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CONSTRAINTS FACED BY FARMERS IN ADAPTING TO CLIMATE CHANGE

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ABSTRACT

Some constraints faced by the farmers due to climate variability, be it the delay in seasonal rainfall; heavily or less occur rainfall, its unexpected arrival during the reproductive phase of the crops, or even the increase in night temperature, continue to strike the farmers financially, forcing them to rethink farming as a viable proposition. The present study involving a sample size of 240 farmers from Gujarat, India, employed the Garrett's ***mean score*** *to determine the constraints to climate change. The findings revealed that among the Among the constraints in managing the adverse implications of climate change, lack of finance was found to be the most critical constraint faced by the farmers in the study area. With a Garrett mean score (GMS) of 57.10. The constraint was ranked two in the overall study area with a Garrett mean score of 55.76. High cost of adaptation is one constraint which is not perceived to be a serious issue across the study area as the perceptions of farmers with regards to its severity was found to be mixed. Only in the districts of Jamnagar and Junagadh, the constraint was ranked second in terms of severity with a Garrett mean score of 56.80 and 55.67, respectively.*

Keywords: *climate change; constraints; garrett's mean score*

INTRODUCTION

Climate also known as the "average weather", can be defined as the measurement of the mean and variability of relevant quantities of climatic variables (such as temperature or 7precipitation) over the classical period of 30 years (IPCC, 2007). Climate change refers to a statistically significant variation, often irreversible, in either the mean state of the climate or in its variability due to anthropogenic factors in addition to the natural factors, persisting for an extended period. Climate change has emerged to be the greatest challenge to the environment surmounted by anthropogenic pressure (Ashalatha *et al*., 2012). It has also a direct influence on both quantity and quality of crop production. Major climate change indicators such as rainfall, temperature, *etc.* can significantly affect crop production and yield. Climate change and its consequences on human life and the surrounding environment require constant research and engagement. Though all sectors in the economy ranging from manufacturing to tourism are affected by climate change and its variability in developing countries like India, agriculture happens to be the most vulnerable sector to come under the radar of climatic change consequences as it continues to be dependent on the vagaries of monsoon and with farmers happen to be least protected to combat its negative externalities.

The effects of climate variations are global, but for countries like India with a burgeoning population to cater to, the dependence on agriculture is immense not only in terms of food production but also employment generation. Therefore, climate change research is prioritized in the country with a special focus on strengthening the adaptation of farmers to its implications (Yeragorla Venkata Harikrishna and Seema Naberia 2021). But the weaknesses that exist in the form of structural constraints, institutional bottlenecks, and technological gaps further compound the climate change implications and limit the effectiveness of interventions (IPCC 2007; Tajpara *et al*., 2020).

OBJECTIVE

To determine the constraints faced by farmers while managing the implications of climate variability and change.

METHODOLOGY

The present constraints study was conducted Saurashtra region, a sample size of 240 respondents was surveyed from the study area consisting of Junagadh, Amreli, Rajkot and Jamnagar districts in Saurashtra region, Gujarat. From the districts selected, two talukas each were in turn selected purposively on the basis of maximum area under cultivation. Subsequently, the list of villages was obtained from each of the selected taluka and then the villages were selected randomly using random number generator function in MS Excel. From each of the selected villages, ten farm

respondents were selected randomly.

Garrett's ranking technique

To study the constraints faced by farmers while managing climate change implications, Garrett's ranking technique was used (Garrett and Woodsworth, 1969). The order of importance given by the farmers to the constraints is converted into numerical scores and then converted into ranks through this technique. The constraints are arranged in ascending order from the respondents' point of view in such a way that even if the same number of respondents select two or more constraints the ranks would vary depending upon the degree of importance given by the respondents while ordering the constraints. Once the ranks were obtained for the constraints, they were converted into percentages using the following equation:

$$\text{Percentage position} = 100*(R_{ij}-0.5)/ N_j \quad \ldots(1)$$

Where,

R_{ij} = Rank given for factor (constraint) by the j^{th} respondent; and

N_j = Number of factors (constraints) ranked by the j^{th} respondent;

RESULTS AND DISCUSSION

Constraints perceived while adapting to climate change

Garrett's ranking technique was employed to understand the prevailing constraints in the study area that hinder the adaptation of climate change management strategies. This technique was preferred over others since it gives the respondent the choice to rank each and every one of the constraints in an ordered fashion of giving top ranks to the most experienced constraints and bottom ranks or no rank at all to the constraint least or not faced at all. The farmers' preferences were then converted into scores using the Garrett ranking table and higher the score higher would be the rank for the concerned constraint. In a nut shell, even an individual constraint of an individual farmer can be individually ranked using this technique.

For this study, the following eight different constraints were employed *viz*. (i) lack of finance; (ii) lack of knowledge about technology; (iii) lack of access to agricultural inputs; (iv) high cost of adaptation; (v) lack of technical know-how; (vi) inadequate training and demonstration on improved technical practices/ technologies; (vii) lack of access to information on climate change; (viii) labour shortage, and (ix) others to be specified by the individual farmers.

All these constraints were selected on the basis of available literature as well as expert discussion followed up by a pilot study. The responses were elicited from the farmers and were assigned ranks on the basis of their perception on the severity of the issue. None of the respondents specified any other constraint apart from the eight constraints given to them for ranking. As it could be seen in Table and Figure shortage of labour was perceived to be the most important constraint in the study area followed by the lack of access to key inputs and lack of finance. On the other hand, lack of knowledge on technology and lack of access to climate information were found to be the least important constraints as perceived by the farm respondents in the study area. The present findings are in line with the findings Ziervogel *et al*. (2006); and Agarwal (2008) who observed that the factors such as accessibility and usefulness of climate information, the institutional set-up and the socio-economic situation of households affect farmers' adaptation capacity to climate variability. The findings on constraint analysis in the study are further elaborated in the below given sections.

Lack of finance

Among the constraints in managing the adverse implications of climate change, lack of finance was found to be the most critical constraint faced by the farmers in the study area. With a Garrett mean score (GMS) of 57.10 it was found to be ranked one in Jamnagar district of Saurashtra region, Gujarat. In case of other districts and overall region, the constraint was ranked as the third most important constraint perceived by the farmers while adapting to climate change. The GMS was also found to be more or less the same with little variations across the districts under the study as well as the pooled data ranging from 54.90 in Junagadh district to 55.43 in the overall Saurashtra region.

This is a serious constraint hampering the prospects of climate smart agriculture in the region since in spite of knowing very well about the adaptation strategies, the farmers were not in a position to allocate additional funds for incorporating such practices into their farm schedule. Besides, lack of finance among the farmers may pose a serious threat to on time application of crop production and crop protection measures as well as on time deployment of farm labour and other resources. This has to be overcome in the study area by reassessing the credit needs of the farmers in accordance to the implications of climate indicators and by liberalizing the options of credit facilities at special interest rates. The direct cash transfer scheme being implemented by the GOI named Pradhan Mantri Kisan Samman Nidhi Yojana (PM-Kisan Yojana) is a right step in this direction through which all small and marginal farmers are credited up to Rs 6,000 per year as minimum income support besides improving financial inclusion in farm sector.

Lack of knowledge on technology

This is the least perceived constraint in the study area and was ranked the last among all the constraint with a Garrett mean score ranging from 25.38 in Rajkot district to 35.87 in Junagadh district and 29.75 in the overall study area. The farmers seem to have every other available information on technology related to climate smart agriculture be it drip / sprinkler irrigation or greenhouse technology or mulching technology or the rationale in using organic farm supplements. What is holding them back during adaptation process is the lack of finance as discussed earlier. The Junagadh Agricultural University along with its seven (07) Krishi Vigyan Kendras (KVKs) and one Sardar Smruti Kendra (SSK) conduct regular training programmes to the farming on all latest technologies so as to keep farmers updated and stay relevant to the changing times. The entire Saurashtra region comes under the jurisdiction of the University. This should be one of the reasons for the farmers not perceiving the lack of knowledge on technology as a major constraint when it comes to adaptation to climate change.

Table 1: Constraints perceived by farmers while adapting to climate change in the study area (n240)

Sr. No.	Constraints perceived	Junagadh district		Rajkot District		Jamnagar District		Amreli district	
		GMS	Rank	GMS	Rank	GMS	Rank	GMS	Rank
1	**Lack of finance**	54.90	**3**	54.65	3	57.10	1	55.47	3
2	**Lack of knowledge on technology**	35.87	**8**	25.38	8	25.57	8	32.22	8
3	**Lack of timely access to requisite inputs**	53.73	**4**	55.02	2	56.43	3	57.08	2
4	**High cost of adaptation**	55.67	**2**	53.38	4	56.80	2	52.55	5
5	**Lack of technical know-how**	41.60	**7**	52.92	5	53.85	5	39.25	7
6	**Inadequate training and demonstration**	50.98	**5**	50.18	6	51.82	6	52.83	4
7	**Lack of access to climate information**	49.70	**6**	46.55	7	41.45	7	42.75	6
8	**Shortage of labour**	57.40	**1**	61.60	1	56.28	4	66.62	1

Note: GMS refers to Garrett Mean Score

Lack of access to requisite inputs

More than lack of finance, the farmers in the study area perceived the lack of access to requisite inputs as the major constraint during climate change adaptation. The constraint was ranked two in the overall study area with a Garrett mean score of 55.76. In case of districts, the farm respondents in Amreli and Rajkot districts perceived the lack of access to inputs as the second major constraint with the GMS estimated to be 57.08 and 55.02, respectively. In the same vein, the constraint was found to the third major constraint in Jamnagar, albeit with a higher GMS of 56.43, and the fourth major constraint in Junagadh with GMS of 53.73. The farmers perceived supply disruptions in fertilizers and pesticides, that too, during peak seasons. In addition, the supply of organic supplements which are highly required for soil conditioning as well as moisture retention in the field were also perceived to be limited in supply. The timely availability of improved cultivars in tune with the changes in cropping pattern and schedule was found to be another major deterrent perceived by the farmers. Lack of finance coupled with lack of access to agricultural inputs can lead to deleterious consequences hampering the prospects of farming in the region, if goes unaddressed.

High cost of adaptation

High cost of adaptation is one constraint which is not perceived to be a serious issue across the study area as the perceptions of farmers with regards to its severity was found to be mixed. Only in the districts of Jamnagar and Junagadh the constraint was ranked second in terms of severity with a Garrett mean score of 56.80 and 55.67, respectively. In case of Amreli district, high cost of adaptation was perceived only as the fifth major constraint with a GMS of 52.55, whereas the same was perceived as the fourth major constraint in the overall study area and Rajkot district with a GMS of 54.60 and 53.38, respectively. In general, the famers perceived higher cost of cultivation of all inputs from fertilizers to pesticides and not only ‘adaptation inputs. A cursory glance at the cost of cultivation of principal crops data available at the Department of Agricultural Economics, Junagadh Agricultural University, Junagadh (Gujarat) indicate escalating production cost in the study area to the tune of 37 per cent in hired labour component and 28 per cent in cost of chemicals.

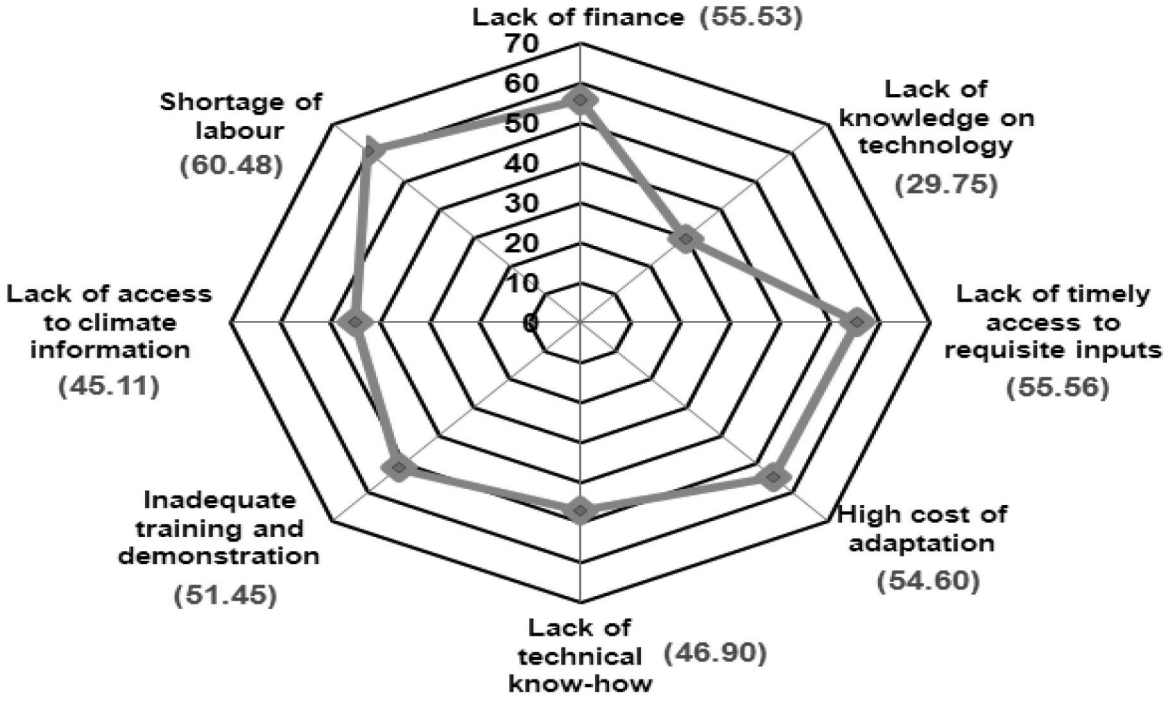

Fig. 1: Estimated Garrett Mean Score of climate change adaptation constraints of farmers in Saurashtra region of Gujarat (n=240)

Lack of technical know-how

Lack of technical know-how of the technological and technical practices related to climate change adaptability was also the least perceived constraint in the study area. Among the eight different constraints assigned to the farmers, this was ranked sixth in the overall study area with a Garrett mean score (GMS) of 46.90. Only in case of Jamnagar (53.85) and Rajkot (52.92), the GMS of the constraint were found to exceed 50 and it was perceived to be the fifth major adaptation constraint. On the contrary, it was perceived to be the seventhmajor constraint in Junagadh and Amreli districts with a Garrett mean score of 41.60 and 39.25, respectively. The lack of technical know-how can be considered in tandem with the lack of knowledge on technology.

Inadequate training and demonstration

Though the farmers espoused sufficient knowledge related to technology as well as technical know-how, the felt need for training and demonstration related to climate change adaptation strategies is relatively strong in the study area. Overall, the constraint was ranked fifth in the overall study area with a GMS of 51.45. Further, the GMS of the constraint was found to be more than 50.00 across the study districts ranging from 50.18 in Rajkot to 52.83 in Amreli. Accordingly, the inadequate training and demonstration was perceived to be the fourth major constraint in Amreli; fifth major constraint in Junagadh and sixth major constraint in Rajkot and Jamnagar districts. Thereby, it is imperative that the public extension system being operated in the region need to be accommodate training and demonstration programmes related to climate smart agriculture. A baseline survey on climate change adaptation may be conducted among the farmers so as to ascertain not only the type of trainings needs but also to account the training gaps. A separate mechanism ensuring the follow up and horizontal spread of the adaptation practices related to climate smart agriculture.

Lack of access to climate information

This is yet another least perceived climate change adaptation constraint in the study area and is found to be ranked seventh in the overall study area with a GMS of 45.11. Across the study districts, the constraint was found to be ranked either sixth or seventh major issue with a Garrett mean score below 50.00 ranging from 41.45 in Jamnagar district to 49.70 in Junagadh district. The climate information are always embedded in all the training and capacity building programmes conducted by the extension system trinity of JAU-KVK-GoG. Besides, the Junagadh Agricultural University also hosts a separate Agrometeorology Cell wherein weather bulletins are dispatched at regular intervals to suit the needs of the farmers. The scientists involved at the Agrometeorology Cell of the University also increase climate awareness among the farmers with their timely climate

related talks in local television and radio channels.

Shortage of labour

Shortage of labour was perceived to the most important constraint in the study area when it comes to climate change adaptation. It was found to be ranked number one across the districts as well as the study area as a whole except Jamnagar. With a Garrett mean score of 56.28, the shortage of labour was perceived to be only the fourth major constraint in Jamnagar district. At the same time, the lack of finance which was perceived as the first major constraint by Jamnagar farm respondents was with a GMS of 57.10 alone. Otherwise, the GMS of labour shortage was found to be higher across the districts with 66.62 in Amreli followed by 61.60 in Rajkot and 57.40 in Junagadh districts. This is such a crippling constraint that even when the finance is available and access to inputs is guaranteed, the farmer would not be in a position to follow any adaptation strategy for the shortage of labour at critical time period. Moreover, as the farmers increasingly give away all the farm related operations on contract basis, it becomes highly difficult to incorporate climate change adaptation strategies as and when needed.

It is also found that only 34.50 per cent of the farm respondents seem to follow farming as a stand-alone full-time activity. With the support of family labor also not available, it is also not easy to convince a farmer about any new climate change adaptation strategy. In addition, the farmers also perceive escalating cost of hired farm labor and the climate related uncertainties also hinder farmers to employ laborers in the season.

CONCLUSION

Among the constraints in managing the adverse implications of climate change, lack of finance was found to be the most critical constraint faced by the farmers in the study area. With a Garrett mean score (GMS) of 57.10. More than lack of finance, the farmers in the study area perceived the lack of access to requisite inputs as the major constraint during climate change adaptation. The constraint was ranked two in the overall study area with a Garrett mean score of 55.76. High cost of adaptation is one constraint which is not perceived to be a serious issue across the study area as the perceptions of farmers with regards to its severity was found to be mixed. Only in the districts of Jamnagar and Junagadh the constraint was ranked second in terms of severity with a Garrett mean score of 56.80 and 55.67, respectively. Shortage of labour was perceived to the most important constraint in the study area when it comes to climate change adaptation. It was found to be ranked number one across the districts as well as the study area as a whole except Jamnagar. With a Garrett mean score of 56.28, the shortage of labour was perceived to be only the fourth major constraint in Jamnagar district. At the same time, the lack of finance which was perceived as the first major constraint by Jamnagar farm respondents was with a GMS of 57.10 alone.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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