Dealing with Climate Change – Farmer's Pragmatic Way

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ABSTRACT

India's first national communication, which was submitted to the UNFCCC (United Nations Framework Convention on Climate Change) in 2004, describes the potential impacts of climate change. Two-thirds of the total sown area of the country is drought-prone, with monsoon rains showing high inter-annual, intra-seasonal, and spatial variability. Agriculture production is typically a risky business and farmers faced a variety of agricultural risks due to climate change. To deal with the climate change, farmers have been adapting alternative agricultural practices evolved over by time and experience. This paper investigates the various strategies adapted by the farmers to combat the production risk with a special focus to climatic variables is presented. The study was carried out in the east coastline of Nagapatinam district of Tamil Nadu with sample size of 180 farmers selected by adopting simple proportionate random sampling The Survey was carried out with a well structured interview schedule and with focus group discussion and data were analysed with the help of descriptive statistics and simple percentage analysis. Most (93.38%) of the paddy farmers were aware and experienced in production risks. The probability of occurrence of risk and impact of risk was much perceived with respect to weather based variables and biological variables. The widely adopted strategies were choice or selection of variety, Integrated Pest Management, registered for crop insurance and adopted by 75.55, 71.11 and 66.66 per cent respectively. More than two-third (67.22%), one-fifth (20.00%) and little more than one-tenth (12.78%) of paddy farmers had resorted to ex-post risk management strategies, ex-ante risk management strategies and ex-ante and ex-post risk management combined respectively. Appropriate risk management policy at the macro and micro level should be evolved by considering both ex-ante and ex-post strategies. Designing suitable micro level crop insurance programme, establishing early warning system and promoting Para extension personnel as climate risk manager in every village would be some of the suggested institutional interventions to mitigate the climate change.

Keywords: *Risk management strategies, Agricultural risks, Production risks; Climate change;*

The enterprise of agriculture is subject to great many uncertainties and risks. Agricultural risk is associated with negative outcomes that arise from imperfectly predictable climatic, biological, human related and market variables. Indian agriculture is predominantly controlled by monsoon. Up to 80.00% of variability in crop yields is attributable by weather. Paddy is an important crop grown widely across the country in highly diverse ecosystems; it is rated as high- risk crop (*Barah, 2008*). It is being a major staple food, for the majority of population, any change in rice production system has wider application. Paddy contributed about 46 per cent of total cereals production in the country, subjected to wide variety of risk and inclusive of climate change. To overcome those agricultural risks especially due to climatic change farmers have been adopted different agricultural strategies, which would be evolved over a period of time by virtue of experience with a specialty of time tested and has high reach out effect. Risk management strategies refer to ***ex-ante*** measures taken before such an event has taken place, whereas risk coping strategies are, ***ex-post*** strategies dealing with the consequences of the event (*World Bank Report, 2005*). Invariably, farmers use both ***ex-ante*** strategies and ***ex-post*** strategies. Therefore understanding agricultural risks arises out of different sources and ways of managing it deserves serious attention. Hence, an attempt has been made to explore various agricultural

risk management strategies adapted by the farmer to deal with the climate change is presented in this paper.

METHODOLOGY

Six blocks of Nagapattinam District of Tamil Nadu was selected with a sample size of 180. The samples were distributed to 12 villages by adopting simple proportionate random sampling based on the secondary data served by the Primary Agricultural Credit Banks, Commercial Banks and Block level agricultural office of the study area. The data related to awareness of paddy farmers towards agricultural risks, experience in various kinds agricultural risks, perceived causes and impact of agricultural risks , kinds of risk management strategies adapted and actucalrisk management practices adapted to combat the production risks/ climatic risks were collected by using a well structured interview schedule, focus group discussion and observation. The percentage analysis, mean and ranking methods were used for analysis of data for meaningful interpretations.

RESULTS AND DISCUSSION

Awareness of paddy farmers regarding the various types of agricultural risks : The awareness of paddy farmers regarding the various types of agricultural risks is presented in Table 1

Table .1 Knowledge empowerment of farmers in GALASA Programme (N=60)

S. N.	Knowledge empowerment components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Adoption of IPM practices	1.8	3.2	5.2063**
2	Adoption of INM practices	1.9	3.4	1.0131
3	Adoption of IWM practices	2.2	3.0	8.3649**
4	Use of machineries & equipments	1.3	3.8	3.0612**
5	Knowledge on value addition	2.0	3.0	8.1276**
6	Knowledge on account keeping	2.3	2.8	1.0427
7	Knowledge on agricultural programmes of Krishi bhavan	2.1	3.6	8.1312**
8	Information about human right	2.3	2.9	3.0132**
	Total mean score	18	25	
	Overall mean Score	2.3	3.1	

Source: Primary Data t value (1% significance) = 2.6617

*Production risks :*From the above Table 1 it is seen that most (93.38%) of the paddy farmers were aware about the production risks. The reason was that the production risks demanded great challenges in the study area due to climate change. Production risks like delayed receipt of Mettur dam water in time, receiving heavy rainfall receipt during samba season coinciding with different stages of paddy crops, outbreak of pests and diseases like brown plant hopper and blast and non-availability inputs *viz.*, fertilizers and chemicals. All these production risks were predominant in the district and are recurring ones subjected mainly due to climate change.

Human resource risks : Human risk was known to the vast majority (88.34%) of the paddy growers. The obvious reason being that human resource risks was being an alarming feature in agriculture. It could be interpreted that the availability of manpower for the various agricultural operations possessed a greater threat and lead to high risk in farming. This has universally felt in all kinds of farming. The migration of labourers especially youth to the secondary and territory sectors would be the main reason attributed for the non availability of manpower for agricultural operations. All these said reasons, would have caused human resource risks in farming heavily. Thereby, the paddy farmers identified human resource risks, as one of the major risks in farming.

Financial risks : Exactly three-fourth (74.45%) of the paddy farmers were well aware about the financial risks. Finance is the major agri-input essential for farming. In spite of the presence of number of formal credit institutions like PACBs and commercial bank in the grass root levels, the availability of finance, timeliness and adequacy are still problematic. Thus, these factors forced the farmers into the financial risks. On the other hand, the farmers were forced to approach non-formal financial institutions available locally and fell down into the clutches of moneylender. Thus awareness of financial risks was well pronounced by the paddy farmers.

Market risks : Market risks is a wide spread risk applicable to all kinds of crops and farmers. Result depicts that more than two-thirds (67.78%) of paddy farmers knew about the market risks and their impacts. It could be interpreted that market price is one of the major determinants to decide whether the farming was profitable or non-profitable. Even though the yield

obtained was lower and if farmers got remunerable price means, it would be benefited. On the other hand, optimum yield and less remunerative price would even attract mostly the market risk. In this situation, market risk was pronounced as against the rupee invested and gain reaped on a particular point of time. They could also understand that market fluctuations and intermediaries' intrusions were the critical factors deciding the market price. All such understanding and experiences might have increased the awareness about the market risks.

Policy risks : Nearly half (48.34%) of the paddy farmers knew about the existence of policy risks in farming. The price fixation, announcement of Minimum Support Price, issue of subsidy, fixing target beneficiary, etc., are the policy matters. But it has got its own impact on farming either directly or indirectly. The paddy farmers in the district were found much affected by the policy risks.

Agricultural risks as experienced by the paddy farmers : Agriculture production is typically a risky business and farmers faced a variety of agricultural risks. The data related to different agricultural risks experienced by the paddy farmers were elicited and presented in Table 2

Table 2. Psychological empowerment of farmers in GALASA Programme (N=60)

S. N.	Psychological empowerment components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Confidence	1.8	3.6	4.3567**
2	Decision making quality	2.1	3.5	2.2185*
3	Risk taking ability	2.2	3.5	3.3242**
4	Courage	2.0	3.8	7.8198**
5	Motivation in farming	1.8	4.0	9.2541**
6	Positive attitude	2.2	3.1	1.5678
7	Self esteem	2.3	3.2	2.5740**
	Total mean score	14.4	24.7	
	Overall mean score	2.1	3.5	

Source: Primary Data t value (1% significance) = 2.6617

It is seen from the Table 2 that vast majority (93.38%) of paddy farmers were subject to experienced the production risks, followed by human resource risks (88.34%) financial risks (74.45), market risks (67.78%) and policy risks (48.34%).

From the findings it could be concluded that the paddy farmers were faced an array of agricultural risks and only that intensity of risks would vary according to the influence of external variables. However, the production risk was much pronounced due to the greater influence of climate change in the study area. Further it could be generalized that more than two-third of the paddy farmers were exposed to all kinds of agricultural risks *viz.,* production risks, market risks, financial risks and human resource risks, whereas only less than a half (48.34%) of the respondents only had the experience of policy risks.

Perceived causes and Impact of Production risks : A list of perceived causes for various production risks / climatic risks have been identified and responses in terms of level of its probability of occurrence and impact were obtained from paddy farmers and then transformed to 3 point continuum with the scores of 3, 2 and 1. Mean scores were worked out and the pertinent results have been presented in Table 3

Table 3. Social empowerment of farmers in GALASA Programme (N=60)

S. N.	Sociological empowerment components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Free to work with group members	2.3	3.4	6.4136**
2	Participation in group activities	2.6	3.0	2.4269**
3	Involvement in decision making	2.7	3.4	7.5136**
4	Attendance in grama sabha meeting	2.7	2.8	0.1094
5	Free interaction with family members & outsiders	3.4	3.5	0.0513
6	Team spirit	2.5	3.2	1.6399
7	Leadership quality	2.6	3.1	3.9637**
8	Group consensus to solve problem	2.4	3.2	8.2600**
9	Developing institutional contact	2.1	4.0	9.2419**
10	Linkage with developing departments	2.1	3.9	3.3441**
11	Group marketing skill	1.8	3.1	3.9292**
12	Developing skill to solve conflict	2.3	2.9	4.5603**
	Total mean score	29.5	39.5	
	Overall mean score	2.5	3.3	

Source: Primary Data t value (1% significance) = 2.6617

The over all mean score for the production risks with respect to its probability of occurrence worked out was 1.424, whereas over all mean score for its impact

was 1.829. The mean score indicated that causes of risk with respect to its probability occurrence and impact were fairly high. Therefore, the perception level could also be fairly high.

As it could be further seen from the Table 3 weather-based causes (rainfall, temperature, and drought), biological variables like pest, disease, nutrient deficiency, availability of critical inputs, and lack of knowledge on new varieties or technology were the major causes of production risks than others. The probability of occurrence of risk was much perceived with respect to weather based variables and biological variables. On the other hand the impact of risk was high in the case of weather based variables followed by biological variables. In addition to that the availability of critical inputs also felt serious impact on farming.

Among the causes of production risks, the weather based variables and biological variables had shown high probability of occurrence as well as impact. This is evident from the fact that, the district is being, often subjected to the climate change resulted in natural calamities. The recent Nisha cyclone 2008 in the district had caused the damage to paddy crop to the tune of Rs. 8546 crores. This supported the result obtained.

Agricultural risks management practices adopted to combat the production risks : The actual risk management strategies adopted physically to overcome agricultural production risks in paddy cultivation were collected and presented in Table 4

It could be seen from Table 4 that there were ten strategies which have been found adopted physically by the paddy farmers to combat the production risks arising out of climate change. Among the ten, the widely adopted were choice or selection of variety, Integrated Pest Management, registered for crop insurance and adopted by 75.55, 71.11 and 66.66 per cent respectively.

The reason attributed could be that the three strategies have direct effect on the yield attributes and showed visible results as per their perception.

The other strategies *viz.*, adjusting sowing time (46.66%) Integrated Nutrient Management (31.11%), diversification of crops (17.77%) proper planning to stock inputs (11.66%), diversification of enterprise (10.55%), increased area under organic farming (6.66%) and adoption of modern technology (SRI) (6.11%).

Table 4. Economic empowerment of farmers in GALASA Programme (N=60)

S. N.	Economic empowerment components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Increased income due to yield obtaining	2.3	3.3	1.8342
2	Saving money	1.5	2.4	4.3848**
3	Investments	1.2	1.7	6.5988**
4	Availing agriculture loans	1.2	2.3	2.0157*
5	Financial management skill	2.4	3.0	1.1696
6	Extent of dependency on money lenders	1.0	1.0	NA
7	Availing the facilities of KCCS	1.4	1.8	0.0030
8	Availing personal insurance	1.5	1.8	0.0002
9	Availing family insurance	1.0	1.0	NA
10	Availing crop insurance	1.1	2.7	3.7410**
11	Purchase of inputs of farming	1.7	3.5	2.7519**
	Total Mean Score	16.3	24.5	
	Overall mean score	1.48	2.2	

Source: Primary Data t value (1% significance) = 2.6617

Shiyani (1988) also reported that farmers had shifted from subsistence to commercial crops cultivation and exhibited their orientation towards crop diversification.

Kinds of risk management strategies followed by the paddy farmers :

It is useful to understand strategies used by the paddy farmers to deal with agricultural risk. The kind of strategies developed by the paddy farmers were extracted out and presented in Table 5.

Table 5. Political empowerment of farmers in GALASA Programme (N=60)

S. N.	Political empowerment components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Membership in the social organizations	1.7	1.8	0.0896
2	Position in the political parties	1.3	1.4	1.0000
3	Freedom of expressing ideas in politics	1.4	1.5	0.0327
4	Conflict management	1.7	2.1	9.3474**
	Total mean score	6.1	6.9	
	Overall mean score	1.5	1.7	

Source: Primary Data t value (1% significance) = 2.6617

A cursory look into the Table 5. it is quite apparent that more than two-third (67.22%) of paddy farmers had resorted to ex-post risk management strategies, where as little more than one-tenth (12.78%) had followed the ex-ante risk management strategies.

The possible reason for the adoption of ex-post risk management strategies could be that it was customary practice to recover the paddy crop only after the exposure to risks. They might have felt that ex-post risk management strategies lead to recovery and resume of the crops. Moreover, the ex-post risk management strategies gave some transparency scenario, where in it could be easy to estimate and devise the recovery mechanism. In general, most of the government intervention regarding the agriculture sector is of ex-post in nature. The relief package is one such example of these kinds. Hence, mostly the paddy farmers adopted ex-post strategies.

Table 6. Creativity empowerment of farmers in GALASA Programme (N=60)

S. N.	Empowerment variables components	Mean Scores		T-test value
		Before Joining	After Joining	
1	Generation novel ideas	1.6	1.7	0.0183
2	Orientation towards crisis management	2.1	2.8	1.8151
	Total mean score	3.7	4.5	
	Overall mean score	1.9	2.3	

Source : Primary Data t value (1% significance) = 2.6617

On the other hand, lesser proportion of farmers had resorted to ex-ante risk management strategies. These sections of farmers had high orientation towards prediction and forecasting of casual factors for the risk especially due to much exposure to climate change. The experience gained over a period of time might have instructed the farmers to adapt the ex-ante risk management strategies. Farmers who had this strategies, generally showed a high degree of preparedness to face the risk. In addition to that, they might sensitize some of the agricultural risks in advance.

Discussion had so far on the farmers, who had adopted ex-ante risk management strategies and ex-post risk management strategies as two separate entities. The section of farmers who constituted exactly one-fifth (20.00%) had adopted the ex-ante and ex-post risk management combined. The reason attributed for such result reported could be that ex-ante or ex-post risk management strategies alone not able to manage adequately the agricultural risk. Hence the farmers could have adopted these two strategies combined**.**

Table 7. Empowerment Dynamics Index of farmers in the GALASA Programme (N=60)

Componen Dimensions of empowerment	Index	
	Before joining	After joining
Knowledge Empowerment Index(KEI)	0.45	0.63
Psychological Empowerment Index(PsyEI)	0.41	0.71
Social Empowerment Index (SEI)	0.49	0.66
Economic Empowerment Index(EEI)	0.30	0.45
Political Empowerment Index(PEI)	0.31	0.35
Creativity Empowerment Index(CEI)	0.37	0.45
Empowerment Dynamics Index(EDI)	0.24	0.42

CONCLUSION

It could be concluded that, no single agricultural risk management strategy alone would be sufficient to combat production risks arising out of climate change. Hence the paddy farmers could have adopted more than one strategy to face production risks. Therefore, it is imperative to consider those strategies for documentation and validation to evolve appropriate farmer friendly adaptive risk management strategies inclusive of both ex –ante and ex post to combat production risks in paddy. On the light of findings obtained and researcher's insights the followings implications could be suggested as an institutional interventions to mitigate the production risks due to climate change.

1. Appropriate risk management policy at the macro and micro level should be evolved by considering both ex-ante and ex-post strategies.
2. Designing suitable micro level crop insurance programme and establishing early warning system are to be thought
3. Promoting Para extension personnel as a climate risk manager in every village should be done.

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