Prediction of Farmers' Access to Pradhan Mantri Fasal Bima Yojana (PMFBY) Scheme using Discriminant Analysis

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Abstract

Crops are subject to risks generated by adverse weather conditions, natural disasters, biological reasons and market price volatility. Crop insurance is a strategy hedge the risk of loss arising out of agricultural activities. The PMFBY was launched in 2016 with an impetus on agricultural sector. The successes of crop insurance business depend on the awareness of the beneficiaries about the products and services rendered. Hence the study aims at analysing awareness and access to the Scheme by the farmers who have insured their crops mandatorily or voluntarily. The sample farmers were drawn from Thondamuthur block in Coimbatore District of Tamil Nadu, which is notified by PMFBY scheme as the Low Risk Profile District purposively taking into account those who have insured their crops under PMFBY Scheme during the study period of Kharif 2018. The sample size includes 187 respondents comprising of 115 loanee farmers covered under the scheme and 72 non-loanee farmers covered under the scheme voluntarily. The primary data were collected through structured interview schedule and were subjected to test of reliability. The secondary data was collected from published sources. The descriptive statistics and inferential statistics namely factor analysis and discriminant analysis was employed in data analysis. The result showed that a moderate level of awareness is prevailing PMFBY scheme among the farmers about the features of the scheme. The non-loanee farmers were much aware of various features than loanee farmers. The access to the scheme by the non-loanee farmers were determined by announcement of cut-off date ahead of the particular season and support services available at the villages. The access to the scheme by the loanee farmers is because of mandatory deduction of premium out of agricultural credit, Insurance policy provided at their doorstep by authorities, agencies and involvement of local leaders.

1. Introduction

Agriculture is the most important sector of the Indian economy. About 70% of population are depending upon agriculture for their livelihood and employment.

The agriculture sector contributes to 17% of the GDP. With fragmented land holding, the small and marginal farmers are growing. Crop insurance is a strategic measure to manage risk in yield loss by reducing the impact of income loss on the farmers (Sarangi and Panigrahi, 2016). The farmers are protected against

the variations in yield resulting from uncertainties like natural factors beyond their control and pest infestation, etc. (Rajaram and Chetana, 2018). The forward and backward linkages of agriculture impinge on other sectors of the economy. From a social point of view, the crop failure due to natural disasters leads to acute problems affecting large number of producers. Since the welfare of everyone gets affected, the farmer's problem becomes a community problem (Mishra, 2018). Crop insurance which is subsidized by the Central and State governments are purchased by farmers to protect against either the loss of their crops due to natural disasters or the loss of revenue arising from variations in the prices of agricultural commodities (Kumar, *et. al,* 2011).

1.1 Pradhan Mantri Fasal Bima Yojana (PMFBY)

In India, the Pradhan Mantri Fasal Bima Yojana (PMFBY) scheme was launched in 2016. It replaces all the prevailing insurance schemes in India. The PMFBY scheme has been launched by the Government of India with an impetus on agricultural sector and integrates multiple stakeholders on a single platform. The scheme aims at providing financial support to farmers suffering crop loss/damage arising out of unforeseen events. It supports sustainable production in agriculture sector by way of, stabilizing the income of farmers to ensure their continuance in farming, encouraging farmers to adopt innovative and modern agricultural practices and ensuring flow of credit to the agriculture sector with the expected outcome of food security, crop diversification and enhancing growth and competitiveness of agriculture sector besides protecting farmers from production risks, localized risks, post-harvest losses etc. Further aims at adoption of technology for the purpose of yield estimation. With the subsidized and low rates of premium and by increased farmer awareness aims at increasing the crop insurance penetration in India. The eligibility criteria for insurance coverage is that all farmers availing Seasonal Agricultural Operations (SAO) loans from Financial Institutions (i.e. loanee farmers) for the notified crop(s) would be covered compulsorily and the Scheme would be optional for the non-loanee farmers.

1.2 Review of Literature

The awareness of the farmers about crop insurance and risk management measures implemented by the government were low level. The yield loss is compensated by the farmers by borrowing from friends and relatives and they have low level of literacy (Soni and Trivedi, 2013). As self-supporting relief measure, the farmers resorted to sale of assets, hypothecation of assets and jewels and borrowing from friends and relatives as relief measures (Uvaneswaran and Mohanapriya, 2014). According to Rajeev (2019) the poorer and marginalised communities of India need greater attention of policymakers in terms of increased crop insurance cover and the need for improving the design of the scheme. Although larger farmers were more likely to lack interest in the scheme, they had greater insurance coverage than others. According to Mohapatra, *et. al,* (2016) adequate awareness to be created among the farmers by educating the benefits of insurance to facilitate them to decide on the various tools in risk management. Efforts should be made by agricultural universities and the state department of agriculture, to sensitize the farmers. Increase in awareness on crop insurance scheme by encouraging social participation of farmers (Pandaraiah and Sashidar, 2015). Bundling agricultural insurance with credit facilitates can lead to improved outcomes for the farmers and lending institutions (Mukarjee, *et. al,* 2017).

1.3 Statement of the Problem

The most significant features of agriculture in India is the fluctuation in agricultural income due to variation in yields of crop and market price of agricultural produces. The institutional support and technological advances have made low improvement in reducing the risk and agriculture production and impacted little on the risk coping capacity of the farmers because of unstable agricultural production. In spite of the number of risk management strategies developed by the farmers and rural societies, the occurrence of crop loss is inevitable. Insurance is the simple and viable mechanism to hedge risk. The crop insurance considered as an effective risk reducing and loss management measure that

would enable the farmers to take calculated risks. In order to maximize returns the farmers need to have access to formal risk coping mechanism. The risk and uncertainties prevailing in agriculture is continuing to be the major concern of the policy makers in India. The PMFBY scheme is made available to the farmers throughout the nation to insure crops. In order to get an insight on access to the scheme among the farmers the study is undertaken.

2. Research Methodology

The locale of the study area is Thondamuthur Block, which is in Coimbatore District in Tamil Nadu and is one among the 14 blocks of Coimbatore district. The block has 10 villages and there are totally 18346 families in this Block. The PMFBY scheme has been widely implemented in Coimbatore district. The major rivers drained in this region are the tributaries of Bhavani, Noyyal. The number of occupied people of Thondamuthur block is 32627 however 33453 are unemployed. And out of 32627 working individual, 2635 persons are completely reliant on agriculture. Out of ten villages, five villages were selected based on intensity of agricultural activities, where in farmers who have insured crops under the PMFBY Scheme were identified purposively, as the sample respondents. Accordingly, 187 farmers were identified from Devarayapuram (52), Madampatti (44), Madavaryapuram (32), Thennammanallur (30) and Vellimalaipattnam (29). The study period was from the months of May to July 2019. Based on the mode entering in to the PMFBY scheme, the 187 farmers were classified as Loanee farmers (115 numbers) and Non-loanee farmers (72 numbers). A structured interview schedule was used to collect primary data from the farmers and the secondary data from published reports of the Government, Insurance companies, books and journals. The Cronbach alpha test of data reliability resulted with 0.834 for loanee farmers and 0.892 for non-loanee farmers awareness about the scheme. The primary data collected were analysed through descriptive statistics and inferential statistics namely factor analysis and discriminant analysis.

3. Results and Discussions

The resultsof data analysis are presented as below:

3.1 Socio-economic Profile of the Respondents

The socio-economic profile of the farmers places an important role in promoting crop insurance products. The socio-economic profile farmers belonging to Coimbatore district in which the PMFBY scheme is implemented is presented in (Table 1).

It is revealed from Table 1 that 61.49% of the sample farmers were loanee farmers and the remaining 38.51% were non-loanee farmers.

On analysis the socio-economic profile of the loanee farmers, Majority (66.08%) of them were in the age group of 45 to 65 years. Male farmers constitute 60.86% and female farmers 39.13%. Majority of the sample farmers follow Hindu Religion (95.65%). The farmers were mainly educated up to school level (64.34%) and 31.30% were illiterate. The respondents were predominantly married (95.65%) and live as nuclear families (69.56%). The family size shows that 55.65% have more than four members in their family whereas 44.34% have up to four members. Agriculture is the primary occupation for 97.39% of the sample farmers. About 60% of the loanee farmers have farming experience of more than 40 years and 33.91% of the loanee farmers have 20 to 40 years of farming experience. For 53.04% of the respondents, 2-4 family members were helping in farming activities and for 40% of the respondents up to 2 family members help them in farming. With regard to annual income earned out of farming activities, 66.08% have earned up to ₹. 50,000 and 28.69% have earned between ₹. 50,000 to ₹. 1, 00, 000. According to Agriculture census 2015, based on the size of the land holding the farmers were classified as marginal farmers (upto 1 Hectare), small farmers (1 to 2 hectares), medium farmers (2 to 4 hectares) and large farmers (above 4 hectares).

Among the loanee farmers, 51.31% were marginal farmers, 33.04% were small farmers, 11.30% were

Table 1. Socio economic profile of the sample farmers

Variables No.of respondents		Loanee farmers (n = 115)		Non-Loanee farmers (n = 72)		Total farmers (n = 187)	
		Percentage	No.of respondents	Percentage	No.of respondents	Percentage	
Age (in years)	Up to 45	6	5.21	6	8.33	12	6.40
	45-65	7.6	66.08	42	58.33	118	63.10
	65 and above	33	28.69	24	33.33	57	30.50
Gender	Male	70	60.86	65	90.27	135	72.20
	Female	45	39.13	7	9.72	52	27.80
Religion	Hindu	110	95.65	68	94.44	178	95.20
	Christian	4	3.47	4	5.55	8	4.28
	Muslim	1	0.86	-	-	1	0.53
Education	Illiterate	36	31.30	19	26.38	55	29.41
	School	74	64.34	50	69.44	124	66.31
	UG	3	2.60	2	2.77	5	2.67
	PG	1	0.86	-	-	1	0.53
	Others	1	0.86	1	1.38	2	1.07
Marital status	Married	110	95.65	63	87.5	173	92.50
	Unmarried	4	3.47	9	12.5	13	7.00
	Widowed	1	0.86	-	-	1	0.50
Family type	Joint	35	30.43	6	8.33	41	21.90
	Nuclear	80	69.56	66	91.66	146	78.10
Family size	Up to 4	51	44.34	38	52.77	89	47.60
	4 and above	64	55.65	34	47.22	98	52.40
No. of. Family Members Participating in Farming	up to 2	46	40	38	52.77	84	44.90
	2 – 4	61	53.04	26	47.22	87	46.50
	4 and Above	8	6.95	8	-	16	8.60
Is farming primary occupation	Yes	112	97.39	71	98.61	183	97.90
	No	3	2.60	1	1.38	4	2.10
Farming Experience (in years)	up to 20	7	6.08	6	8.33	13	7.00
	20 – 40	39	33.91	35	48.61	74	39.60
	40 and Above	69	60	31	43.05	100	53.50
Total farm income(₹)	up to50,000	76	66.08	49	68.05	125	66.80
	50,000 – 1,00,000	33	28.69	20	27.77	53	28.30
	1,00,000 – 1,50,000	3	2.60	1	1.38	4	2.10
	Above 1,50,000	3	2.60	2	2.77	5	2.70
Classification of farmers	Marginal	59	51.31	32	44.44	91	48.66
	Small	38	33.04	28	38.89	66	35.29
	Medium	13	11.30	11	15.28	24	12.84
	Large	5	4.35	1	1.39	6	3.21
Area Insured(in hectares)	up to 1	72	62.61	48	66.67	120	64.17
	1 – 2	43	37.39	24	33.33	67	35.83

Source: Primary data

medium farmers and 4.35% large farmers. Majority of the loanee farmers 62.61% insured up to 2.5 hectares of land. Majority of the loanee farmer (62.61%) have insured crops cultivated in up to 1 hectare of land and 37.39% have insured the cropped area of 1 and 2 hectare. Majority of the total sample farmers were either marginal farmers (48.66%) or small farmers (35.29%). The medium farmers were 12.84% and large farmers were 3.21%. The sample of non-loanee farmers represented by 45 to 65 years of age (58.33%) and above 65 years (33.33%). Majority of them were male (90.27%) and female (9.72%). About 94% of the non-loanee farmers followed Hindu religion. About education, 69.44% studied up to school and 26.38% were illiterates. Majority of the respondents were married (87.5%). Majority of the non-loanee farmers live as nuclear families (91.66%). The family size for 52.77% of the farmers were up to four members and for 47.22% of the farmers have more than four members in their family. For 52.77% of the non-loanee farmers up to two members in the family have helped in agriculture whereas for 47.22% of the farmers, 2 to 4 members helped in farming. The agriculture is the primary occupation for 98.61% of non-loanee farmers. The farming experience shows that 48.61% of non-loanee farmers have 20 to 40 years of experience and 43.05% have above 40 years of experience. The annual farm income for 68.05% non-loanee farmers were up to ₹. 50,000 and for 27.77% of the farmers it was between ₹. 5, 00,000 to ₹. 1, 00,000.

Of the non-loanee farmers 44.44% were marginal farmers, 38.89% were small farmers, 15.28% were medium farmers and 1.39% were large farmers. Majority of the non-loanee farmers 66.67% have insured the cropped area of less than 1 hectare and 33.33% have insured between 1 and 2 hectares of cropped area. Majority of the total respondents 64.17% have insured up to 1 hectare and 35.83% have insured 1 to 2 hectares under the scheme.

3.2 Awareness on Features of PMFBY Scheme among Farmers

The main challenge before the insurance providers is to constantly innovate new products to suit customer needs, to meet certain changes in policy holder's behaviour, government intervention, competition, distribution network, technological advancement, service quality and customer relationship management. The success of any insurance business depends on the awareness of insurance products among beneficiaries. After the launch of PMFBY, large scale marketing activities have been organised by Central and State Governments which resulted in increased non-loanee coverage, however still many farmers were not yet covered under the scheme due to lack of awareness about the scheme features, benefits, process of enrolment and process of claim settlement (Mishra, 2018). Hence the factor analysis was carried out to identify the awareness of the farmers about the listed 21 features of PMFBY scheme, among loanee and non-loanee farmers as well among the total sample farmers in the study area. Accordingly, the responses obtained from the farmers were tested for adequacy and sphericity. The responses obtained from the sample farmers were factorized. The factor solution which met the criteria of Eigen value more than one defined by factors. The results of factor analysis were shown in (Table 3). It reflects the responses of loanee and non-loanee farmers and total responses of the farmers in their awareness about various features of the scheme. The KMO test proved the goodness of fit of the data collected from loanee and non- loanee farmers and for the total responses (Table 2).

Table 2. KMO and Bartlett's test

Particulars		Loanee farmers	Non-loanee farmers	Total Farmers
Kaiser-Meyer-Olk in Measure of Sampling Adequacy.		0.610	0.725	.594
Bartlett's Test of Sphericity	Approx. Chi-Square	2.12E3	3.807E3	6.6585E3
	Df	210	210	210
	Sig.	.000	.000	.000

Source: Computed data

Table 3. Awareness on features of PMFBY scheme among sample farmers

Factor	Loanee farmers	% of variance	Non-loanee farmers	% of variance	Total sample Farmers	% of variance
I	**Risk coverage** Yield loss (0.798)	22.02	**Sum insured** Sum insured up to threshold limit (0.829)	18.98	**Assessment crop yield and Risk coverage** Localised calamities (0.697) Technology in loss assessment (0.777)	14.25
II	**Sum insured** Equal to threshold yield or scale of finance whichever is higher (0.824)	17.08	**Subsidized premium** Rate of premium payable by the farmer (792). Subsidy on premium shared equally by central and state government (0.783)	15.01	**Eligibility to insure risk** Eligible to farmers with insurable interest (0.703) Covers prevented sowing (0.682)	8.83
III	**Crop cutting experiment** Technology usage in crop cutting experiments (0.796)	7.75	**Estimates of crop yield** Crop cutting experiments (0.911)	12.01	**Indemnity claim and estimation of crop yield** Indemnity claim (0.634) Crop cutting experiments (0.696)	8.26
IV	**Seasonality and cut-off date** Uniform for loanee and non-loanee farmers (0.701)	5.14	**One season – one premium** Season wise difference in rate of premium	5.25	**Levels of indemnity** Three levels of indemnity	7.86
V	**Subsidized premium** Rate of premium payable by the farmer (0.713) Subsidy on premium shared equally by central and state government (0.697)	4.76	**Indemnity** Threshold limit shall be benchmark yield	4.81	**Sum Insured** Coverage of both kharif and Rabi season (0.731) Loanee farmers (0.641)	6.93
VI	**Localised calamities** Insurance coverage for Localised calamities (0.749)	4.43	**Unit of insurance** Unit of insurance is the notified Area	4.69	**Unit of insurance is a Notified Area** Notified area (0.654) Coverage to non- loanee farmers (0.691)	6.33
VII	**Insurable Interest** Eligibility to insurance based on insurable interest in the crop (0.623)	4.23	-		**Subsidized premium** Subsidy on premium shared equally by central and state government (0.902) Rate of premium payable by the farmer (0.754)	5.65
VIII	-	-	-	-	Voluntary coverage	4.81
Communality	Indemnity equal to threshold yield or scale of finance whichever is higher		Sum insured up to threshold limit		Subsidy on premium shared equally by central and state government	
Total Variance		65.41		60.75		62.92

Source: Computed data. Figures in parenthesis represents factor loading

From the point of view of Loanee farmers, their awareness on the features of PMFBY Scheme shows that risk coverage resulted as the factor one explaining 22.02% of variance, particularly the risk cover for yield loss; the factor two, resulted with sum insured equal to threshold yield or scale of finance whichever is higher, explaining 17.08% of variance on their awareness about the scheme, the factor third, use of technology in crop cutting experiment resulted with 7.75% of variance; the factor four, uniform seasonality and cut-off date for both loanee and non-loanee farmers contributing to 5.14% of variance; the factor five, subsidy in premium explaining 4.76% of variance; the factor six, insurance coverage for localised calamities explaining 4.43% on awareness about the scheme and finally the factor seven, eligibility to insurance is based on the insurable interest in the crop explaining 4.23% of variance. All the seven factors totally explaining 65.41% of variance

on the awareness of the loanee farmers about the scheme.

From the point of view of non-loanee farmers, their awareness on the features of the PMFBY Scheme shows that sum insured for non-loanee is up to the threshold limit, resulted as factor one explaining 18.98% of variance; factor two, subsidy in premium explaining 15.01% of variance; factor three, estimation of crop yield with crop cutting experiments explaining 12.01% of variance; one season one premium resulted as factor four explaining 5.25% of variance; the factor five indemnity which consists of threshold yield shall be bench mark yield explaining 4.81% of variance and factor six, the unit of insurance is the notified area explaining 4.69%. All these six factors together explained 62.75% of variance on awareness of non-loanee farmers about the PMFBY scheme.

From the total responses, the farmer's awareness of Assessment crop yield and Risk coverage explaining 14.25% of variance; Eligibility to insure risk explaining 8.83%; Indemnity claim and estimation of crop yield with 8.26%; Levels of indemnity 7.86%; Sum Insured explaining 6.93%; Unit of insurance is a Notified Area with 6.33%; Subsidized premium explaining 5.65%; Voluntary coverage 4.81%. The communality value indicates their awareness on subsidy in rate of premium. All these factors together explained 62.92% of variance on awareness of the farmers about the PMFBY scheme.

Though percentage the total variance influenced by the resulted factor was almost equal among the loanee and non-loanee farmers, the factors resulted and their rate of variance differed.

A complete understanding the features of the scheme and its inherent benefits are for the farmer's access to the scheme. It is indicated from the rate of total variance that the insurance implementing machinery is still required to work through understanding about the scheme among the beneficiaries. On comparing awareness of loanee farmers with that of non-loanee farmers, the loanee farmers were focused towards knowing about risk coverage, sum insured

and estimation of crop yield through crop cutting experiments, as they were brought into the scheme on a compulsory basis. The communality value indicates their awareness on Indemnity equal to threshold yield or scale of finance whichever is higher.

On the other hand, the non-loanee farmers were enrolled into the scheme purely on a voluntary basis on their own interest and were aware of sum insured, subsidy in premium, methods of estimation of crop yield and season wise difference in rate of premium. The communality value indicates their awareness on sum insured up to threshold limit.

3.3 Access to PMFBY Scheme by the Sample Farmers

The role that PMFBY scheme plays in improving and ensuring risk coverage of farmers has been analysed. At the operational level, the access to crop insurance and coordination by the insurance authorities in providing supportive services and information and resources availability were tested through discriminant analyses. The study tried to identify the access to PMFBY scheme by the loanee and non-loanee farmers by using discriminant analysis through null hypothesis that there is no significant difference in the access to the scheme by the loanee and non-loanee farmers as to selected variables (Table 4).

In the present study, the categorical dependent variable is the access to PMFBY Scheme by loanee farmers and non-loanee farmers and the ten criteria are the independent variables. The Wilk's lambda value of 0.360 shows that the two groups are significantly discriminating. The estimated discriminant function was statistically valid as indicated by the Eigen value of 1.061.

The difference in mean value computed regarding access to PMFBY scheme by the loanee and non-loanee farmers revealed, the difference their perception about each of the item studied. On comparing the access to PMFBY scheme by the loanee and non-loanee farmers, the non-loanee farmers, voluntarily insured their crops because of the information received by them about PMFBY schemes available to them in

regional language (0.45), the crop insurance available at their own village or door step (0.43), their previous experience of receiving claims of compensation (0.41), the involvement of primary cooperative societies (0.30) in promoting the PMFBY scheme among farmers, easy approachability to create insurance (0.25), promotion of the scheme by scheduled commercial banks (0.23) document finalisation service available at the village (0.16) and facilitation of insurance service (0.08). Further loanee farmers availed PMFBY scheme mainly due to premium deduction out of crop loan disbursed to them by the primary cooperative societies (0.37) apart from the other reasons studied.

Between loanee and non-loanee farmers crop the insurance scheme available at their doorstep accounted for 28.2% of variation in access to the scheme while the crop insurance made available through primary cooperative societies accounted for 14.73% variation. The compensation claim received in the past accounted for 11.30% of variation. The facilitation service centres available at the village to enrol in to crop insurance such as internet facility centres and supportive educated personnel's available at the village helped the farmers to insure on time, contributing to 10.70% of variation.

The practice of the primary cooperative societies by deducting amount of premium from the agriculture credit disbursed to the farmers accounted for about 7% variation in the access to the PMBFY scheme. The deadline to insurance or cut-off date notified by the insurance company accounted for about 6% variation and document finalizing service accounted for about 6% variation in the access to PMFBY scheme. The reason like ease of approachability and proposition of the scheme by the banks accounted for a meagre percentage of variation towards access to PMFBY scheme by the farmers.

It is inferred that while comparing with the loanee farmers, the non-loanee farmers, the non-loanee farmers accessed the PMFBY scheme due to insurance products provided through primary co-operative societies, explanation of the details of insurance document in the regional language and the benefit of claim compensation received for the past losses.

4. Conclusion

It has been concluded that the aggressive marketing before the start of kharif and rabi season is requited so that the farmers be informed about the availability of crop insurance. The adverse selection could be limited by the act of the farmers agreeing to insure all the eligible acreage of a crop planted. As the farmers have insured small portion of cropped area in order to enjoy the benefit of full insurance, the farmers to be guided to insure the entire crop area. Through information dissemination about the features of the PMFBY Scheme, the farmers doubt and ignorance about the scheme can be addressed which would support them in informed decision making. The speedy disbursal of compensation after one season would financially support the farmers to avail crop insurance for the following season. The role of internet facilitation and support centre functioning at the village level to be recognised for insuring crops by submission of online application by non-loanee farmers. The product bundling of PMFBY Scheme with agriculture credit to be continued as it would bring out compulsory coverage of loanee farmers.

5. Acknowledgements

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