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RESEARCH PAPER

A detailed study on factors affecting the crop insurance with respect to coconut in Karur district of Tamil Nadu

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Abstract : Factor analysis attempts to identify underlying variables that determine the various risk coping mechanism followed and risk management strategies adopted by the farmers, and provides an empirical classification scheme of clustering of statements called factors. It is clear that among the 18 variables, only eight variables like gender, land holdings of the farmer, contact with extension agency, organic farming, livestock position, integrated farming, awareness about market information and number of days of employment in a year were found to have positive and significant correlation.Among eight variables, strategies like integrated farming, contact with extension agency, awareness about market information, and organic farming, were considered to be important factors.Among the eight factors, three factors were extracted depending on component matrix eigen values.

Key Words : Factor analysis, Principle component analysis, Correlation co-efficient, Rotated component matrix

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INTRODUCTION

Factor analysis explains the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that could explain most of the variance that is observed in a much larger number of manifest variables. Factor analysis is also used to generate hypotheses regarding causal mechanisms or to screen variables for subsequent analysis. Any one variable may be completely identified or grouped with one or more variables. It may be partially so identified, or it may be completely independent of other variables. The factor analysis is based on correlation co-efficients.

Prior to running the factor analysis, Kaiser Meyer Olkin (KMO) measure of sampling adequacy and Bartlet's test of sphericity were performed. This analysis started with matrix of inter-correlation coefficients between the variables. (If there are k variables there will be (k (k-1)/2) different correlations to calculate). Then an interim factorization of the correlation matrix was produced. This was referred as unrotated solution as it had to be transformed or rotated to a psychologically acceptable final solution. Factor analysis needs mean and standard deviation of the variables, inter-correlation

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matrix, a principal components (or axes) analysis and a varimax rotation (Kothari, 1990).

Objectives :

– To find out the variables that are responsible for adopting crop insurance with respect to coconut.

– To group the variables that are responsible for adopting crop insurance components based on rotated component matrix.

Material and Methods

Mathematical development – Principle component analysis (PCA) :

It begins with an adjusted data matrix, *X*, which consists of *n* observations (rows) on *p* variables (columns). The adjustment is made by subtracting the variable's mean from each value. That is, the mean of each variable is subtracted from all of that variable's values. This adjustment is made since PCA deals with the covariances among the original variables, so the means are irrelevant. New variables are constructed as weighted averages of the original variables. These new variables are called the factors, latent variables, or principal components. Their specific values on a specific row are referred to as the factor scores, the component scores, or simply the scores. The matrix of scores will be referred to as the matrix *Y*.

The basic equation of PCA, in matrix notation, given by:

$$Y = W' X$$

where, *W* is a matrix of co-efficients that is determined by PCA.

The basic equation of PCA in linear form is given by:

$$y_{ij} = w_{1i} x_{1j} + w_{2i} x_{2j} + ... + w_{pi} x_{pj}$$

The factors are a weighted average of the original variables. The weights, *W*, are constructed so that the variance of y_1, $Var(y_1)$, is maximized. Also, $Var(y_2)$ is maximized such that the correlation between y_1 and y_2 is zero. The remaining *yi's* are calculated so that their variances are maximized, subject to the constraint that the covariance between y_i and y_j, for all *i* and *j* (*i* not equal to *j*), is zero.

The matrix of weights, *W*, is calculated from the variance-covariance matrix, *S*. This matrix is calculated using the formula:

$$S_{ij} = \Sigma\left(x_{ik} - \bar{x}_i\right)\left(x_{jk} - \bar{x}_j\right)/n^{-1}$$

The singular value decomposition of *S* provides the solution to the PCA problem. This may be defined as:

$$U\,2SU = L$$

Where *L* is a diagonal matrix of the Eigen values of *S*, and *U* is the matrix of Eigen vectors of *S*. *W* is calculated from *L* and *U*, using the relationship:

$$W = UL^{1/2}$$

The *W* is simply the Eigen vector matrix *U* scaled so that the variance of each factor, y_i, is one. The correlation between an i^{th} factor and the j^{th} original variable may be computed using the formula:

$$r_{ij} = u_{ji} \frac{\sqrt{li}}{sjj}$$

Here u_{ij} is an element of *U*, *li* is a diagonal element of *L*, and s_{jj} is a diagonal element of *S*. The correlations are called the factor loadings and are provided in the *Factor Loadings* report. When the correlation matrix, *R*, is used instead of the covariance matrix, *S*, the equation for *Y* must be modified. The new equation is:

$$Y = W'D\,X - 1$$

where D is a diagonal matrix made up of the diagonal elements of *S*. In this case, the correlation formula may be simplified since the s_{jj} are equal to one.

Statistical Package for Social Sciences (SPSS) was used for doing the factor analysis. The factor analysis of the 18 variables was conducted using the Principal Component Method. Each of the 18 variables was assigned to the factor which had the highest

Table A : List of variables considered for factor analysis

Sr. No.	Variables
1.	Age of the farmer (Years)
2.	Education of the farmer (Years)
3.	Farming experience of the farmer(Years)
4.	Gender (Male/ Female)
5.	Land holdings of the farmer(Ha)
6.	Farm income (Rs./ha)
7.	Non- farm income (Rs./farm)
8.	Asset position of the farmer (Rs./ha)
9.	Contact with extension agency (Yes/No)
10.	Dependent only on agriculture (Yes/No)
11.	Irrigation facilities available with the farmer (Yes/No)
12.	Organic farming (Yes/No)
13.	Livestock position (No/farm)
14.	Integrated farming (Yes/No)
15.	Crop rotation (Yes/No)
16.	Contact with other farmers (Yes/No)
17.	Awareness about market information (Yes/No)
18.	Number of days of employment in a year

communalities value and factor loadings value.

The variables whose communalities were greater than 0.70 were retained. The factors with Eigen- values greater than 1.0 were considered and the analysis was done. The list of attributes considered for the factor analysis are reported in Table A.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Factor analysis for coconut farms

Correlation co-efficient for sample coconut respondents :

Statistical package for social science (SPSS) was used for performing factor analysis. To start with, correlation between the variables was found and the results are furnished in Table 1.

From the above table, it is clear that among the 18

Table 1 : Correlation co-efficient for sample coconut farmers

Sr.No.	Variables	Correlation co-efficient
1.	Age of the farmer (Years)	0.065 NS
2.	Education of the farmer (Years)	-0.206 NS
3.	Farming experience of the farmer (Years)	0.343 NS
4.	Gender (Male/ Female)	0.253*
5.	Land holdings of the farmer (Ha)	0.223*
6.	Farm Income (Rs/ha)	-0.206 NS
7.	Non- farm Income (Rs/farm)	-0.186 NS
8.	Asset position of the farmer (Rs/ha)	-0.119 NS
9.	Contact with extension agency (Yes/No)	0.069*
10.	Dependence only on agriculture(Yes/No)	-0.140 NS
11.	Irrigation facilities available with the farmer (Yes/No)	0.087 NS
12.	Organic farming(Yes/No)	0.225*
13.	Livestock position (No/farm)	0.078*
14.	Integrated farming(Yes/No)	0.227*
15.	Crop rotation(Yes/No)	0.098 NS
16.	Contact with other farmers(Yes/No)	-0.044 NS
17.	Awareness about market information(Yes/No)	0.087**
18.	Number of days of employment in a year	0.056**

** = Correlation is significant at the 0.01 level * = Correlation is significant at the 0.05 level
NS=Non-significant

Table 2 : Factor analysis for sample coconut respondents

Total variance explained

Sr. No.	Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
		Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1.	Gender	1.975	24.686	24.686	1.975	24.686	24.686	1.729	21.611	21.611
2.	Land holdings of the farmer	1.522	19.021	43.707	1.522	19.021	43.707	1.519	18.987	40.598
3.	Contact with extension agency	1.086	13.575	57.282	1.086	13.575	57.282	1.335	16.683	57.282
4.	Organic farming	0.929	11.614	68.896						
5.	Livestock position	0.836	10.453	79.349						
6.	Integrated farming	0.746	9.319	88.668						
7.	Awareness about market information	0.487	6.092	94.760						
8.	Number of days of employment in a year	0.419	5.240	100.000						

Extraction method: Principal component analysis variables, only eight variables like gender, land holdings of the farmer, contact with extension agency, organic farming, livestock position, integratedfarming, awareness about market information and number of days of employment in a year were found to have positive and significant correlation. Thus, these eight variables were considered for factor analysis.

Factor analysis for sample coconut respondents :

The results of factor analysis for sample respondents are furnished in Table 2.

From the Table 2, it is clear that among the eight factors, three factors were extracted depending on component matrix Eigen values. These three factors were extracted from 8 factors indicating the overall perception of the farmers towards various risk copping mechanism adopted. It is important to note that they were found to explain more than 57.28 per cent of the variance.

Rotated component matrix:

The components have been grouped under three factors based on the values obtained from rotated component matrix. The groupings of components based on rotated component matrix are shown in the Table 3.

Table 3 : Grouping of components based on rotated component matrix

Sr. No.	Groups	Components
1.	Group-1	Land holding pattern of the farmer
		Livestock position of the farmer
		Integrated farming
2.	Group-2	Contact with extension agency
		Gender
		Number of days of employment in a year
3.	Group-3	Awareness about market information
		Organic farming

Communalities :

The results of communalities were furnished in Table 4.

From the above Table 4, it is clear that among eight variables, strategies like integrated farming, contact with extension agency, awareness about market information, and organic farming, were considered to be important factors (which were selected based on extraction of more than 0.70).

Table 4 : Communalities for coconut farmers

Sr. No.		Communalities	
		Initial	Extraction
1.	Land holding pattern of the farmer	1.000	0.688
2.	Livestock position of the farmer	1.000	0.566
3.	Integrated farming	1.000	0.707
4.	Contact with extension agency	1.000	0.767
5.	Gender	1.000	0.693
6.	Number of days of employment in a year	1.000	0.697
7.	Awareness about market information	1.000	0.718
8.	Organic farming	1.000	0.720
	Extraction method : Principal component analysis		

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