

MEASURING EFFICIENCY OF PRIMARY MILK COOPERATIVE SOCIETIES: A CASE STUDY OF SOUTH GOA

Suraj M. Popker*, Guntur Anjan Raju**

Abstract *This paper endeavours to measure efficiencies of primary dairy milk cooperatives societies using the non-parametric technique of data envelopment analysis and attempt is also made to have the comparative picture as dos audit report correctly reflect the efficiency of primary dairy cooperatives societies in audit classification. The empirical results show that 13 of the 20 primary dairy cooperatives are found to be efficient and, thus, define the efficient frontier of the primary dairy cooperatives, with the TE scores range from 0.404 to 1, with an average of 0.936. As far as comparative study of efficiency and audit classification is considered it is found that audit classification dos not reflects the efficiency of primary dairy societies.*

Keywords *Audit Classification, DEA, Efficiency*

INTRODUCTION

In India, agriculture still remains the predominant economic activity and fluctuations in it have its serious repercussion on the whole of the economy. Over past couple of decades the dairy has made significant progress in India. Dairy cooperatives have played a prominent role in the development of dairy industry in India. A huge amount of money has been spent on the creation of infrastructure and provision of facilities for the cooperative dairies. The dairy cooperative has a four level structure, which consists of National Dairy Development Board (NDDB), state federations, milk unions, and dairy cooperative societies operating at the national level, state level, district level, and village level, respectively. The milk unions of dairy cooperative societies control primary dairy cooperatives societies, and these primary dairy cooperatives societies are the focus of this study. The Operation Flood programme has converted us from milk deficient to milk surplus country. The per capital availability of milk has increased from about 112 grams per day in 1968-69 to 252 grams per day in 2007-08. The major credit for this achievement goes to cooperative dairy societies. The annual value of India's milk production is estimated to be Rs.1, 430 billion in 2008-09.

In Goa, before liberation cooperative movement was virtually absent in Goa. After liberation as Union Territory of India, Goa had adopted Maharashtra Cooperative Societies Act, in 1962 and subsequently office of the Registrar of Cooperative Societies was created. Since then there has been significant growth cooperative societies in state. In Goa, there are 2, 244

Cooperatives societies with the 8, 11,495 members of which only 163 are Dairy societies with the membership of 19,895. This clearly indicates that, out of total societies 2.45% societies are dairy cooperatives with 7.26% of membership is membership of dairy cooperatives in total membership of cooperatives. In Goa, cooperative milk societies were established in 1964, but its success story started only after 1982, when Goa Dairy followed "Anand Dairy" patten to overcome the earlier drawbacks in its functioning.

LITERATURE REVIEW

Dairying forms an important subsidiary occupation in agriculture, which has the largest employment potential. So it is necessary to study the efficiency and economics of dairy societies and farming and the dairy development. Many studies have been conducted by different researcher on dairy cooperatives and dairy development. A detailed review of some of the important previous studies have been made and presented as under. Dagistan, Koc, *et al.* (2009), studied, "Identifying Technical Efficiency of Dairy Cattle Management in rural area through a Non-Parametric Method: A case study for the east Mediterranean in Turkey". The main objective of their study was to identifying technical efficiency of dairy cattle management, supported by project of World Bank in rural areas. Data Envelopment Analysis technique was employed to determine Technical Efficiency. Study reveals that out of 100, only 15 farms were technically efficient in term of input usage. Study also finds that other factors also affect the technical efficiency such as benefit/cost ratio, number of animal, agricultural revenue

* Assistant Professor of Commerce, C.E.S College of Arts and Commerce Cuncolim Salcete Goa, India.
E-mail: surajpopker72@rediffmail.com

** Head of Department, Department of Commerce, Goa University, Goa, India. E-mail: rajuanjana@rediffmil.com

etc. Satbir Singh *et. al.* (2000) studied 'Efficiency and productivity analysis of cooperative dairy plants in Haryana and Punjab States of India'. The objective of this study is to measure cost efficiency and total factor productivity of the cooperative sector by covering many multi-input and multi-output dairy plants in two states of India. Data Envelopment Analysis (DEA) and Fisher index approach are employed to measure cost efficiency and total factor productivity, respectively. One output that is the quantity of milk products produced by the dairy plant and four input variables like raw material, labour, capital, and other inputs are used in analytical models. The study reveals that cooperative dairy plants shows variations in efficiency and total factor productivity scores among plants. Chhikara *et al.* (1975) studied the relative efficiency of the different types of milch animals in area of Jind milk plant of Gujarat. They fitted cob-douglas production function to estimate marginal value productivities and milk production (input output details of (milch animals). They concluded that the use of green fodder, dry fodder, concentrates and human labour had explained about 45, 93 and 90 percent of variation in the milk output of cow, murrah buffalo and crossbred cow respectively. The net return over the variable cost was highest for the crossbred cow, followed by murrah buffalo and cow. The total cost of milk production in lactation was Rs 1795, Rs 3340 and Rs 2687 for the cow, murrah buffalo and crossbred cow in that order. Jithendra Kumar (1990) studied the performance of dairy cooperatives and their impact on milk production, income and employment in Chittoor district of Andhra Pradesh. The study revealed that the societies which were above the average level has shown better performance with an increase in membership and milk procurement, and profits of societies showed and increasing rate except the society-II. Mattigatti (1990) studied the performance of milk producers' cooperative societies and their impact on dairy farming in Dharwad district. The author selected a number of physical and financial indicators to evaluate the performance. The secondary data required were collected from the various annual reports of milk producers' cooperative societies for the period 1986-88. He opined that both the physical and financial indicators of the societies showed significant growth in their values. The above average societies have already progressed with higher values for the indicators compared to below average societies, while below average societies well shown a greater rate of growth, hence; he concluded that over the period of time all these societies would contribute to the overall development of the societies.

PROBLEM OF THE STUDY

In Goa there are about 12,569 crossbred cattle and about 63,747 indigenous cattle which procured milk on an average

51,000 litters a day. Government of Goa has spent about Rs. 163.18 Lakh for dairy development. There are five veterinary hospital and 545 milk distribution centres. But, even today Goa imports more than 58 percent of its milk required from neighbouring states of Maharashtra and Karnataka. The performance of primary dairy milk cooperatives is influenced by number of factors like: sincerity of the member farmers, supply of feed and fodder, veterinary services, technical, working capital, etc. The performance of dairy milk cooperatives is depicted in the annual audited report of the society which supply information to the stakeholders. Auditor after considering certain norms like share capital, membership, turnover, profitability, participation of members, management, financial position, books & records, sundry debtors, status of societies, milk testing, submission of audit rectification report etc., allots marks and based on these marks grades viz. A, B, C and D class are given indicating overall performance of the respective society. But, these exercises do not depict the efficiency of primary cooperatives societies. Even the financial ratio fails to indicate actual performance of societies as multiple ratios give multiple results. To overcome this problem an attempt is made in this paper to study the efficiency of dairy milk cooperatives societies by using the Data Envelopment Analysis and to have comparative picture as to the audit classification correctly reflect the efficiency of dairy cooperatives societies in audit classification.

METHODOLOGY

The required data are collected from the annual audited statements of 20 societies of south Goa out of 58 societies which are on the books of record of the Registrar of Cooperative Societies. The efficiency measurement is done by using Data Envelopment Analysis (DEA). Data envelopment analysis (DEA) is the non-parametric mathematical programming approach to frontier estimation. Charnes, Cooper and Rhodes (1978) proposed a model which had an input orientation and assumed constant returns to scale (CRS). Subsequent papers have considered alternative sets of assumptions, such as Banker, Charnes and Cooper (1984) who proposed a variable returns to scale (VRS) model.

The CRS assumption is only appropriate when all DMUs are operating at an optimal scale (i.e. one corresponding to the flat portion of the LRAC curve). Imperfect competition, constraints on finance, etc. may cause a DMU to be not operating at optimal scale. The use of the VRS specification will permit the calculation of Technical Efficiency (TE) devoid of these Scale Efficiency (SE) effects.

VRS Model can be stated as:

$$\begin{aligned} & \min_{\theta, \lambda} \theta, \\ \text{st} \quad & -y_i + Y\lambda \geq 0, \\ & q_{xi} - X\lambda \geq 0, \\ & N1\phi\lambda = 1 \\ & \lambda \geq 0, \end{aligned}$$

where, N1 is an N1 vector of ones.

This approach forms a convex hull of intersecting planes which envelope the data points more tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained using the CRS model. The VRS specification has been the most commonly used specification in the 1990's.

The TE scores obtained from a CRS DEA into two components, one due to scale inefficiency and one due to "pure" technical inefficiency. This may be done by conducting both a CRS and a VRS DEA upon the same data. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency, and that

the scale inefficiency can be calculated from the difference between the VRS TE score and the CRS TE score.

The SE value does not indicate whether the DMU is operating in an area of increasing or the decreasing returns to scale. This may be determined by running an additional DEA problem with non-increasing returns to scale (NIRS) imposed. This can be done by altering the DEA equation above by substituting the $N1\phi\lambda = 1$ restriction with $N1\phi\lambda \leq 1$, to provide

$$\begin{aligned} & \min_{\theta, \lambda} \theta, \\ \text{st} \quad & -y_i + Y\lambda \geq 0, \\ & \theta x_i - X\lambda \geq 0, \\ & N1'\lambda \leq 1 \\ & \lambda \geq 0, \end{aligned}$$

The nature of the scale inefficiencies (i.e. due to increasing or decreasing returns to scale) for a particular DMU can be determined by observing whether the NIRS TE score is equal

Table 1: Efficiency Scores of the Dairy Societies in South Goa

Names of societies	CRSTe	VRSTe	Scale Efficiency
Veroda Sha. Dudh. Cuncolim	0.775	0.854	0.908
Vadem Sha. Dudh. Curti-Sangeem	0.845	0.847	0.997
Dudhsager Sha. Dudh sangeem	1.000	1.000	1.000
JaiBhavani Sha.Dudh Sacorda sageem	1.000	1.000	1.000
Shri Maliargun Sha. Dudh Bhati Sangeem	1.000	1.000	1.000
Vijay Sha Dudh dharbandoda sangeem	1.000	1.000	1.000
Gopalkrishna Dudh Kalay Sangeem	1.000	1.000	1.000
Navajivan Sha. Dudh Bolkany Sangeem	1.000	1.000	1.000
Cudchaday Sha.Dudh Qupeem	1.000	1.000	1.000
Shri Bhomipurush Fatarpa Queepem	1.000	1.000	1.000
Shri Amla Sha.Dudh Ambavali Queepem	1.000	1.000	1.000
Kushavati Sha. Dudh Shriroda Queepem	0.301	0.743	0.404
Sateri Mahamaya Sha.Dudh kotambi Queepem	1.000	1.000	1.000
Molem Sha.Dudh Molem Sangeem	1.000	1.000	1.000
Sateri Shantadurga Sha.Dudh Shelday Queepem	0.822	0.829	0.991
Shri Maliargun Sha. Dudh kawarem Sangeem	0.635	0.721	0.881
Shri Mahadev Sha. Dudh Sangod Sangeem	1.000	1.000	1.000
Sangeem She. Dudh Sangeem	0.429	0.808	0.531
Balabheem Sha.Dudh dabhal Sangeem	1.000	1.000	1.000
shantadurga Sha.Dudh Shegao Queepem	1.000	1.000	1.000
Mean Score	0.89	0.94	0.936

Source: Compiled from Secondary Data

Table 2: Allocation of Marks for Audit Classification in regards to the Norms Prescribed

Sr.No.	Norms/ Factors	Marks allotted
1	Share capital	5
2	Membership	2
3	Turnover	10
4	Profitability	10
5	Participation of members	15
6	Management	10
7	Financial position	15
8	Books & records	5
9	Sundry Debtors	5
10	Status of societies	5
11	Milk testing	5
12	Submission of audit rectification report	5
13	Training of Staff / Management	3
14	Regular verification of cash / stock by Secretary / Manager	3
15	Discretion of Auditor	2
	Total	100

Source: Audit Handbook

to the VRS TE score. If they are unequal then increasing returns to scale exist for that DMU. If they are equal then decreasing returns to scale apply.

In our study we consider 6 inputs and 4 outputs for calculation of technical efficiency. The inputs considered are: Capital Fund, Deposits, Salary, Operating Expenses, Percentage of Board Members attending Board Meeting, Grants from Government, and No. of Registered Members. On the other hand four outputs are: Income from Milk, Income from Fodder, Other Income, and Ratio of milk supplying members to total members. In this study further an attempt is made to compare the audit classification to see whether correctly reflect the efficiency of dairy cooperatives societies is reflected in audit classification.

RESULTS AND DISCUSSION

Table 1 presents the technical efficiency scores of the dairy cooperatives societies from south Goa which, constitute a representative sample of 20 societies out of 58 societies which are on the books of record of the Registrar of Cooperative Societies. Data indicate that the average VRS TE score are 0.94 for the year under study. The numbers of societies on the efficiency frontier are 13 which are about 65 percent of sample societies indicating that efficiency of dairy cooperatives is quite satisfactory. The remaining 7 (i.e., 35 percent) dairy cooperatives societies have TE scores less than 1 which means that they are relatively technically inefficient. The average efficiency score under CRS is equal to 0.89, and results indicate that Kushavati Shakari Dudh

society, Shiroda-Queepem is the most inefficient primary milk society with efficiency score of 0.301 i.e. society is inefficient by 69.9 percent. Other societies below efficiency frontier are: Sangeem

She. Dudh- Sangeem, Shri Maliargun Sha. Dudh kawarem Sangeem, Sateri Shantadurga Sha. Dudh Shelday Queepem, Vadem Sha. Dudh. Curti-Sangeem, Veroda Sha. Dudh. Cuncolim, Vadem Sha. Dudh. Curti-Sangeem.

The performance of primary dairy cooperative society is depicted in annual report in the form of auditor's report. Auditor in his report classifies the societies on the marks scored by the society's i.e. if society scores 60 marks and above then it is classified as 'A' class society; if society scores more than 50 but less than 60 marks then it is classified as 'B' class society; if society scores more 35 marks but less than 50 then it is classified as 'C' class society; and society scoring less than 35 marks is classified as 'D' class society after considering varies norms or factors. Table 2 indicates different norms or factors with marks allocated to them which auditor consider while conducting the audit of primary societies.

Table 3 depicts comparative picture of the efficiency and audit classification of primary dairy cooperatives. From the table it is clear that some of the societies namely Dudhsager Sha. Dudh- sangeem, Shri Maliargun Sha. Dudh Bhati-Sangeem, Navajivan Sha. Dudh Bolkany-Sangeem, and Shantadurga Sha. Dudh Shegao-Queepem, are technically efficiency societies but classified as 'C' and 'D' types of societies as per the audit classification and in some cases where societies

Table 3: Comparative Picture of the Efficiency and Audit Classification of Primary Dairy Cooperatives

Names of Society	CRSTE	VRSTE	Scale Efficiency	Marks	Audit Class
Veroda Sha. Dudh. Cuncolim	0.775	0.854	0.908	43	C
Vadem Sha. Dudh. Curti-Sangeem	0.845	0.847	0.997	46	B
Dudhsager Sha. Dudh sangeem	1.000	1.000	1.000	36	C
JaiBhavani Sha.Dudh Sacorda sageem	1.000	1.000	1.000	60	A
Shri Maliargun Sha. Dudh Bhati Sangeem	1.000	1.000	1.000	38	C
Vijay Sha Dudh Dharbandoda Sangeem	1.000	1.000	1.000	56	B
Gopalkrishna Dudh Kalay Sangeem	1.000	1.000	1.000	61	A
Navajivan Sha. Dudh Bolkany Sangeem	1.000	1.000	1.000	35	C
Cudchaday Sha.Dudh Qupeem	1.000	1.000	1.000	54	B
Shri Bhomipurush Fatarpa Queepem	1.000	1.000	1.000	33	D
Shri Amla Sha.Dudh Ambavali Queepem	1.000	1.000	1.000	70	A
Kushavati Sha. Dudh Shriroda Queepem	0.301	0.743	0.404	35	C
Sateri Mahamaya Sha.Dudh kotambi Queepem	1.000	1.000	1.000	58	B
Molem Sha.Dudh Molem Sangeem	1.000	1.000	1.000	58	B
Sateri Shantadurga Sha.Dudh Shelday Queepem	0.822	0.829	0.991	51	B
Shri Maliargun Sha. Dudh kawarem Sangeem	0.635	0.721	0.881	45	C
Shri Mahadev Sha. Dudh Sangod Sangeem	1.000	1.000	1.000	55	B
Sangeem She. Dudh Sangeem	0.429	0.808	0.531	39	C
Balabheem Sha.Dudh dabhal Sangeem	1.000	1.000	1.000	50	B
shantadurga Sha.Dudh Shegao Queepem	1.000	1.000	1.000	36	C

Source: Compiled from Table 1 and 2

are classified as 'B' class societies but efficiency of these societies are poor then aforesaid societies.

CONCLUSION

This study proposes a simple framework for measuring the efficiency of primary dairy cooperative society. The analysis is based on a DEA model that allows for the incorporation of multiple inputs and multiple outputs in determining the relative efficiencies. The general conclusion is that on an average, primary dairy cooperatives societies are efficient. For the non-efficient societies, it is found that these inefficient societies can achieve the efficient frontier if ratio of milk supplying members to total membership enhance. From above discussion it is clear that factors which considered by auditor for classifying these primary societies are of less significance and potential of prejudice on the part of auditor is feasible. Some variables like Discretion of Auditor, Books & records, and Submission of audit rectification report considered for classifying societies as A, B, C and D and marks allocated to them are found to insignificant. Factors like financial position, Management, Membership

and Training of Staff/management should have been allotted more marks which was lacking. Hence it can be concluded that audit classification does not reflect the efficiency of primary dairy cooperatives societies.

REFERENCES

- Banker, R. D., Charnes, A., & Cooper, A. W. (1984). Some models for estimating technical and scale inefficiency in data envelopment analysis. *Management Science*, 30, 1078-7092.
- Chandramohan, R., & Periyasami, N. (2008). Financial performance of Thanjavur district co-operative milk producers' Union Ltd. *Indian Cooperative Review*, 46(2), 146.
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operation Research*, 2, 429-444.
- Chhikara, D. P., & Gangwar, A. C. (1975). Resource productivity in milk production and returns from cattle, Crossed cow and murrah Buffalo. *Indian Journal Agricultural Economics*, 30, 145-146.

- Dagistan, E., Koc, B., Gul, M., Parlakay, O., & Akpinar, M. G. (2009). Identifying Technical Efficiency of Dairy Cattle Management in Rural Areas Through a Non-Parametric Method: A Case Study for the East Mediterranean in Turkey. *Journal of Animal and Veterinary Advances*, 8(5), 863-867.
- Devaraja, T. S. (2001). Channels and price spreads in milk marketing in co-operative and private sectors of Karnataka. *Agricultural Marketing*, 28, 21-23.
- Jithendrakumar, D. S. (1990). *Performance of Dairy Cooperatives and Their Impact On Milk Production, Income and Employment In Chitoor District (A.P.)*, M.Sc. (Agri) Thesis, Univ. Agric. Sci., Dharwad, 1990
- Mattigatti, R. M. (1990). *Performance of Milk Producer's Cooperative Societies and their Impact on Dairy Farming in Dharwad district, Karnataka*, M.Sc. (Agriculture) Thesis, University of Agriculture Science, Dharwad.
- Misra, S. K., & Puri, V. K. (2001). *Indian Economy*. Himalaya Publishing House, Mumbai, pp.228.
- Pawar, J. R., & Sawant, S. K. (1979). Comparative efficiency of alternative milk marketing agencies in western-Maharashtra. *Indian Journal of Agricultural Economics*, 34(4), 160-167.
- Sartorius, K., & Kirsten, J. (2007). A framework to facilitate institutional arrangements for smallholder supply in developing countries: An agribusiness perspective. *Food Policy*, 32, 640-655.
- Singh, S., Fleming, E., & Coelli, T. (2000). Efficiency and productivity analysis of cooperative dairy plants in haryana and punjab states of India. Working Paper Series in Agricultural and Resource Economics. Retrieved from <http://www.une.edu.au/febl/EconStud/wps.htm>
- Singh, R. B., & Dayal, R. (2004). Economic analysis of production and marketing of milk in central region of Uttar Pradesh. *Indian Journal of Agricultural Economics*, 59(3), 654.
- Thakur, D. S. (1996). Impact of dairy development through milk cooperatives: A case study of Gujarat. *Indian Journal of Agricultural Economics*, 41(3), 83-89.
- Thanassoulis, E. (2001). *Introduction to the Theory and Application of data Envelopment Analysis: A Foundation Text with Integrated software*, Dordrecht, Kluwer.