INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

Performance of the Markfed, Karnataka - Factor Analysis Approach

H.G. Shankara Murthy, T.D.J. Nagabhushanam and K.C. Hiremath*

In order to find out satisfactory solutions to the problems of agricultural marketing in India, institutional innovations such as regulated markets and co-operative marketing organisations have been tried. Though these institutions have solved the problems to some extent, it has become necessary, particularly after the advent of the green revolution and consequent increases in demand for inputs and market services for products, to further strengthen the infrastructure for marketing of both farm inputs and outputs. The intervention of the government to redeem the situation through state owned corporations appears to be an effective thrust in the direction of tackling the problems of marketing of both inputs and outputs. Thus three different types of institutions have been simultaneously operating at present, namely, private agencies, co-operative institutions and state owned corporations with a view to ensuring orderly marketing.

Underscoring the importance of orderly marketing, the Marketing Committee of the United Nations Conference on Food and Agriculture rightly stressed that it would be useless to increase output of food and it would be equally futile to set up optimum standards of nutrition, unless means could be found to move the food from the producer to the consumer at a price which represents a fair remuneration to the producer and is within the consumers' ability to pay.

The objectives of marketing federations at the state level are to assist the primary marketing societies in undertaking marketing functions more effectively and to arrange for the sale of the produce even beyond the jurisdiction of the primary marketing societies including inter-district, inter-state and export trade. Besides, these federations have to assume the work of distribution of agricultural inputs and consumer articles to farmers. The other major functions of these federations are to collect and disseminate market intelligence and to aid the primary marketing societies in the construction of godowns and establishment of processing units. One such institution with such multiple goals and integrating role is the Karnataka State Co-operative Marketing Federation, which came into being in 1960. It is an apex institution with twin goals of strengthening the co-operative movement in the field of marketing and improving the marketing efficiency of the member societies.

The membership of the Federation had increased from 258 in 1960-61 to 533 in 1984-85. The spatial coverage of the Federation was expanded from a mere 21 branches/depots to 30 in the state during the same period. Though the Federation was engaged in supplying fertilisers and other consumption articles during the earlier years, it gradually diversified its operations to a variety of agricultural commodities. It entered into the processing/ manufacturing activities. Thus the total volume of business of the Federation had increased from Rs. 383.31 lakhs in 1960-61 to Rs. 8,002.54 lakhs in 1984-85. A critical study of the business performance of the Federation is of immense use in knowing the strong and weak

* Professor and Head, Division of Agricultural Marketing and Co-operation, University of Agricultural Sciences, Dharwad, Professor and University Head (Retd.), Department of Agricultural Economics, A.P. Agricultural University, Hyderabad and Professor of Social Sciences, Water and Land Management Institute, Dharwad, respectively.

points in its working and in evolving strategies for its efficient functioning. An attempt is made in the paper to identify the factors influencing the performance of the Karnataka State Co-operative Marketing Federation and evaluate the direction and magnitude of their influence.

MATERIALS AND METHODS

The MARKFED, Karnataka was selected purposively for the study. In all, 40 indicators were identified and they were considered to have a close association with the functioning/performance of the Federation. Of them, five indicators, namely, membership, number of branches/depots, number of employees, number of deputationists and number of direct recruits related to the physical aspects of the Federation and they are termed as physical indicators, while the remaining 35 indicators belonged to financial aspects (monetary aspects) of the Federation and are termed as financial indicators (Table I). To analyse the performance of the Federation time-series data were drawn from the annual reports of the Federation for a period of 25 years from 1960-61 to 1984-85.

Since there has been considerable inflation in the economy, the financial (monetary) indicators would not reflect the real values of the performance of the Federation. Therefore, it was considered proper to correct and adjust these financial indicators for inflation, using the prices of 1961-62 (constant prices approach).

TABLE I. PERFORMANCE INDICATORS

Sr. No.	Indicators	Code No.
(1)	(2)	(3)

Physical indicators

1.	Membership	PI_1
2.	Number of branches/depots	PI_3
3.	Number of employees	PI_4
4.	Number of deputationists	PI_5
5.	Number of direct recruits	PI_6

Financial indicators

6.	Share capital excluding government's share	PI_{10}
7.	Total share capital	PI_{11}
8.	Share capital of government	PI_{12}
9.	Statutory reserve fund	PI_{13}
10.	Bad and doubtful reserve fund	PI_{14}
11.	Depreciation fund	PI_{15}
12.	Other funds	PI_{16}
13.	Long-term investments	PI_{17}
14.	Value of total purchases	PI_{18}
15.	Value of fertilisers purchased	PI_{19}
16.	Value of purchase of other commodities	PI_{20}
17.	Value of total sales	PI_{21}
18.	Value of fertiliser sales	PI_{22}
19.	Value of sales of other commodities	PI_{23}
20.	Establishment expenses	PI_{24}
21.	Gross income	PI_{25}
22.	Net income	PI_{26}
23.	Average inventory	PI_{27}
24.	Total expenses	PI_{28}
25.	Fixed assests	PI_{29}
26.	Interest on borrowings	PI_{32}
27.	Subsidy received from government	PI_{33}

(Contd.)

TABLE I *(Concld.)*

Sr. No. (1)	Indicators (2)	Code No. (3)
28.	Bank loan received	PL_{34}
29.	Government loan received	PL_{35}
30.	Total amount borrowed	PL_{36}
31.	Total value of assets	PL_{37}
32.	Owned funds	PL_{39}
33.	Total liabilities	PL_{40}
34.	Total operating expenses	PL_{43}
35.	Net worth	PL_{44}
36.	Current liabilities	PL_{45}
37.	Current assets	PL_{46}
38.	Working capital	PL_{48}
39.	Net working capital	PL_{49}
40.	Net value of fixed assets	PL_{50}

Note:- To start with, 50 performance indicators were attempted and ultimately 10 were eliminated from the analysis as they had no material influence.

To portray the real picture of the financial performance of a business organisation during the inflationary period, the present historical financial statement figures had to be recomputed taking in to account the changes in the value of money. In this study, the General Purchasing Power Adjusted Accounting (GPPA) was employed. For this purpose, the All India Index Numbers of Wholesale Prices of all commodities with 1961-62 as the base period were used for adjusting the monetary transactions of the Federation for inflation. In the absence of more appropriate index numbers for different groups of commodities and services and different varieties within the group of commodities and services transacted by the Federation, the All India Wholesale Price Indices were made use of, though it is a limitation of the study.

Factor Analysis

Factor analysis is a technique of multivariate analysis. It is similar in form to the standard multiple regression. It provides a means of identifying and measuring the relationships or basic patterns in a data set. The unique features of factor analysis are that it greatly facilitates identification of key traits from the mosaic of overlapping relationship and is capable of achieving scientific parsimony by reducing a set of large number of variables to a convenient size of underlying factors (often called dimensions, axes or vectors) which cannot be easily accomplished by any other analytical technique including the multiple regression analysis.

The principal component solution has been employed in analysing the performance indicators of the Federation over a period of 25 years from 1960-61 to 1984-85.

The component model (for details, see Davies, 1984) is expressed as

$$Z_j = a_{j1} F_1 + a_{j2} F_2 + a_{j3} F_3 + \ldots\ldots + a_{jq} F_q$$

where Z_j = magnitude of the indicator j; *i.e.*, jth principal component or factor in the model,

a_{jq} = the factor loading of the qth indicator in the jth principal component or factor,

F_q = the amount of association in magnitude of indicators, the uncorrelated trait measured by factor 'q' which is possessed by indicator j,

j = factor loading with reference to indicators (1,2,3, ..., q),

q = a set of indicators in the model (1,2, ..., q),

$a_{jq} F_q$ = factor coefficient or loading of indicator j on factor q.

In this study, only the first two dimensions are considered because firstly, it afforded the convenience in presenting the results and secondly and more importantly, the third and subsequent dimensions failed to explain a sizeable proportion of the variation of the matrix.

The computer (DESVOX-11) facilities available at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad were taken advantage of for factor analysis and the package developed by the Department of Biomathematics, University of California (BMDF Software) was used. The initial orthogonal solution was rotated by varimax method. Since the results obtained by the initial extraction in terms of magnitude of variations explained by the dimensions or factors were themselves better than the rotated ones, the unrotated factor loadings were therefore used.

Factors or dimensions were named based on the indicators contained with factor loadings that exceeded 0.250. The factor loadings from 0.251 to 0.49 were termed as low, 0.50 to 0.69 as medium and from 0.70 to 1.00 as high.

The performance of the Federation was influenced by many variables but the variations were governed by a few underlying dimensions. The identification and assessment of the magnitude of association of these underlying dimensions provided deeper insights in understanding the phenomenon and in formulating appropriate policies. Additional information on the magnitude of influence of each dimension or factor and also on the relationship of each variable with each of the dimensions were to be brought out by factor analysis. The variables were assigned to a particular dimension based on the degree of their association. The maximum variability existing in a phenomenon could be explained by the extraction of a large number of dimensions. If the number of dimensions happened to be quite large, the interpretation of the results would be cumbersome. Therefore, in the selection of dimensions, a compromise was struck between the accuracy of conclusions and the convenience in interpretation. However, the interactions were so programmed that the dimensions which explained the maximum variation in a configuration of the original variables were extracted in their descending order of importance. This procedure helped in the selection of a few major dimensions for presentation and discussion.

RESULTS AND DISCUSSION

The performance of the Federation was influenced largely by factors such as financial, physical, political, sociological and the behavioural attitudes of policy makers and officials of the Federation. Its performance was evaluated by employing the quantitative variables (physical and financial indicators).

In the first set, 40 variables for the period 1960-61 to 1984-85 (*i.e.*, 25 years) were considered and a correlation matrix of 40 × 40 was designed. Of this 40 × 40 configuration, four dimensions were extracted. Out of these four dimensions extracted, only the first two were selected for interpretation as other dimensions failed to explain the variation of the configuration to a larger extent. The factor loadings obtained are presented in Table II.

Initially, each variable was considered as a factor by itself. In this set, 40 variables were identified for factor analysis. If 40 dimensions were to be extracted, they together would have explained the total variation of the 40 × 40 correlation matrix. This would not have resulted in the scientific parsimony. Thus four dimensions were extracted. The percentage variation explained by the third and the fourth dimensions was not substantial. Therefore, the first two dimensions were considered for presentation and discussion. Each of the 40 variables had factor loadings on all the dimensions. The extent of association of a variable was reflected by its factor loading in a dimension. The higher the value of factor loading of a variable on a particular dimension, the greater would be the association with that dimension.

Because of this situation, it is a general practice that the variables would be discussed with respect to a dimension on which they have higher factor loadings. The variables were segregated and assigned to one of the two dimensions based on the magnitude of factor loadings of these 32 variables. This technique facilitated easy comprehension and interpretation of the dimensions. For instance, the variable, number of employees (code No. PI_4) was assigned to the first dimension because its factor loading (0.959) was more than that on the second dimension (-0.035). Similarly, Government loan received (code No. PI_{35}) was listed under the second dimension since its factor loading (0.952) on the second dimension was higher than that on the first dimension (0.806).

TABLE II. EXTENT OF VARIATION EXPLAINED BY DIFFERENT DIMENSIONS ON THE PERFORMANCE OF THE FEDERATION

Dimension or Factor	Variance* explained in absolute values	Variance explained in percentage	Cumulative proportion of total** variance	Cumulative proportion of total variance in percentage
(1)	(2)	(3)	(4)	(5)
1.	20.584946	51.46	0.514624	51.46
2.	6.518265	16.30	0.677580	67.76
3.	3.876165	9.69	0.774484	77.45
4.	2.253807	5.63	0.830830	83.08

* Variance explained by each factor is the Eigen value for that factor.
** Total variance is defined as the sum of the diagonal elements of the correlation matrix.

Even within the first dimension, some variables had positive factor loadings, while a few others had negative factor loadings with a continuum from -0.305 to 0.959. The variables were arranged in the descending order of their factor loadings as it helped in evaluating the importance of each variable with regard to the dimension and the association among the variables. The variable, number of employees, had the highest positive association with the first dimension, while the highest negative association was observed with respect to the variable, subsidy received from the government. Further, the association between any two variables could be ascertained by the product of the two corresponding factor loadings. Thus, for example, the association between number of employees and establishment expenses was $0.959 \times 0.953 = 0.91391$ and between the establishment employees and subsidy received from the Government was $0.959 \times -0.305 = -0.2925$ and so on.

It is worth noting that the identification and naming of any dimension or factor or axis would be a subjective conclusion. Generally, the heavily loaded key variables would be considered as bases in the identification and naming of dimension. This procedure was followed in the study.

The First Dimension

Thirty-three variables had more factor loadings on the first dimension than on the second, while six variables had relatively higher factor loadings on the second dimension (Table III). The array of variables had been arranged in the descending order of the magnitudes of factor loadings. The key physical indicators of the Federation in the first dimension were: number of membership and number of branches/depots.

TABLE III. VARIABLES (INDICATORS) WITH RELATIVELY HIGHER FACTOR LOADINGS ON FIRST TWO DIMENSIONS ON THE PERFORMANCE OF THE FEDERATION

Variable code No. (1)	First dimension Variables/Indicators (2)	Factor loadings (3)	Variable code No. (4)	Second dimension Variables/Indicators (5)	Factor loadings (6)
PI_4	Number of employees	0.959	PI_{35}	Government loan received	0.952
PI_6	Number of direct recruits	0.957	PI_{40}	Total liabilities	0.931
PI_{24}	Establishment expenses	0.953	PI_{46}	Current assets	0.929
PI_{39}	Owned funds	0.935	PI_{37}	Total value of assets	0.840
PI_1	Membership	0.925	PI_{27}	Average inventory	0.821
PI_{43}	Total operating expenses	0.919	PI_{34}	Bank loan received	0.490
PI_{21}	Value of total sales	0.916			
PI_{11}	Total share capital	0.914			
PI_{12}	Government's share capital	0.912			
PI_3	Number of branches/depots	0.910			
PI_{44}	Net worth	0.898			
PI_{29}	Fixed assets	0.890			
PI_{50}	Net value of fixed assets	0.873			
PI_{10}	Share capital excluding the share of government	0.851			
PI_{15}	Depreciation fund	0.846			
PI_{17}	Long-term investments	0.832			
PI_{13}	Statutory reserve fund	0.813			
PI_{22}	Value of fertiliser sales	0.796			
PI_{14}	Bad and doubtful reserve fund	0.771			
PI_{48}	Working capital	0.739			
PI_{36}	Total amount borrowed	0.729			
PI_{32}	Interest on borrowings	0.720			
PI_{28}	Total expenses	0.716			
PI_{49}	Net working capital	0.701			
PI_{18}	Value of total purchases	0.671			
PI_{19}	Value of fertiliser purchases	0.556			
PI_5	Number of deputationists	0.543			
PI_{16}	Other funds	0.480			
PI_{25}	Gross income	0.450			
PI_{20}	Value of purchases of other commodities	0.396			
PI_{23}	Value of sales of other commodities	0.307			
PI_{26}	Net income	-0.097			
PI_{33}	Subsidy received from government	-0.305			
	Percentage variation explained by the first dimension	51.46		Percentage variation explained by the second dimension	16.30

The other key variables in the first dimension in respect of financial indicators of the Federation, namely, establishment expenses, total operating expenses, working capital, total expenses and net working capital constituted the financial indicators of expenses.

The value of each item such as total sales, fertiliser sales, total purchases, fertiliser purchases, purchases of other commodities constituted the financial indicators pertaining to business transactions.

Total share capital, Government's share capital, share capital excluding government's share, owned funds, depreciation fund, statutory reserve fund, bad and doubtful reserve fund and other funds constituted the financial indicators pertaining to share capital and funds.

The important variables like net worth, fixed assets, net value of fixed assets and

long-term investments accounted for the financial strength of the Federation.

Total amount borrowed and interest on borrowings were considered as financial indicators reflecting borrowings.

All the above variables were positively associated among themselves while they were negatively (or inversely) associated with the net income (-0.097) and subsidy received from the Government (-0.305).

The first dimension explained 51.46 per cent of the total variation in the correlation matrix. From the point of overall performance of the Federation, physical and financial indicators reflected the growth and strength of the Federation. Hence, the first dimension was named as "Growth in Physical and Financial Indicators".

The Federation had grown enormously as could be observed from the first dimension through various indicators. At the same time, the establishment expenses occupied the third place with a factor loading of 0.953 and the net income (-9.097) indicated inverse relation with the performance of the Federation. Further, the poor performance of the variables, namely, value of purchase of other commodities and value of sale of other commodities which had relatively low factor loadings of 0.396 and 0.307 respectively showed less importance compared to the value of total purchases (0.671), the value of total sales (0.916) and the value of fertiliser sales (0.796).

The performance evaluation of individual business activities of the Federation discussed earlier confirmed these results. (The results are not presented here.)

Among the marketing activities, only the fertiliser business activity had made profits, while the pesticides business activity had been striving to attain a position of no loss-no profit, though it had incurred marginal losses. Similarly, the marketing activity of the Federation with respect to agricultural commodities had incurred losses over the period of study and had been striving to attain a no loss-no profit position. Also, the sale value of purchases of other commodities and value of sale of other commodities showed less importance in the performance of the Federation. All the manufacturing activities of the Federation had incurred losses, particularly the ROC (Raichur Oil Complex). The aggregate analysis of all the activities of the Federation (both marketing and non-marketing) revealed that the Federation had been incurring an annual net loss to the tune of Rs. 10.85 lakhs during the study period. The variable, net income, which had a factor loading of -0.097 in the first dimension also reflected this phenomenon.

The analysis of the compound growth rates of the physical and financial indicators also corroborated the results of the first dimension.

The results of the financial ratio analysis also confirmed the results of the first dimension. The compound growth rates (CGRs) (Table IV) of physical indicators for the overall period were significant, namely, the number of employees 7.08 per cent, number of direct recruits 8.98 per cent, membership 2.62 per cent and number of branches/depots 1.81 per cent. The compound growth rates for financial indicators - establishment expenses (13.51 per cent), owned funds (22.40 per cent), value of total sales (5.71 per cent), total share capital (20.59 per cent), Government's share capital (21.13 per cent), fixed assets (18.66 per cent), long-term investments (23.63 per cent), value of fertiliser sales (5.86 per cent) - were significant while that of value of sales of other commodities (4.95 per cent) was not significant.

The gross ratio (percentage) worked out for the Federation also showed that it spent Rs. 137.19 as against a gross income of Rs. 100 during the study period of 25 years, reflecting disproportional expenses in the business transactions over the period. The net capital ratio indicated a good financial strength of the Federation, suggesting that it possessed assets

worth Rs. 1.2011 for each rupee of liability.

From the analysis of the first dimension, it could be inferred that the Federation had been spending relatively more on establishment expenses and its profit margins were not commensurate with the expenses incurred and the number of employees engaged.

The Second Dimension

The second dimension explained 16.30 per cent of the total variation in the correlation matrix. The key variables on this dimension were Government loans received (0.952), total liabilities (0.931) and bank loans received (0.490). These variables constituted the financial liability indicators of the Federation.

The current assets (0.929), total value of assets (0.840) and average inventory (0.821) were the key variables constituting the financial asset indicators. These variables in the second dimension were designated as "Growth in Assets and Liabilities of the Federation". Interestingly, there was no polarisation of variables as in the case of first dimension.

It was interesting to note that the total liabilities of the Federation had grown sharply over the years along with its total assets as indicated by their loadings. These results were in conformity with the results of the financial ratio analysis and the compound growth rates analysis.

TABLE IV. COMPOUND GROWTH RATES OF SELECTED PHYSICAL AND FINANCIAL
INDICATORS OF THE FEDERATION DURING 1960-61 TO 1984-85

Sr. No. (1)	Physical indicators (2)	CGR (3)	Sr. No. (4)	Financial indicators (at constant prices) (5)	CGR (6)
1.	Membership	2.62 (11.064)	1.	Share capital excluding govern-ment's share	13.34** (9.674)
2.	Branches/depots	1.81** (16.139)	2.	Government share capital	21.13** (8.168)
3.	No. of employees	7.08** (23.622)	3.	Total share capital	20.59** (8.264)
4.	No. of deputations	0.79* (2.739)	4.	Fixed funds	22.40** (5.726)
5.	No. of direct recruits	8.98 (24.232)	5.	Fixed assets	18.66** (9.297)
			6.	Total assets	4.49** (3.702)
			7.	Long-term investment	23.63** (7.426)
			8.	Total working capital	3.25* (2.428)
			9.	Total liabilities	2.77* (2.090)
			10.	Inventory	1.08 (0.578)
			11.	Total sales	5.71** (9.634)
			12.	Sale of fertilisers	5.86** (7.831)
			13.	Sale of other commodities	4.95 (1.186)
			14.	Establishment expenses	13.51** (14.281)

** Significant at 1 per cent level.
* Significant at 5 per cent level.
Figures in parentheses indicate 't' values of log b.

The compound growth rate worked out for the financial indicators of the Federation, namely, total liabilities (2.77 per cent) and total assets (4.49 per cent) were significant. Both the indicators had high factor loadings. Inventory had a growth rate of 1.08 per cent and it was not significant. This showed that the inventory as such did not pose a problem to the Federation, considering its volume of business. The net capital ratio for the Federation was Rs. 1.20, indicating a good financial strength inasmuch as it had assets worth Rs. 1.2011 for every rupee of liability.

The third and the fourth dimension explained respectively 9.69 per cent and 5.63 of the total variation, whereas the first two dimensions together explained 67.76 per cent of the total variation in the configuration. All the four dimensions extracted through the factor analysis explained in all 83.08 per cent of the total variation.

CONCLUSIONS

The factor analysis revealed the existence of two main underlying dimensions in the performance of the Federation, namely, "Growth in Physical and Financial Indicators" and "Growth in Assets and Liabilities". The first dimension explained 51.46 per cent of the variation in the performance of the Federation while the second explained 16.30 per cent of the total variation (in the correlation matrix of 40 × 40 configuration). The first two dimensions together explained 67.76 per cent of the total variation. Interestingly, the results were in conformity with the findings of the Financial Ratio Analysis and Compound Growth Rate Analysis.

REFERENCE

Davies, W.K.D. (1984). Factorial Ecology, Gower Publishing Company Ltd., England.