting a total sample of 240 respondents. The table 1 shows the illustration of the sampling technique followed.

The study employed an exploratory and descriptive research design as it was concerned to providing an insight on the farmers' level of awareness and the effects of the factors influencing it. Relevant variables were identified in consultation with experts, and based on extensive review of related literature. The following table 2 shows the different variables selected for the study.

A structured questionnaire was constructed using different scales as mentioned in the Table 2. Face-to-face interview technique was followed to collect data. Door to door survey was done and individual farmers were contacted either at home or their fields. Then the collected data was transferred to Master sheet after coding and tabulation. It was then analysed used MS Excel and SPSS software to find the correlation and regression coefficients. Path analysis was also performed to determine the direct and indirect effects of the variables on the awareness of the respondents regarding climate change. Other tools like frequency, percentage, Mean, Standard deviation etc. were also computed.

Awareness is the first step towards gaining knowledge about something. In this study, awareness of respondents regarding climate change was measured by a scale developed by Vasanthi [25]. The scale consisted of 21 statements to which responses were recorded in the form of 'Yes' or 'No' answers carrying scores 1 and 0, respectively. The total score of each farmer was worked out by summing up scores of all statements. Further, mean and standard deviation were computed and the respondents were grouped into three categories as below:

S. No.	Categories of awareness regarding climate change	Range
1	Low	<Mean-SD
2	Medium	Mean±SD
3	High	>Mean+SD

Mean score

Mean score was calculated for assigning the ranks. The mean score was obtained by total scores of an item divided by the total number of respondents. The mean was calculated by using formula: $\bar{X} = \sum Xi \div N$

Where,
$\bar{X}$ = Mean
Xi = value of the ith respondents
N= Total no. of respondents
Standard deviation
The standard deviation measures is the absolute dispersion of variability of distribution. Mean and standard deviation were used for categorization of respondents into different categories.
SD=√((∑(X_i-x̄)^2)/(n-1))
Where,
SD = Standard deviation
X_i = Value of individual variable
X_i = Assumed mean
n = Total number of items
(n-1 is unbiased estimate of the variance in the population)
Coefficient of correlation
Pearson's correlation coefficient (r) was employed to assess the relationship between dependent and independent variables which could be measured at interval or ratio level of measurement.

Where,
n = Number of respondents
∑XY = Sum of products of both variables
∑X = Sum of values of variable X
∑Y = Sum of values of variable Y
∑X2 = Sum of squares of variable X
∑Y2 = Sum of squares of variable Y
Regression analysis
Multiple linear regression analysis was done to find out the extent of relationship between dependent and selected independent variables and to know the influence of independent variables on awareness and adaptability of farmers. Further, the computed 'b' values (regression coefficients) were tested with 't' test for its significance.
Y = a + b1X1 + b2X2 + b3X3 + ... + btXt + e
Where,
Y = the variable to be predicted
Xi = the variable used to predict Y
a = the intercept
b = the slope (regression coefficient)
e = the regression residual
Path coefficient analysis
All the selected characteristic with their possible correlation coefficients were included in the path coefficient analysis to estimate the direct and indirect effects of independent variables on the dependent ones. The following equations were employed for estimating the various direct and indirect effects.
r1y = P1y + r12P2y+ ..... + r1pPpy
r2y = r21P1y + P2y+ ..... + r2pPpy
rpy = rp1P1y + rp2P2y + ……..+ Ppy
Where,
P1y, P2y……Ppy are direct effects of character 1,2,……..p on y and r1y, r2y……rpy denote correlation coefficient between independent characters 1,2……..p and dependent characters.

RESULTS AND DISCUSSION

This section presents the findings of this study on the awareness of farmers regarding climate change and factors influencing it in Saurashtra region of Gujarat. Let's first discuss the level of awareness that the respondents had about the changing climate.

Awareness regarding climate change: A structured questionnaire developed by Vasanthi [25]was used to determine the awareness level of farmers. The scale for awareness consisted of 21 items to which, the responses were taken either as 'Yes' or 'No'. For each of these 21 statements, the scores given by respondents were calculated and the frequencies of 'Yes' responses were computed. These frequencies were then converted to percentages and accordingly, ranks were given to each statement. This has been depicted in Table 3.

The data in table 3 indicate that 95.41 per cent of the farmers were aware about the increasing annual mean temperature and hence the statement 'The Annual Mean Temperature during last 10 years has been increased' has been accorded 1st rank, followed by 'The availability of ground water has been decreased due to climate change' at rank 2nd (93.75 %), 'The climate has been changing over years' at rank 3rd (89.58 %), 'Cost of cultivation has been increased because of climate change' with 4th rank (89.17), 'There is a shift in date of commencement of rain over the years' with 5th rank (81.25 %), 'The occurrence of droughts and heavy rainfall is due to climate change' at 6th rank (79.16 %), 'The climate change affects weed infestation, pest incidence and disease incidences' with 7th rank (77.50 %), 'The pattern of monsoon rainfall during the last 10 years has been changed' at 8th rank (77.08 %), 'The number of rainy days is changing every year due to changing climate' at Rank 9th (72.91%), 'The quality of water over the years is declining due to climate change ranked 10th (72.50 %), 'Information in rainfall variability is useful in taking farm decisions such as crop selection, planting date and resource scheduling' ranked 11th (71.67 %).

The statements, 'The crop diseases that were minor earlier have become major due to climate change' ranked 12th (71.25 %), 'The post-harvest losses are more due to climate change' ranked 13th (70.00 %), 'The crop pests that were minor earlier have become major due to climate change' ranked 14th (69.58 %), 'The quality of the soil is declining as the effect of climate change' ranked 15th (67.50 %), 'Impact of climate change on distribution of rainfall over the years has been erratic' ranked 16th (66.67 %), 'Selection of crop due to seasonal variation is difficult' with rank 17th (66.25 %), 'Integrated Farming System helps in diversification of enterprises to reduce the risk involved in sole cropping' ranked 18th (65.00 %), 'Practices like mulching and FYM application are important for soil health and soil water conservation' ranked 19th (60.41 %), 'Borewell and well recharge, rain water harvesting and micro-irrigation help in water conservation' ranked 20th (55.00 %), and last rank i.e. 21st (52.50 %) was accorded to the statement 'Renewable energy is a good source of energy to cope with climate change.'

To measure the awareness in numerical terms, the per cent scores of all statements were summed up and divided by total number of statements which is given as:

$$\text{Awareness regarding climate change} = \frac{\text{Sum total of percent score of all statements}}{\text{Total number of statements } (i.e.\ 21)}$$

$$\text{Awareness regarding climate change} = \frac{1544.51}{21} = 73.55 \text{ per cent}$$

Distribution of respondents according to their level of awareness: As mentioned in the methodology section, respondents were categorised into three categories based on the standard deviation and mean. The information has been presented in the Table 4.

The data from Table 4 reveal that nearly two-third (65.84 %) of the respondents had a medium level of awareness regarding

climate change, followed by 22.08 per cent and 12.08 per cent of them, having low and high levels of awareness regarding climate change, respectively. The medium level of awareness represented by two-third of the respondents, can be attributed to the fact that majority of them had medium levels of mass media exposure, information seeking behaviour, access to mass media and extension participation. This might have contributed to the majority of the respondents having medium level of awareness regarding climate change.

Factors influencing the awareness regarding climate change: Based on the literature review and consultations with experts, 14 variables were selected as shown in Table 2. These independent variables were categorised as personal, communication, psychological and situational variables. To find out the influence of these factors on the awareness regarding climate change, correlation and multivariate regression analysis was performed. Furthermore, to ascertain the direct and indirect effects of the independent variables on the dependent variable, Path analysis was done. The findings of the study have been detailed below:

Correlation between variables: The table 5 indicates the correlation analysis of the data. From the table, it is elicited that that all the variables showed a significant relationship with awareness regarding climate change except age ($r=108^{NS}$) and farm size ($r=0.0137^{NS}$). Variables such as education (0.346**), information seeking behaviour (0.386**) access to weather forecast (0.319**) innovativeness (0.469**), scientific orientation (0.331**), preparedness for adaptation (0.505**), perception regarding climate change (0.478**) and cropping pattern (0.445**) showed relatively higher significance than other variables. Other variables *viz.* Farming experience (r= 0.137*), extension participation (r=0.143*), mass media exposure (r=0.130*) and risk orientation (r=0.155*) showed positive and moderately significant correlation with the awareness regarding the climate change.

Functional relationship between awareness regarding climate change and the profile characteristics of farmers: The correlation coefficient merely portrays coexistence of relation between any two variables. The procedure does not capture the interaction effect among variables. One variable is associated with or simultaneously dependent on several others. Awareness regarding climate change was postulated as a linear function of various variables. It is not influenced solely by any of these factors taken in isolation but is a part of complex and interacting system. Based on this approach, the multiple regression analysis using linear model was carried out to know how exactly the independent variables affect the dependent variable. The findings have been framed in the table 6.

Out of 14 independent variables, eight variables *viz.* education, farming experience, information seeking behaviour, scientific orientation, preparedness for adaptation, perception regarding climate change and cropping pattern showed a significant functional relationship with the awareness regarding climate change as their p value is less than 0.05. All these variables were causing as much as 75.20 per cent of variation in the dependent variable indicated by coefficient of determination (R^2). Farming experience, information seeking behaviour and innovativeness were also found to be important factors in influencing the awareness of the respondents regarding climate change as these variables exhibited a significant relationship ($p<0.05$) with the dependent variable.

It can also be noted that some variables showed significant correlation but did not have a significant functional relationship. This could be due to the presence of some intervening variables or a complicated relationship among variables.

Direct, indirect and substantial indirect effects of selected characteristics on the awareness of respondents regarding climate change

In order to quantitatively interpret the direct, indirect and substantial indirect effects of selected variables on the awareness of the respondents regarding climate change, path analysis was carried out.

Path coefficients of the selected 12 independent variables (with significant correlation coefficients) and awareness of respondents regarding climate change with respect to direct effects, total indirect effects and substantial indirect effects that were channelled through other independent variables have been presented in Table 7.

Direct effect of independent variables on the awareness of respondents regarding climate change

The ranking of variables based on the total direct effects on awareness level of respondents in Table 7 revealed that preparedness for adaptation (X12) had the highest direct effect (0.336) on the awareness of respondents regarding climate change and was accorded rank I, followed by perception regarding climate change (X13) with direct effect value of 0.264 (rank II), information seeking behaviour (X7) with direct effect value of 0.195 (rank III), cropping pattern (X14) with a direct effect value of 0.184 (rank IV) and innovativeness (X9) with a direct effect value of 0.140 (rank V).

The data also reveal that risk orientation (X10) had a direct effect value of 0.139 (rank VI), followed by access to weather forecast (X8) with direct effect value of 0.125 (rank VII), scientific orientation (X11) having direct effect value of 0.123 (rank VIII), mass media exposure (X6) had a direct effect value of 0.112 (rank IX), farming experience (X3) with direct effect value of 0.080 (rank X), education (X2) with direct effect value of 0.076 (rank XI) and extension participation (X5) possessing a direct effect value of 0.024 (rank XII).

Indirect effect of independent variables on the awareness of respondents regarding climate change

With respect to the indirect effects of the selected variables on the awareness levels of respondents regarding climate change, the ranking of indirect effects revealed that innovativeness (X9) had highest total indirect effects value of 0.329 (rank I), followed by education (X2) with total indirect effects value of 0.270 (rank II), cropping pattern (X14) having total indirect effects value of 0.261 (rank III), perception regarding climate change (X13) having total indirect effects value of 0.214 (rank IV) and scientific orientation (X11) with total indirect effects value of 0.208 (rank V).

The data in the table 7 further reveal that access to weather forecast (X8) had a total indirect effects value of 0.194 (rank VI), followed by preparedness for adaptation (X12) with total indirect effects value of 0.169 (rank VII), extension participation (X5) with total indirect effects value of 0.119 (rank VIII), information seeking behaviour (X7) with a total indirect effects value of 0.091 (rank IX), farming experience (X3) having total indirect effects value of 0.057 (rank X), mass media exposure (X6) possessing total indirect effects value of 0.028 (rank XI)

and risk orientation (X10) having a total indirect effects value of 0.016 (rank XII).

Substantial indirect effects of independent variables on other variables

The data in Table 7 depicted that the maximum indirect effect of the selected variables on awareness regarding climate change was channelled through respondents' education (X2) in case of eight factors. The second substantial indirect effect was directed through innovativeness (X9) in the case of seven factors. Four substantial indirect effects were directed through respondents' perception regarding climate change (X13), three substantial effects were directed through access to weather forecast (X8) while one substantial indirect effect was directed by scientific orientation (X11).

CONCLUSION

Climate change is unequivocally real and there is enough evidence to prove it. It is high time to work on mitigating and adapting to the changes that are taking place in the climate. Agriculture being one of the most sensitive sectors, is hit hard. We have started observing less yields, more disease and pest incidences, more weed infestation, declining bio-efficacy of herbicides and what not! This study focussed on the measuring the awareness of farmers in Saurashtra region of Gujarat, regarding climate change and the factors that influence the awareness. It was found that 65.84 per cent respondents had a medium level of awareness regarding climate change. The overall awareness among the respondents stood at 73.55 per cent. It was also found that factors such as education, information seeking behaviour, access to weather forecast, innovativeness, scientific orientation, preparedness for adaptation, perception regarding climate change and cropping pattern showed relatively higher significance than other variables. Other variables viz. Farming experience, extension participation, mass media exposure and risk orientation showed positive and moderately significant correlation with the awareness regarding the climate change. Multiple linear regression analysis highlighted the functional relationship between the variables and it was found that out of 14 independent variables, eight variables viz. education, farming experience, information seeking behaviour, scientific orientation, preparedness for adaptation, perception regarding climate change and cropping pattern showed a significant functional relationship with the awareness regarding climate change as their p value is less than 0.05. All these variables were causing as much as 75.20 per cent of variation in the dependent variable indicated by coefficient of determination (R2). Path analysis helped us discover the direct and indirect effects of the variables on the awareness of the respondents indicating that preparedness for adaptation had the highest direct effect and innovativeness had the highest indirect effect. Furthermore, the maximum indirect effect of the selected variables on awareness regarding climate change was channelled through respondents' education in case of eight factors.

FUTURE SCOPE OF THE STUDY

Since the study was limited to Saurashtra region, future replications of similar kind can cover other zones of the state as well incorporating more relevant variables. Also, a longitudinal study capturing changes in farmers' awareness and behaviour over time can provide insights into the effectiveness of ongoing extension and climate awareness programmes. On the basis of some significant predictors like preparedness for adaptation, perception of climate change and the like, decision-support tools or mobile-based advisory apps can be designed to facilitate timely responses by farmers.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

Table 1: Selection of sampling area and respondents

Districts	Talukas	Villages	No. of farmers
Amreli	Dhari	Gadhiya	15
		Trambakpur	15
	Khamba	Umariya	15
		Dariyadi	15
Porbandar	Porbandar	Rajpar	15
		Ratnapar	15
	Ranavav	Valotra	15
		Thoyana	15
Jamnagar	Jamjodhpur	Dal Devadiya	15
		Bharadaki	15
	Kalavad	Metiya	15
		Deri	15
Gir Somnath	Talala	Borbav	15
		Surva	15
	Sutrapada	Moradiya	15
		Prashnavada	15

Table 2: Measurement of independent and dependent variables

S. No.	Variables	Scales/schedules used for study
	Independent variables	
	Personal variables	
1.	Age	Chronological age of the respondents
2.	Education	Scale developed by Pandya and Pandya [16]
3.	Farming experience	Scale developed by Jamadar [9]
4	Farm size	Scale used by State Department of Agriculture
	Communication variables	
5.	Extension participation	Scale developed by Siddaramaiah and Jalihal [20]
6.	Mass media exposure	Scale developed by Gajendra [7]
7.	Information seeking behaviour	Scale developed by Pynbianglang [17]
8.	Access to weather forecast	Scale developed by Kunth [11]
	Psychological variables	
9.	Innovativeness	Scale developed by Singh [21]
10.	Risk orientation	Scale developed by Supe [23]
11.	Scientific orientation	Scale developed by Gajendra [7]
12.	Preparedness for adaptation	Scale developed by Vasanthi [25]

13.	Perception regarding climate change	Scale developed by Dhadwad [6]
	Situational variable	
14.	Cropping pattern	Scale developed by Vasudeo [26]
	Dependent variables	
1.	Awareness regarding climate change	Scale developed by Vasanthi [25]
S. No.	**Variables**	**Scales/schedules used for study**
	Independent variables	
	Personal variables	
1.	Age	Chronological age of the respondents
2.	Education	Scale developed by Pandya and Pandya (2008)
3.	Farming experience	Scale developed by Jamadar (2012)
4	Farm size	Scale used by State Department of Agriculture
	Communication variables	
5.	Extension participation	Scale developed by Siddaramaiah and Jalihal (1983)
6.	Mass media exposure	Scale developed by Gajendra (2011)
7.	Information seeking behaviour	Scale developed by Pynbianglang (2011)
8.	Access to weather forecast	Scale developed by Kunth (2022)
	Psychological variables	
9.	Innovativeness	Scale developed by Singh (1977)
10.	Risk orientation	Scale developed by Supe (1969)
11.	Scientific orientation	Scale developed by Gajendra (2011)
12.	Preparedness for adaptation	Scale developed by Vasanthi (2017)
13.	Perception regarding climate change	Scale developed by Dhadwad (2013)
	Situational variable	
14.	Cropping pattern	Scale developed by Vasudeo (2020)
	Dependent variables	
1.	Awareness regarding climate change	Scale developed by Vasanthi (2017)

Table 3: Distribution of respondents according to the statement wise awareness regarding climate change

S.No.	Statements	Frequency	Percentage	Rank
1.	The climate has been changing over years	215	89.58	III
2.	There is a shift in date of commencement of rain over the years	195	81.25	V
3.	The Annual Mean Temperature during last 10 years has been increased	229	95.41	I
4.	The pattern of monsoon rainfall during the last 10 years has been changed	185	77.08	VIII
5.	The occurrence of droughts and heavy rainfall is due to climate change	190	79.16	VI
6.	The number of rainy days is changing every year due to changing climate	175	72.91	IX
7.	Information in rainfall variability is useful in taking farm decisions such as crop selection, planting date and resource scheduling	172	71.67	XI
8.	The quality of water over the years is declining due to climate change	174	72.50	X
9.	Impact of climate change on distribution of rainfall over the years has been erratic	160	66.67	XVI
10.	Integrated Farming System helps in diversification of enterprises to reduce the risk involved in sole cropping	156	65.00	XVIII
11.	Selection of crop due to seasonal variation is difficult	159	66.25	XVII
12.	The climate change affects weed infestation, pest incidence and disease incidences	167	77.50	VII
13.	Renewable energy is a good source of energy to cope with climate change	126	52.50	XXI
14.	Borewell and well recharge, rain water harvesting and micro-irrigation help in water conservation	132	55.00	XX
15.	Practices like mulching and FYM application are important for soil health and soil water conservation	145	60.41	XIX
16.	The quality of the soil is declining as the effect of climate change	162	67.50	XV
17.	The crop pests that were minor earlier have become major due to climate change	186	69.58	XIV
18.	The crop diseases that were minor earlier have become major due to climate change	171	71.25	XII
19.	The post-harvest losses are more due to climate change	168	70.00	XIII
20.	Cost of cultivation has been increased because of climate change	214	89.17	IV
21.	The availability of ground water has been decreased due to climate change	225	93.75	II

Table 4: Distribution of respondents according to their awareness regarding climate change

S. No.	Awareness regarding climate change	Frequency	Percentage
1.	Low awareness regarding climate change (score<14.57)	53	22.08
2.	Medium awareness regarding climate change (between 14.57-19.11)	158	65.84
3.	High awareness regarding climate change (score>19.11)	29	12.08
	Total	**240**	**100.00**
Mean=16.84 S.D.= 2.27			

Table 5: Correlation Matrix of Profile Characteristics with Awareness Regarding Climate Change

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
Age (X1)	1.000														
Education (X2)	0.108 NS	1.000													
Farming Experience (X3)	0.215*	0.346 **	1.000												
Farm Size (X4)	-0.031 NS	0.167 *	0.193 *	1.000											

Extension Participation (X5)	0.059 NS	0.290 **	0.178 *	0.043 NS	1.000										
Mass Media Exposure (X6)	0.094 NS	0.314 **	0.142 *	0.058 NS	0.238 *	1.000									
Information Seeking (X7)	0.127 NS	0.386 **	0.205 *	0.091 NS	0.276 **	0.319 **	1.000								
Access to Weather Forecast (X8)	0.144*	0.319 **	0.228 *	0.113 NS	0.245 *	0.287 **	0.376 **	1.000							
Innovativeness (X9)	0.198*	0.469 **	0.312 **	0.145*	0.338 **	0.350 **	0.404 **	0.429 **	1.000						
Risk Orientation (X10)	0.176*	0.155 *	0.208 *	0.087 NS	0.192 *	0.273 **	0.344 **	0.289 **	0.391 **	1.000					
Scientific Orientation (X11)	0.132 NS	0.331 **	0.265 **	0.119 NS	0.275 **	0.312 **	0.367 **	0.348 **	0.438 **	0.326 **	1.000				
Preparedness for Adaptation (X12)	0.215*	0.505 **	0.371 **	0.162*	0.401 **	0.394 **	0.452 **	0.427 **	0.481 **	0.362 **	0.429 **	1.000			
Perception of Climate Change (X13)	0.198*	0.478 **	0.319 **	0.149*	0.376 **	0.388 **	0.438 **	0.413 **	0.456 **	0.339 **	0.412 **	0.463 **	1.000		
Cropping Pattern (X14)	0.186*	0.445 **	0.298 **	0.135*	0.349 **	0.365 **	0.419 **	0.397 **	0.431 **	0.322 **	0.394 **	0.448 **	0.476 **	1.000	
Awareness (X15)	0.108 NS	0.346 **	0.137 *	-0.013 NS	0.143 *	0.130 *	0.386 **	0.319 **	0.469 **	0.155 *	0.331 **	0.505 **	0.478 **	0.445 **	1.000

Table 6: Multiple regression analysis of independent and awareness regrading climate change

S. No.	Variables	Regression coefficient (b_i)	S.E.	t value
1.	Age (X1)	0.232	0.158	1.162
2.	Education (X2)	0.063**	0.017	3.805
3.	Farming experience (X3)	0.018*	0.007	2.343
4.	Farm size (X4)	0.222	0.019	1.162
5.	Extension participation (X5)	0.009	0.012	0.758
6.	Mass media exposure (X6)	0.028	0.033	0.849
7.	Information seeking behaviour (X7)	0.320*	0.155	2.291
8.	Access to weather forecast (X8)	0.001	0.088	0.005
9.	Innovativeness (X9)	1.243*	0.250	2.174
10.	Risk orientation (X10)	0.242	0.128	1.885
11.	Scientific orientation (X11)	0.063**	0.017	3.705
12.	Preparedness for adaptation (X12)	0.072**	0.019	3.789
13.	Perception regarding climate change (X13)	0.051**	0.016	3.285
14.	Cropping pattern (X14)	0.370**	0.108	3.433

**= Significant at 0.05 level K = 6.09 R^2 = 0.7502*
*** = Significant at 0.01 level*

Table 7: Direct, indirect and substantial indirect effects of selected variables on awareness of respondents regarding climate change

Variable No.	Variables	Correlation coefficient	Direct effect	Rank	Indirect effect	Rank	Two substantial indirect effects
X2	Education	0.346**	0.076	XI	0.270	II	0.15 X8 0.07 X9
X3	Farming experience	0.137*	0.080	X	0.057	X	0.19 X2 0.06 X9
X5	Extension participation	0.143*	0.024	XII	0.119	VIII	0.09 X2 0.06 X9
X6	Mass media exposure	0.130*	0.112	IX	0.028	XI	0.08 X9 0.07 X2
X7	Information seeking behaviour	0.286**	0.195	III	0.091	IX	0.06 X13 0.04 X2
X8	Access to weather forecast	0.319**	0.125	VII	0.194	VI	0.25 X13 0.15 X2
X9	Innovativeness	0.469**	0.140	V	0.329	I	0.16 X14 0.06 X2
X10	Risk orientation	0.155*	0.139	VI	0.016	XII	0.09 X8 0.07 X11

X11	Scientific orientation	0.331**	0.123	VIII	0.208	V	0.24 X9 0.16 X13
X12	Preparednes for adaptation	0.505**	0.336	I	0.169	VII	0.31 X13 0.05 X8
X13	Perception regarding climate change	0.478**	0.264	II	0.214	IV	0.12 X2 0.07 X9
X14	Cropping pattern	0.445**	0.184	IV	0.261	III	0.16 X9 0.05 X2

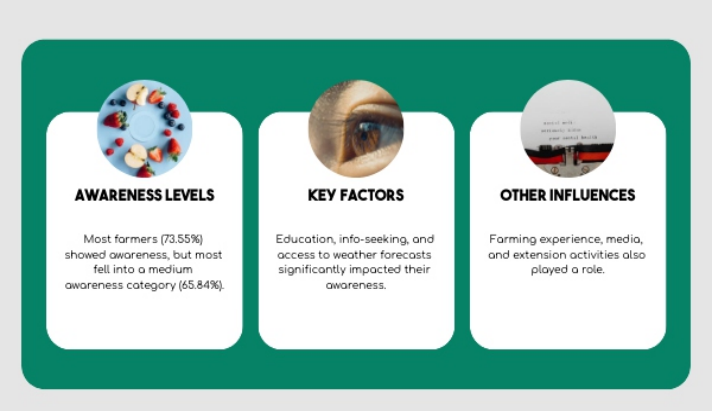

Figure 1: Graphics Abstract

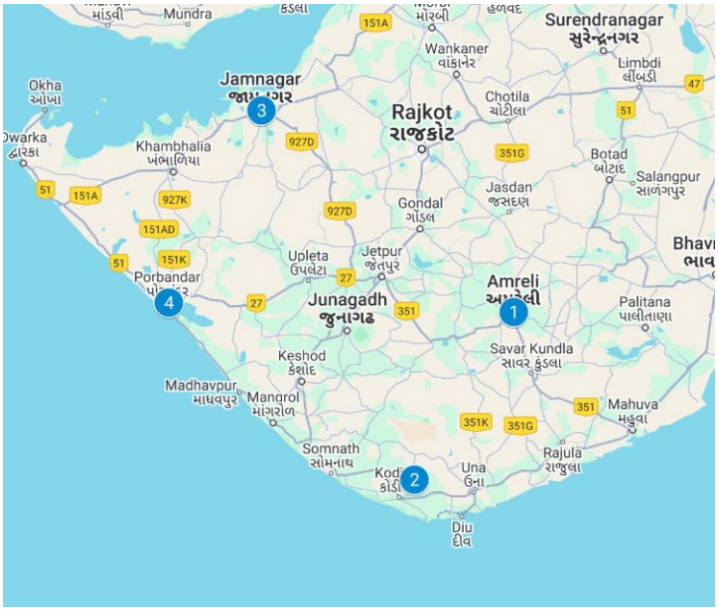

Figure 2: Map showing the location of selected districts

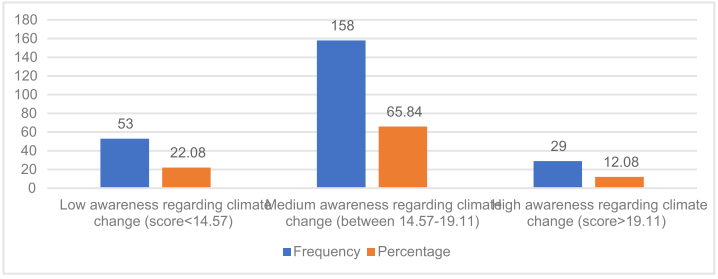

Fig 3: Distribution of respondents according to their awareness regarding climate change

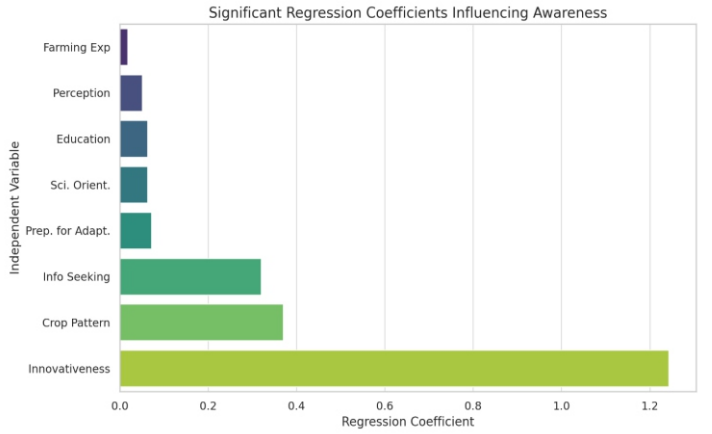

Figure 4: Regression co-efficients and factors influencing awareness regarding climate change

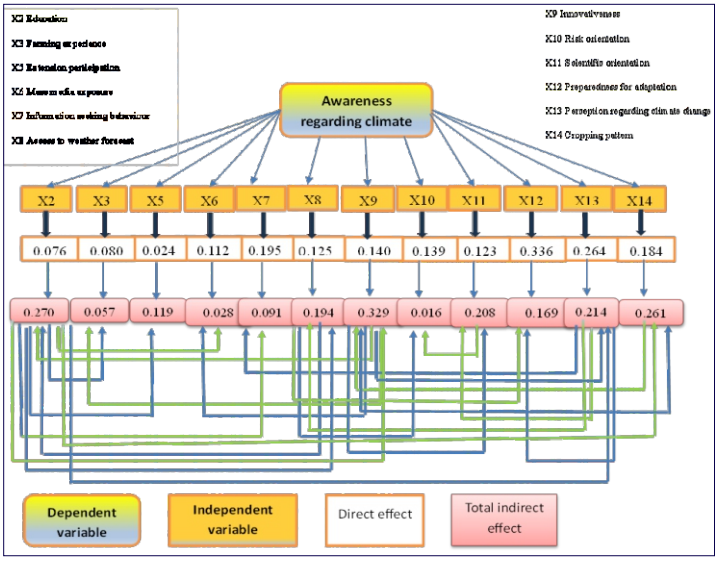

Figure 5: Direct, indirect and substantial indirect effects of selected variables on awareness of respondents regarding climate change

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