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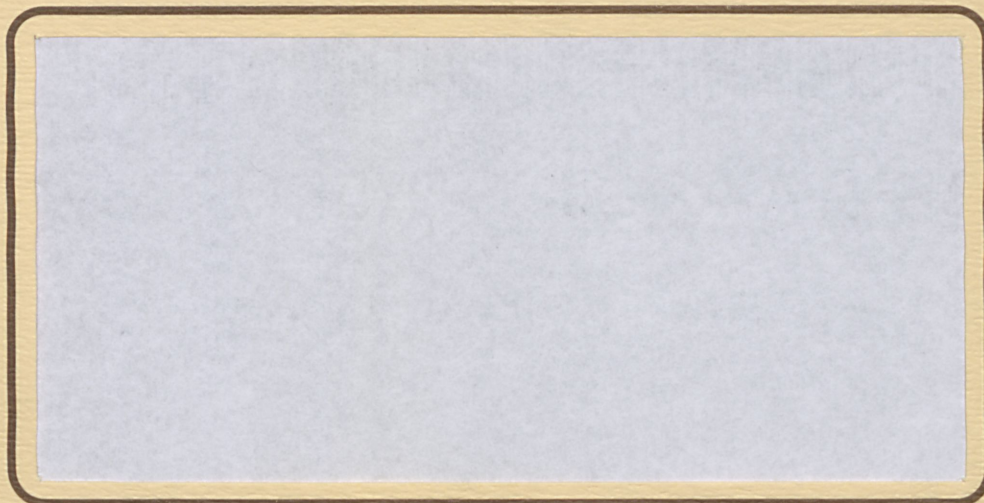
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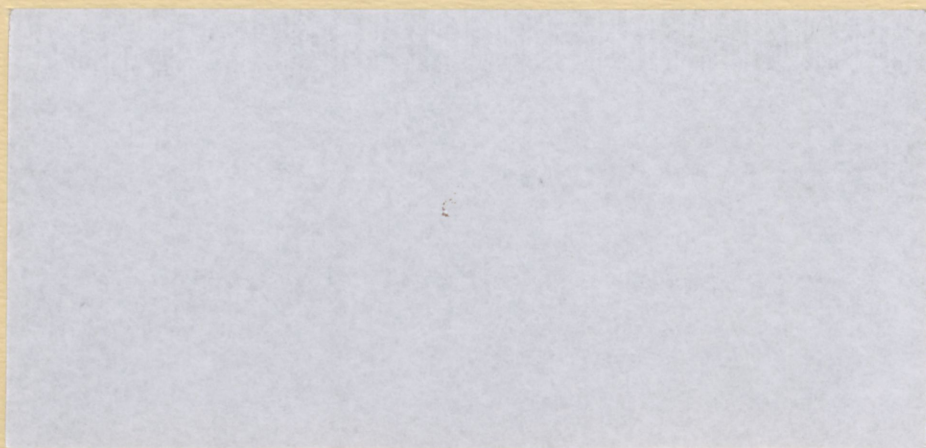


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**MILK MARKETING
BY DAIRY COOPERATIVES IN INDIA**

Joan Fulton
Mukesh Bhargava

Project Report 93-02

REPORT TO THE
FUND FOR SUPPORT OF INTERNATIONAL DEVELOPMENT ACTIVITIES
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MILK MARKETING BY DAIRY COOPERATIVES IN INDIA

PREFACE

In January 1992 the Fund for the Support of International Development Activities approved Dr. Fulton's and Dr. Bhargava's project proposal titled "Improving the Performance of Milk Marketing by Dairy Cooperatives in India". The objectives of the study as outlined in the proposal were to:

1. Identify markets where the dairy cooperatives have had above average performance in marketing milk and where they have had poor performance in marketing milk.
2. From a detailed study of these markets, identify factors that contribute to better performance in the marketing of liquid milk.
3. Develop and identify strategies, specifically dealing with promotion, pricing, and product development that the cooperative dairies could use to increase their share of the markets.

In April 1992 Dr. Fulton travelled to India. The following objectives of the trip were successfully met: (i) valuable contacts were established with the faculty at the Institute of Rural Management at Anand (IRMA), (ii) extensive data on the physical and financial operations of the cooperative dairies across India were obtained. Upon Dr. Fulton's return to Canada analysis of the data was undertaken by Dr. Fulton and Dr. Bhargava. This research resulted in the preparation of a manuscript which is currently under review with the *Journal of International Food and Agribusiness Marketing*. Additional research resulted in a second paper which is currently being prepared for publication as an IRMA research report. In December 1992 Dr. Bhargava travelled to India. In addition to presenting the results of the research he obtained commitment from colleagues at IRMA to pursue additional funding to further this joint research on the performance of the dairy cooperatives.

Following is a report of the findings which resulted from the research of the past year.

INTRODUCTION

Research on agriculture in developing economies is an integral part of the overall research on marketing and economic development. Low income economies account for an estimated 61 percent of the world's current population of 4.8 billion people (World Bank 1990). In addition, 72 percent of the labor in these countries is engaged in agriculture, which accounts for 33 percent of the gross domestic production. The fact that these countries are far from being self sufficient in food production¹ is further evidence of the importance of this research.

This report examines the results of a marketing intervention in the dairy sector in India. The establishment and growth of dairy cooperatives has been the outcome of three large and related development programs: Operation Flood I, II and III. The United Nations Interagency Mission reported that Operation Flood I was the world's largest dairy development program (reported by Paul, 1983, p. 16). Currently the cooperative organizations play a significant role in India's production and consumption of milk. In 1991 the membership of these organizations included over 7.4 million milk producers, with the total quantity of milk marketed daily averaging 8.05 million litres.

In this report we review the operations of the dairy cooperatives in India and discuss the effect these organizations have had on improving the economic well-being of the population of India. We also identify markets where the dairy co-operatives have had above average performance in marketing milk and suggest factors which contribute to this success. The report begins by summarizing the literature on marketing and economic development. In the context of this literature we illustrate the importance of these dairy cooperatives. A discussion of different measures of marketing performance concludes the literature review. Next we provide an overview of the dairy sector in India and the roles played by the organizations at each of the local, regional

¹ In 1988 low income economies imported 32 million tonnes of cereals, in addition to the 6.9 million tonnes provided as aid (World Bank, 1990).

and national levels. A description of the data and methods of analysis leads up to the results. The final section draws conclusions and suggestions for further study.

LITERATURE REVIEW

Marketing and Economic Development

Since Drucker's (1958) seminal work on marketing and economic development a number of researchers have added to the nature and extent of this relationship (Kaynak and Hudanah 1987; Joy and Ross 1989; Dholakia and Sherry, 1987). The foundation of this literature is based on the specific benefits from improved marketing activities. Etemad (1984) provides a synthesis of the specific benefits from marketing. At the aggregate level, marketing is expected to increase the efficiency of the system by integrating the supply, production and distribution systems. These systems provide employment, act as channels for the flow of capital and integrate the rural sector in the market economy thereby aiding economic development (Kaynak 1986a, pg. 22).

A comparison of this theoretical work with practice provides a definite contrast. At the planning level, for agricultural development projects, the adoption of marketing activities has been slow. In a review of the 402 agricultural projects financed by the World Bank prior to 1986, only 12 were primarily marketing projects (Operations Evaluation Department, 1990). This review also suggests that the other projects "failed to recognize the need to prepare a market development program well ahead of the market entry" (pg. 3).

It is interesting to postulate why, as identified by Ross and McTavish (1984) and Kaynak (1986b), most agricultural development projects emphasised methods for improving production. One possibility is that the production orientation reflects the shortage economy common in many third world countries. Project planners and researchers may be adopting the common fallacy that marketing activities are needed only when supply is greater than demand. Indeed the marketing

literature exacerbates this problem since the traditional marketing orientation does not give any emphasis to the supply side factors².

A second possible reason for the lack of emphasis on marketing in development projects may be the perception that the benefits from marketing activities are biased in favor of the privileged class (Dholakia 1984). With this perception one is then lead to the conclusion that a marketing orientation is contrary to one of the important objectives of development projects; an equitable distribution of benefits (see Adelman and Morris (1974), Nugent and Yotopoulos (1979), Sarma (1982), and World Bank (1990) for a discussion of this issue of equitable distribution).

In the next section, following the discussion of measures of marketing performance, we review the operations of the dairy industry in India with particular attention to the role of the cooperative sector. We illustrate that as a result of the introduction of the cooperatives, which was a marketing intervention, dairy production in India has grown. In addition, we show that the appropriate application of marketing intervention need not be biased in favor of the more privileged. The growth of the dairy cooperatives in India over the past 20 years has resulted in an equitable distribution of benefits.

Measures of Marketing Performance

Two different approaches for measuring marketing performance have been suggested by past research. The first approach, the comprehensive review or marketing audit, is as its name suggests, a comprehensive review of the marketing performance (Kotler, Gregor and Rogers, 1977). The marketing audit is applicable when the performance of a single organization is to be addressed. However, with a number of organizations a preliminary ranking of performance may be necessary to make the task of the audit more manageable. The second and more common

² Kohli and Jaworski (1990) do mention that supply side constraints may influence the marketing orientation. However, they fail to detail this factor and instead concentrate on other factors such as turbulence and technological changes.

approach for measuring marketing performance uses direct (e.g., market share, sales) and indirect (e.g., marketing orientation) measures of marketing effectiveness. In this report we follow the second approach and use direct measures of marketing performance.

The most common measure of marketing performance is a direct measure, market share. A large market share is associated with the firm's ability to achieve scale efficiencies and market power. Research in the mid 1970s, examining marketing strategy, identified a positive relationship between market share and profitability (Buzzell, Gale and Sultan, 1975). Market share has a long term orientation which makes it a preferred measure of marketing efficiency to profitability. Although market share has come under question in recent years (Jacobson and Aaker, 1985; Jacobson, 1990) it still remains a popular measure of marketing performance.

The main advantages to using market share as a measure are that it allows a cross industry comparison, and it is relatively easy to use and measure³. Unlike sales as a measure, market share takes the competitive situation and growth across industries into account. The major limitation with market share is that the definition of the market used to estimate the share may be subjective. The fact that market share alone does not ensure profitability is another concern. For this reason a combined measure of market share and profitability may provide a better method of evaluation.

Researchers have argued for multiple measures to fully account for the various dimensions of performance (Chakravarthy, 1986; Lewin and Minton, 1986; Walker and Ruekert, 1987).

Walker and Ruekert recommend three dimensions to measure marketing effectiveness:

1. Growth of market share to measure efficiency
2. Return on investment to measure effectiveness
3. Percentage of new products introduced to measure adaptability

While the use of multiple measures seems advantageous, it poses another problem.

Multiple measures may require a trade-off (Walker and Ruekert, 1987). Increasing market share

³ While other measures of marketing performance such as customer satisfaction, number of new products launched and comparative analysis of the elements of the marketing mix have been advocated and used in the literature, the preponderance of literature uses market share and profitability measures.

by spending more on advertising and promotion may come at the expense of short term profits. The use of multiple measures may lead to different diagnoses depending on the combination of measures used and the time frame studied.

Three direct measures of marketing performance are used in this study to evaluate the marketing effectiveness of the dairy cooperatives in India. These measures are market share, growth in market share and contribution margin. Following a discussion of the operations of the various components of the dairy industry in India the empirical analysis is reported along with recommendations concerning marketing efficiency for the dairy cooperatives.

DAIRY INDUSTRY IN INDIA

To understand the role which the cooperatives currently play in the dairy industry in India, we first set the stage by describing the environment within which these organizations operate. Production and consumption of milk in the developing countries is very different when compared with the developed countries. Table 1 reports the value of milk exports, imports, and trade balance, and illustrates this point. The developed countries have a positive balance of trade in milk products indicating that domestic production is greater than domestic consumption. In contrast, the balance of trade in milk products is negative for the developing countries denoting that they must import milk products in order to meet domestic demand. The policy emphasis in dairying internationally is consistent with these statistics. While the focus in the developed countries is on better management of the demand and supply, the emphasis in the developing countries is on improved production (Khurody 1974; Empson 1990; Grant 1991).

We also report, in Table 1, the trade statistics for India separately. Once again we observe a balance of trade deficit indicating that milk products had to be imported to meet domestic demand. It is interesting to note that since the reported figures are in current dollars the value of the trade deficit in milk was smaller in real terms in 1990 as compared with 1971. This issue is discussed in more depth later when we describe how the development of the cooperatives has lead to increased

Table 1: Balance of Trade in Milk (Fresh, Powder and Other Forms)
(in Million U.S. \$ (current))

	1971	1990
Developed Countries		
Imports	456.1	5062.0
Exports	1038.7	8506.7
Balance of Trade	+ 582.6	+ 3444.7
Developing Countries		
Imports	570.8	4370.9
Exports	26.0	312.2
Balance of Trade	- 544.6	- 4058.7
India		
Imports	18.3	23.3
Exports	0.0	0.4
Balance of Trade	-18.3	-22.9

Source: Food and Agriculture Organization of the United Nations:
Quarterly Bulletin of Statistics - Trade, 1971, 1990

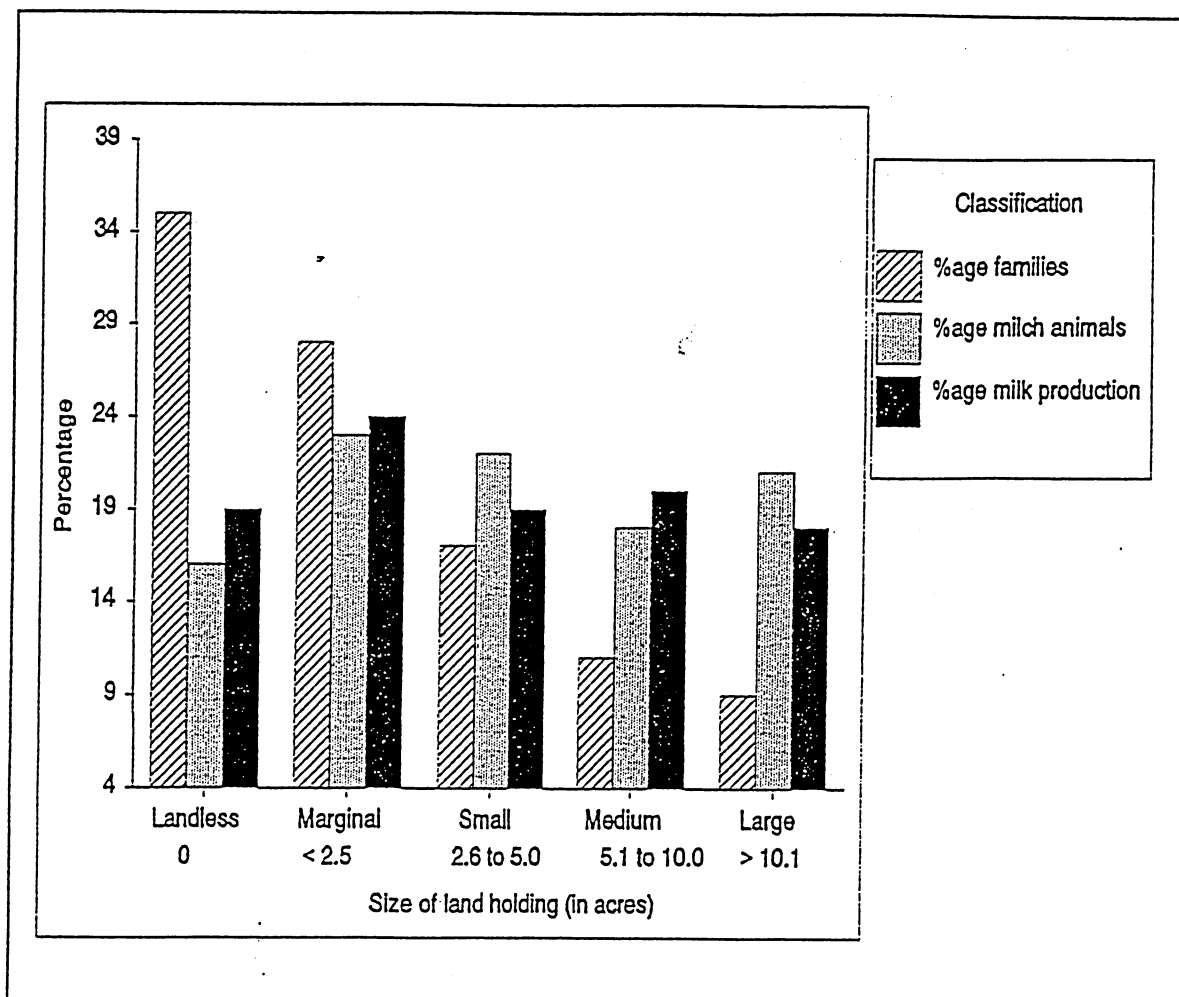
domestic milk production and a move toward self sufficiency. The issue of self sufficiency in milk production is extremely important since dairy products constitute a vital part of the daily diet for all classes of society in India. In an otherwise largely vegetarian diet, milk products provide a significant source of animal protein. Milk is consumed directly, and as milk products such as yogurt, tea and coffee additives, cottage cheese and ice cream.

On the production side, small marginal producers are an important component of the dairy sector in India. Figure 1 reports the results of a 1984 census of six million households in 20,386 dairy cooperatives in 108 milksheds by the National Dairy Development Board (NDDB). Over 40 percent of the milk production originated from producers who were landless or had land holdings of less than 2.5 acres⁴. For these producers, who are landless and marginal land holders, milk production is very important. The milk produced is an important component of the diet for these families. In addition, the surplus milk, which is not consumed by the family, is sold providing a significant portion of the total family income. Milk production is then a subsidiary activity from two perspectives. First of all, families usually have one or two milch animals and milk is produced as a subsidiary activity to farming the land or other labor income. Secondly, the milk which is sold is the surplus milk not consumed by the family.

There are a number of characteristics associated with the production and consumption of milk in India which create challenges or difficulties for the producers. The distribution of milk production across a large number of small producers is one of these factors. Prior to the organized intervention in the dairying sector (ie. the establishment of the cooperatives) producers most commonly sold their milk to the "dudhia" or middleman. The dudhia would in turn sell the milk in the urban centers. The difficulty faced by the producer was an imbalance of market power. As

⁴ This census considered only the dairy cooperatives in the selected regions, limiting its generalizability. Unfortunately, as noted by Alderman (1987), it is not possible to obtain current data on the distribution of land and animal holdings for all dairy producers on a national level.

Figure 1: Households, Milch Animals and Milk Production in India by Landholding Size



Source: Produced from data in Belavadi and Singh (1991).

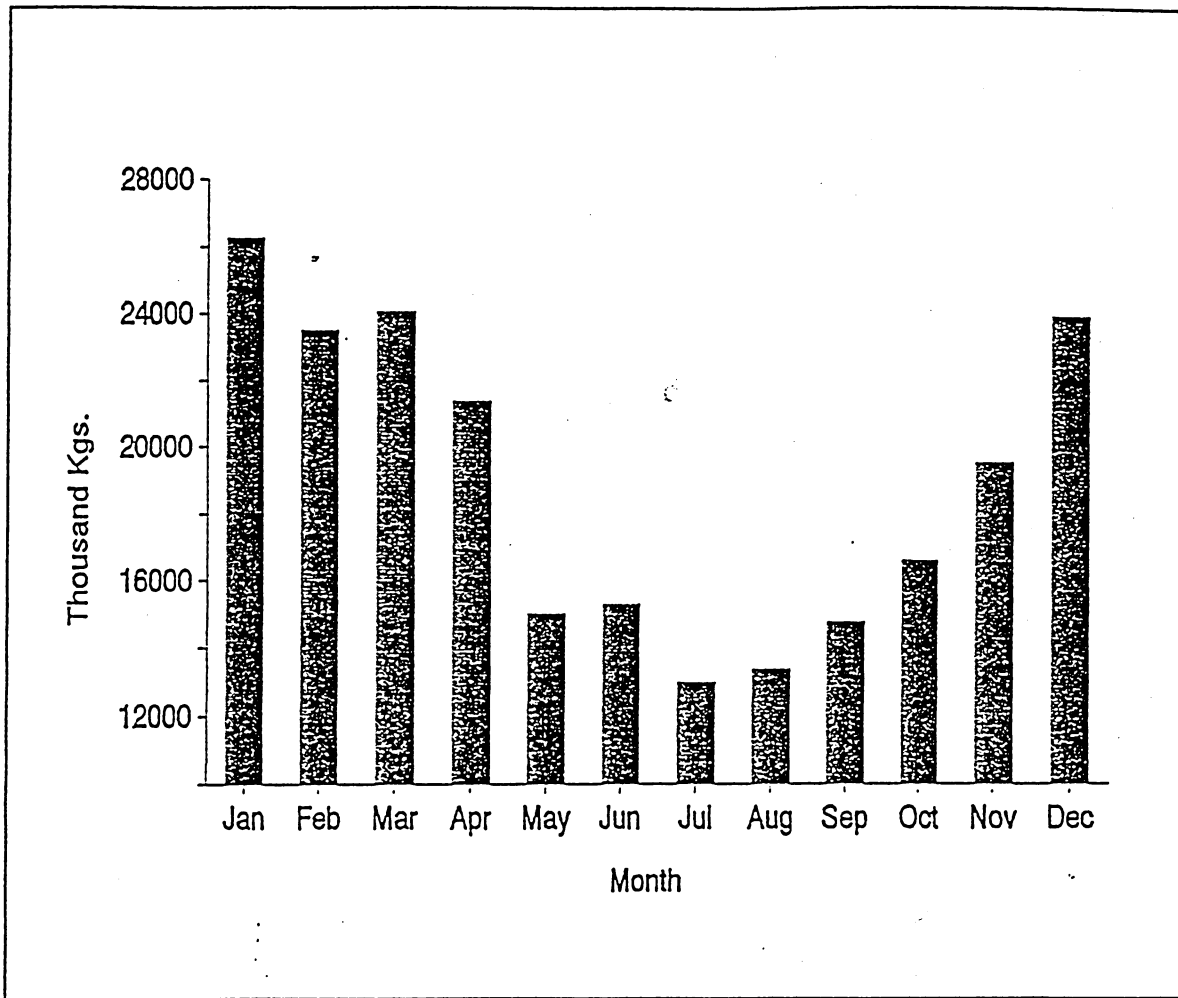
one of many milk producers in a village where only one or two dudhia were buying milk an individual producer was often exploited with respect to the price he/she received.

Large seasonal fluctuations in milk production, as illustrated in Figure 2, is a second factor which creates challenges for producers (Belavadi and Singh 1991). Two factors contribute to this seasonality. The extremely hot weather, coupled with lack of available fodder during the summer months contributes to the decline in milk production. The second factor relates to the fact that buffalo milk constitutes about one-half of the milk production. Existing animal husbandry practices are such that buffaloes calve seasonally with most of the buffaloes calving from July to November. As a result, the autumn and winter months represent the time of peak milk production in India. Seasonality in production, combined with the fact that producers face an imbalance of market power when selling their milk result in situations where producers are either unable to sell their milk or are forced to accept a very low price (ie. during times of peak production).

Another difficulty associated with the dairy industry in India is the complexity of the distribution system. The production of milk is spread across the 550,000 villages in India, while the consumption is distributed across 226 cities with population greater than 100,000. To meet the urban demand, milk must be collected from the individual producers, pasteurized or processed into other products, transported and distributed to consumers. Another related factor contributing to the complexity of the distribution system is the lack of refrigeration in most households in India. With no refrigeration consumers purchase milk twice a day (morning and evening). The distribution system for milk is logistically very intensive. It is important to note that the quantity of milk sold as a percentage of total production varies by region. For example, in regions where transportation systems are not well developed and which are not close to large urban centers very little milk is sold in liquid form. In these cases the surplus milk is converted into butter and "ghee"⁵.

⁵ Ghee is clarified butter used in India for cooking and has a longer shelf life than liquid milk.

Figure 2: Seasonal Variation in Milk Procurement



Statistics for the Kheda Union, Gujarat, India 1991. Source: National Dairy Development Board.

THE COOPERATIVE DAIRIES IN INDIA

The dairy sector in India has experienced a major marketing intervention during the past two decades with the introduction and growth of cooperative business organizations. Currently, the cooperative sector constitutes a significant portion of the dairy industry in India. Belavadi and Singh (1991) report that, in the areas covered by the cooperatives, 66 percent of the milk sold by the producers is collected by locally owned cooperative societies.

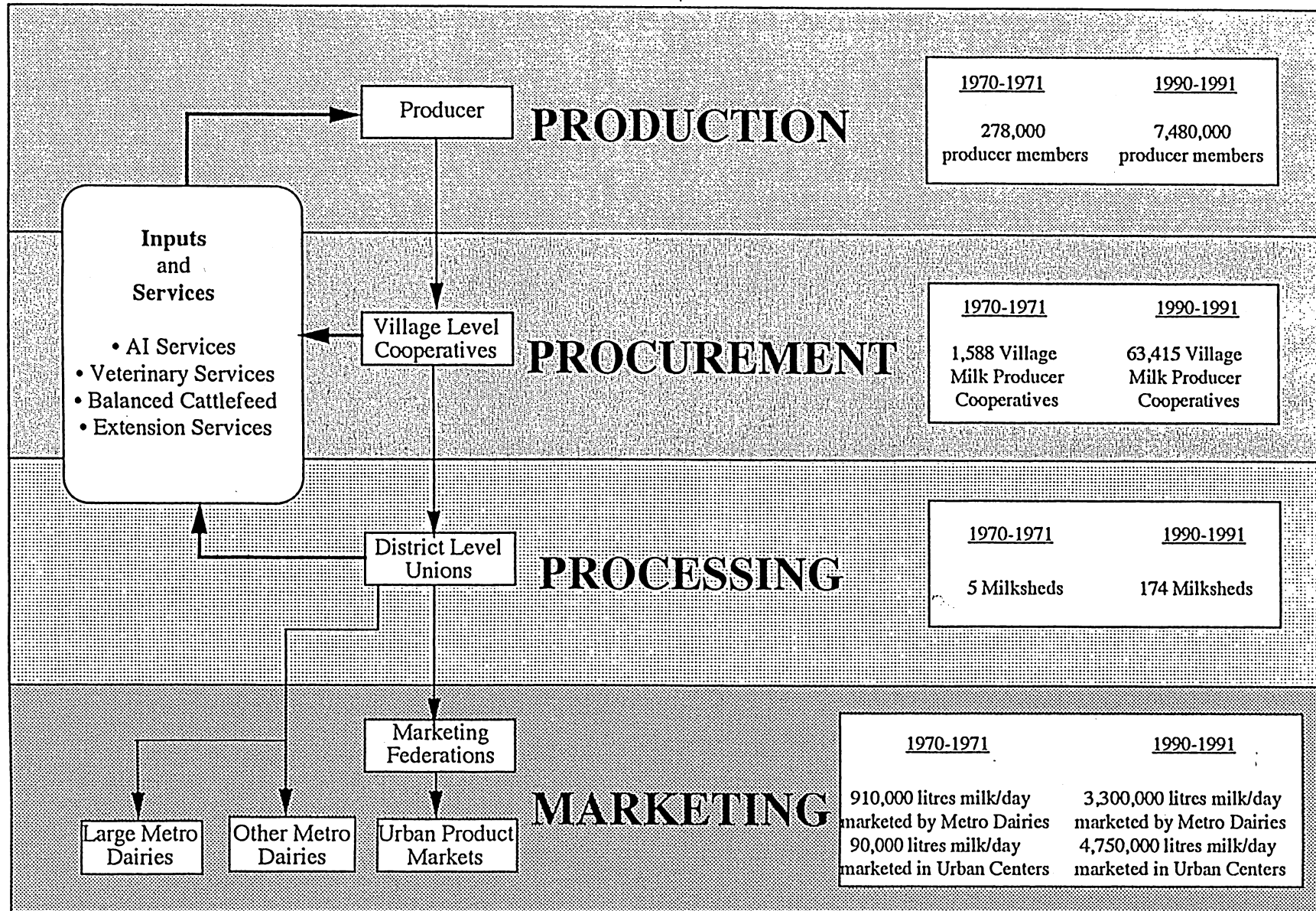
Organizations at the local village level, the district or regional level, the federation level, and the national level characterize the cooperative dairy sector in India. Figure 3 illustrates the flow of milk products from the individual producers through the village and regional level cooperatives to the metro and urban markets. In addition, Figure 3 reports selected statistics which detail the growth in this cooperative sector during the past 20 years. In the following sub-sections we describe the functions of the organizations which comprise the cooperative dairy sector in India.

Village Milk Producers' Cooperatives

As noted in Figure 3 there were over 63,000 village milk producers' cooperatives with a total membership of over 7.4 million producers throughout India in 1991. The members of the village milk producers' cooperatives are individual producers who deliver milk twice a day (morning and evening) to the cooperative. In addition to performing the role of collecting or procuring the liquid milk, these cooperatives serve as a distribution outlet from which the producer members can acquire services and products. These services include artificial insemination (AI), veterinary and extension services, while the products include balanced cattle feed and processed dairy products.

A key characteristic of the individual producers is their small scale of operation with an average daily collection per member of 1.4 litres (Calculated from membership and milk procurement data from the NDDB). Thirty-five percent of the milk producers were landless while another 28 percent were marginal landholders (see Figure 1). Women play a significant role in the

Figure 3: Operation and Growth of Dairy Cooperatives In India



primary production of milk. NDDDB reports that in 1990-91 women made up 15.5 percent of the 7.40 million members in the cooperatives (Belavadi and Singh, 1991). This value may be biased downward given that in many cases ownership, and therefore membership, lies with the male head of the household. However, it is very common for women to take the major responsibility in caring for and milking the animals, as well as delivering the milk to the cooperative for sale.

These small scale producers realize a number of benefits from cooperative membership. As noted in the previous section, with the imbalance of market power which was prevalent in villages prior to the establishment of cooperatives, producers were often exploited with respect to the price they received for their product. In addition, it was not uncommon for the dudhia or middlemen to refuse to buy milk during the peak times of flush production. As producer owned and controlled organizations the village milk producers' cooperatives collect all milk delivered by the member producers. These cooperatives organizations also pay all producer members according to a standardized pricing schedule, which is based on the fat and solids not fat (SNF) content of the milk. With pricing based on the fat and SNF content, which is determined by testing a sample of each members' milk following each delivery, there is no incentive for members to tamper with the milk by adding water to it⁶. Regular payment twice a day (eg. payment is made in the evening for the milk delivered that morning) constitutes yet another advantage of cooperative membership.

The District Unions and The Federation

The organization of the district or union level cooperatives (hereafter referred to as the unions) is on a geographic basis with their members being the local or village level cooperatives. The main functions of the unions are to collect the milk twice a day from the village level cooperative, pasteurize the milk or process it into other milk products, package the milk or milk

⁶ Watering down of milk is indeed a problem in the dairy industry in India. Khurody (1974) reports that in 1968-71, of 61,340 samples of milk taken from urban areas by various municipalities, 31% percent showed signs of being adulterated.

products, and arrange for sale of these final products. Timing is a key factor for these unions, especially when it comes to the collection of milk from the village level cooperatives since these latter organizations have no refrigeration facilities.

The unions provide a number of services to the local cooperatives and the producer members in areas where scale economies make it most feasible for these services to be offered at this level. These include: veterinary services, AI services, member education, and cattle feed. In the case of veterinary services the union employs a team of veterinarians who regularly visit the villages (usually bi-monthly) to monitor the health of the animals and provide immunizations when necessary. The team of veterinarians also provide emergency veterinary services to producer members as needed. Although coordinated through the local village level cooperatives it is the unions which provide AI services. The provision of AI services is usually accompanied with a member education program. In this manner individuals learn how reproduction cycles can be controlled in animals, leading to important indirect benefits with respect to family planning. Singh and Mukunda Das (1982) showed that the awareness of family planning methods was greater in the villages which had dairy cooperatives. The district unions also produce and sell cattle feed, and undertake fodder development. In the production of cattle feed the unions utilize operations research techniques to optimize cost and nutritional content in manufacturing the feed.

Another function of the unions is to smooth out differences in supply and demand which occur seasonally and geographically. It was noted in a previous section that there are large seasonal fluctuations in milk production in India, with production at the lowest level during the summer months. In contrast, demand for milk and milk products is fairly constant throughout the year. With a substantial investment in production capacity for milk powder the district or union level cooperatives⁷ can help to alleviate the seasonal supply and demand imbalances by drying the

⁷ In 1991 the total milk drying capacity was 258,000 metric tonnes per year, which was geographically dispersed across different district or union level cooperatives.

excess milk during the winter months of peak production and reconstituting the milk during the summer months of lean production.

The unions market in the large towns in their area. This involves managing the mix of marketing functions including the intensive distribution system. This allows a customization of the marketing plan for each dairy to suit local competition and customer preferences. In 1991, the unions marketed 80.6 percent of the total throughput as liquid milk, covering 220 class I cities.

In an effort to address the issue of geographical imbalances in supply and demand the unions form state level institutions or federations for marketing milk products. While the primary responsibility of the federations is the marketing of milk products in urban markets, they also negotiate contracts for sales of liquid milk to the four large metropolitan dairies⁸. It should be noted that these cooperative federations compete with each other in the urban markets.

The National Level

At the national level, the coordination of planning, investment, and training of manpower for the dairy cooperatives is done through the National Dairy Development Board (NDDB). The NDDB was established by the Government of India in the mid 1960s as an autonomous institution to be free from the political bureaucracy associated with the government.

A primary objective of the NDDB over the past two decades has been to serve as a catalyst for the development of new cooperatives (at both the local and district levels) across India. With its headquarters in the village of Anand, in the state of Gujarat, the NDDB personnel were strongly influenced by a well established successful cooperative named The Kaira District Co-operative

⁸ Class I cities are urban centers with population more than 100,000 as per 1981 census. Metro cities are the four largest cities in India; Bombay, Delhi, Calcutta, and Madras.

Milk Producers' Union Ltd⁹. In fact the organizational structure of the Kaira District Co-operatives Milk Producers' Union Ltd. formed the blueprint for the new cooperatives and became known as the "Anand pattern". An important feature of the "Anand pattern" was that the ownership and control of assets remained in the hands of the member producers.

The success of the NDDDB has gone hand in hand with its ability to attract outside or international funds. Outside funding allowed for the development of domestic dairy cooperatives beyond what was envisaged in government plans. In particular, international funds provided the NDDDB with the flexibility of working outside the state and national bureaucracies to plan and implement dairy development on a scale that would not have been possible otherwise. In 1970 the NDDDB launched a dairy program known as Operation Flood I. This program, agreed to by the Government of India and the World Food Program of the United Nations, involved gifts from the developed world to India in the form of 126,000 metric tons of skim milk powder and 42,000 metric tons of butter oil for the project period of five years. These gifted commodities were most welcome in India where, as noted in an earlier section, domestic demand exceeded domestic supply of dairy products. In addition, the revenue from the sale of these commodities was used to finance the development program. The NDDDB ensured that these gifted products were sold at a price comparable with that of local production to ensure that the local production would not be undervalued. The program was completed in 1980 with a reported total value of 1160 million Rs.

Operation Flood II was subsequently launched in 1981 to increase the overall scale of the program. This project involved a soft loan of US \$150 million from the World Bank, money generated from the dairy commodities gifted by the European Economic Community and by the

⁹ Located in Anand the Kaira District Co-operative Milk Producers' Union Ltd. sells products under the well known (in India) brand name of AMUL. The development of this cooperative dates back to the 1940s (see Singh and Kelley (1981) and Paul (1983) for further information on the development of this cooperative).

internal resources of the Indian Dairy Corporation¹⁰. Currently, the NDDB is administering and implementing Operation Flood III which is being funded by a World Bank loan/credit of US \$360 million, money generated from the dairy commodities gifted by the European Economic Community and from internal resources of the NDDB.

In addition to being a catalyst for the establishment of cooperative organizations across India the NDDB has served the cooperative dairy sector in other ways. These include working for changes in the national legislation involving cooperatives, general research involving the technology of dairy production in the specific case of India and the establishment of a National Milk Grid to allow for milk to be distributed across the country and help alleviate imbalances in demand and supply which occur geographically.

This section has reviewed the general features which have led to the success of the dairy cooperatives in India. In this report we want to identify factors which make one union more successful than another. In order to do this we must define the measures which we use to determine marketing performance. In the next sections these measures and the methodology are defined.

DATA AND METHODS

The empirical analysis reported here is based at the level of the district union. Data for this analysis were collected from the NDDB's Management Information System. This system is used to organize the data collected on key operations variables (eg. volume of liquid milk procured, volume of milk processed, volumes sold, and prices) from each of the unions on a monthly basis. In addition to data on each of the individual unions, data on total market demand for each city or town is employed in this research. This latter data, derived by the NDDB, was computed from

¹⁰ The Indian Dairy Corporation (IDC) was originally established to handle the financial matters while the NDDB was responsible for the operational matters of the development projects. In 1987 NDDB and the IDC merged with the NDDB name preserved.

national surveys of milk demand. Due to constraints associated with availability of market demand data for smaller centres, this analysis is confined to those unions that market milk to at least one class 1 town. Forty-five months of data, from the time period 1988 to 1991, are used in this analysis¹¹.

Two types of variables are generated and used in this study. The first set represents measures of performance in marketing liquid milk. The three variables in this set are market share, growth in market share and contribution margin. Market share is determined by summing the values of the monthly sale of all liquid milk varieties across all class 1 towns covered by the union. This value is then divided by the total monthly demand for milk in all the markets covered. It is important to note that the market share variable aggregates across all varieties of milk sold by the union and that when the union markets milk to more than one class 1 town the market share variable is the average of the shares in each of the towns. The final calculation in the generation of this market share variable involves calculating the average value of market share across the 45 months of data. Growth in market share is calculated by taking the percentage difference in market share from the time period 1988-1989 to the time period 1990-1991. Finally, contribution margin is calculated as the difference between the price charged for milk marketed and the price paid for milk procured. It is used in this analysis as a surrogate measure of the financial performance of the union. As with the two market share variables, an average value of contribution margin is calculated from the 45 months of data. For each of the unions two average prices are calculated over the 45 months of data: one for milk marketed and one for milk procured. The contribution margin is then determined as the difference between the average price charged and the average price paid for milk. For those unions that are primarily in the milk marketing business (ie. do not procure milk directly from the dairies), the average price paid for milk procured by all unions in the same geographical region is used as the estimate of procurement price.

¹¹ Due to difficulties with the data files, the observations for the first three months of 1991 had to be discarded.

The second set of variables are explanatory variables which are hypothesized to influence the level of performance. Seven explanatory variables, which can be classified into two categories, are used in this analysis. The first category of variables defines the history of the cooperative organizations. These variables include regional location, the age of the organization and the type of organization. The second category of four variables describes the procurement, marketing and organizational related variables of the unions.

A principal component analysis is used to calculate three of these four controllable explanatory variables. The liquid milk capacity, milk powder capacity, amount of milk procured and number of chilling centres combined into one factor which is called the "processing/ procurement" factor. The average number of types of packages and number of cities combine to make the second factor, referred to as "marketing activities". Finally, the total demand and whether the union was also procuring milk were used to capture the organization related variables which makes up the third factor in this analysis. In addition, the variable average price charged is used to account for overall demand related factors. All these variables were calculated from the data provided by NDDB.

The analysis plan consists of three stages. The first stage involves a simple univariate analysis for each of the variables to identify the top ten unions according to the three variables market share, growth in market share and contribution margin. Multiple regression analysis in the second stage, explores the relationships between the measures of performance and the explanatory or independent variables. The third stage employs Data Envelopment Analysis (DEA) to provide a more comprehensive measure of the relative efficiency of these organizations.

RESULTS

Univariate Analysis

A very simple, but useful, component of this analysis is the identification of the top ten unions for each of the three performance measures. These results are summarized in Table 2.

Table 2
Performance of Unions/Dairies in Liquid Milk Marketing
(Class 1 Towns, 1988-91)

Top Ten Dairies/Unions in terms of:

Market Share	Growth in Market Share	Contribution Margin
Kota, Rajasthan	Muzaffarnagar, Uttar Pradesh	G.C.M.M.F., Gujarat
Trivandrum, Kerala	Saharanpur, Uttar Pradesh	Sangli, Maharashtra
Surat, Gujarat	G.C.M.M.F., Gujarat	Darjeeling, West Bengal
Kaira, Gujarat	Akluj, Maharashtra	Kohlapur, Maharashtra
Valsad, Gujarat	Sitapur, Uttar Pradesh	Bharuch, Gujarat
Vododara, Gujarat	Alwar, Rajasthan	Raipur, Madhya Pradesh
Salem, Tamilnadu	Bulandshahr, Uttar Pradesh	Sagar, Madhya Pradesh
Madurai, Tamilnadu	Gauhati, Assam	Jabalpur, Madhya Pradesh
Jaipur Dairy, Rajasthan	Jaunpur, Uttar Pradesh	Aarey Dairy, Maharashtra
Pondicherry, Pondicherry	Mirzapur, Uttar Pradesh	Patiala, Punjab

The first column of Table 2 identifies the top ten unions rated according to market share. These seem to cluster in terms of medium size towns. One reason why the metro dairies do not appear in the list is that individually, they do not account for a large share of the market. The top unions in terms of growth in market share, as illustrated in the second column of Table 2, are an entirely different set of unions. Growth in market share, as a measure of performance, is expected to be biased in favor of the unions which have a low market share. It is interesting to note that the top ten unions based upon contribution margin, illustrated in the third column of Table 2, are different from those using the two other measures of performance. The results reported in Table 2 suggest that when different measures of performance are used to select organizations for detailed study of marketing effectiveness there could potentially be a minimal amount of overlap. The use of multiple measures of performance, while theoretically sound, often leads to a problem in identifying "good" performers.

Factors Related to Measures of Performance

The results of regression analysis comparing the relationship between each of the three facets of marketing effectiveness and the independent variables is discussed in this section. In the case of regional differences an ANOVA identified that there was no difference between unions in the three regional areas comprising the North, West and East regions of India. Therefore, one dummy variable is used to measure the effect of regional differences. One dummy variable is also used to reflect the effect of the age of the organization. Initial analysis revealed that significant differences were found when comparing the organizations that had been registered prior to 1981 and those that were registered after 1981.

The largest amount of variance is explained when market share is the dependent variable. The second regression, with growth in market share being the dependent variable, is the one where the smallest amount of variance is explained. A surprising finding is that in each of the three

regressions none of the factors which the union has control over (ie. the actionable factors) are statistically significant.

Table 3 reports the results of regression analysis. The market share regression indicates that unions in the south have a higher market share. In addition, older unions have a higher market share as compared with unions organized in the last decade. However, the contribution margin regression indicates that unions in the south experience a smaller contribution margin as compared with unions in the rest of India. The analysis also suggests that organizations whose primary function is marketing liquid milk experience a higher contribution margin.

Results of the DEA Analysis

DEA models use operations research techniques to compute which of these units lie on the frontier (i.e. the set of "efficient" units as contrasted with the "inefficient" units). For each of the units, a measure of efficiency is generated, which measures the distance to the frontier to represent the level of inefficiency. Details of the methodology can be found in a number of review articles (Charnes, Cooper and Rhodes, 1978; Epstein and Henderson, 1989; Seiford, 1990).

In order to resolve some of the problems in measuring performance, the DEA technique is used to compute the unions on the efficiency frontier. The results are summarized in Table 4. Six different models, which vary with respect to the combination of outputs and inputs used, are estimated. For each of the models, it is assumed that the unions are operating with variable returns to scale technology and estimation is in the output mode. Combinations of one, two or three outputs and one input are used in each of the six models. The three outputs are the three performance measures, market share, growth in market share and contribution margin as discussed above. Two different inputs, liquid milk processing capacity and a constant, are used in the models. Liquid milk processing capacity is used as a surrogate of size. The logic of using a constant value as an input variable is to discount size as a possible factor in the computation of the measure of efficiency.

Table 3
Summary of Regression Analysis on Factors
Related to Marketing Performance Measures

	Market Share	Growth in Market Share	Contribution Margin
Model Fit			
Adjusted Squared Multiple R	0.145	0.000	0.057
Standardized Coefficients: Uncontrollable Factors			
Regional variation (South = 1; Others=0)	0.382**	- 0.082	- 0.244**
Period when registered (<1981=1; Others=0)	0.258**	- 0.012	- 0.077
Primary function marketing (Marketing =0; Others=1)	0.147	0.001	- 0.221*
Standardized Coefficients: Actionable Factors			
Factor 1 Processing/Procurement	0.050	- 0.140	- 0.011
Factor 2 Marketing Variables	- 0.080	0.071	0.126
Factor 3 Organizational Factors	- 0.019	0.001	- 0.028
Average Price	- 0.053	0.050	N.A.

NOTE: * = $p < 0.05$; ** = $p < 0.01$

Table 4
Results of the DEA Analysis
Names of Unions on the Efficiency Frontier

Model Structure						
Output 1	MS	MS	MS	MS	MS	MS
Output 2	GRMS	GRMS			GRMS	GRMS
Output 3	CONTR	CONTR	CONTR	CONTR		
Input 1	LMCAP	CONST	LMCAP	CONST	LMCAP	CONST
Whether on the Efficiency Frontier						
Kota Rajasthan	Yes	Yes	Yes	Yes	Yes	Yes
Alwar D. Rajasthan	Yes	Yes	No	No	Yes	Yes
Sharanpur U.P.	Yes	No	No	No	Yes	No
GCMMF Gujarat	Yes	Yes	Yes	Yes	Yes	No
Bharuch Gujarat	Yes	No	Yes	No	No	No
Darjeeling W.B.	Yes	Yes	Yes	Yes	No	No
Gulbarga U. Karnataka	Yes	No	Yes	No	Yes	No

Note: Outputs are MS = Market Share; GRMS = Growth in Market Share and CONTR = Contribution Margin.
Inputs are LMCAP = Liquid Milk Processing Capacity; CONST = constant value.

An examination of Table 4 reveals that there are seven unions who appear on the efficiency frontier in some of the models. These seven unions vary widely in size and geographic location. Two unions, Sharanpur and Bharuch, appear on the efficiency frontier in only two models. Kota is the only union which appears on the efficiency frontier in all six models. The advantage of DEA analysis is that the unions are sorted into two sets, those on the efficiency frontier and those not on the efficiency frontier. The unions that are on the efficiency frontier, which is now a manageable number, can be studied in more detail to determine factors affecting good performance.

Factors Related to Measures of Efficiency

An additional regression analysis was carried out to further examine the relationship between the efficiency measures and the independent variables described earlier. These regressions were carried out using the efficiency scores assigned by the DEA analysis as the values of the dependent variables. The efficiency score equals one if the union is on the efficiency frontier. Those unions not on the efficiency frontier have efficiency scores with values greater than one. Table 5 reports the results of the regression analysis.

Over 40% of the variation in the efficiency scores is explained in each of the first two regressions where the dependent variables are first a combination of all three performance measures and secondly a combination of market share and contribution margin. In the third regression, where the dependent variable is a combination of market share and growth in market share, less than 10 percent of the variation in the efficiency scores is explained by the independent variables.

These results are consistent with the discussion earlier in this report where it was noted that there often exists a trade-off for organizations between the objectives of a high market share and a high growth rate of market share.

The regressions indicate that unions in the south have higher levels of marketing efficiency than unions in the rest of India. Unions with a larger liquid milk processing capacity are less

Table 5
Summary of Regression Analysis on Factors Related to
DEA Efficiency Measures

Total Output Measures of Efficiency (Omicron) Scaled by Procurement Levels

	MS+GRMS +CONTR	MS+ CONTR	MS+GRMS
Model Fit			
Adjusted Squared Multiple R	0.432	0.414	0.069
Standardized Coefficients: Uncontrollable Factors			
Regional variation (South = 1; Others=0)	- 0.190*	-0.254**	- 0.181
Period when registered (<1981=1; Others=0)	- 0.036	-0.035	0.003
Primary function marketing (Marketing =0; Others=1)	- 0.090	-0.048	- 0.093
Standardized Coefficients: Actionable Factors			
Factor 1 Processing/Procurement	0.310**	0.168*	0.277*
Factor 2 Marketing variables	0.083	0.008	-0.055
Factor 3 Organizational variables	- 0.133	- 0.140	- 0.033
Average Price	- 0.661**	- 0.680 **	- 0.022

NOTE: * = p < 0.05; ** = p < 0.01

efficient with respect to marketing activities as compared with unions who have a smaller processing capacity. Marketing efficiency scores increase with the average price the union charges.

CONCLUSIONS

This report has reviewed the dairy sector in India over the past 20 years and tried to determine which unions are more successful and why. The results of the milk cooperatives in India have generally been beneficial to both consumers and producers. This is confirmed in a review by the United Nations Interagency Mission which evaluated Operation Flood I and concluded that:

Operation Flood, the world's largest dairy development program, is distinguished by its involvement of small holders and landless rural milk producers. It is a successful example of effective use of food aid and of technical assistance for development. The program has significantly increased the incomes of a very large number of poor rural producers. It has also increased the availability of good quality milk at reasonable prices for city consumers (reported by Paul, 1983, p. 16).

Exploring reasons for the success of this marketing intervention are vital if we are to learn from this experience for development in other countries and with other commodities. Among the reasons cited for the success of these dairy cooperatives are the political and administrative support and length of tenure of the chief executive (Singh and Kelley, 1981; Paul, 1983). Dr. V. Kurien, who was formerly the general manager of the Kaira District Co-operative Milk Producers' Union Ltd. served as chairman of the NDDB from its inception and during the strong growth phase of Operation Flood I, II and III. While there is considerable evidence noting the strong leadership of Dr. Kurien there is no evidence that effective leadership was the sole factor in the success.

The difficulty with crediting leadership with the success of these projects is that one is unable to identify the underlying success factors and therefore unable to replicate the success in other areas. For this reason we have undertaken analysis at the individual union level to determine factors leading to success.

With a combination of regression and DEA analysis, efficient unions have been identified. The only union which appeared on all efficiency frontiers was the Kota, Rajasthan union. It would be useful to study Kota along with other successful unions in contrast to those unions which were far from the efficiency frontier. The results of this study suggest that at the individual union level a few factors contribute to its success.

Unions with a smaller liquid milk processing capacity are more efficient with respect to marketing activities than unions with a larger liquid milk processing capacity. Marketing efficiency appears greater when a higher average price is charged for the milk. This would of course be limited to the point where an increase in price deters demand. It is also noted that unions in the south have a higher degree of marketing efficiency than unions in the rest of India.

More study is required to shed further insight on these factors which have contributed to the success of the dairy cooperatives in India. In particular it will be important to quantify the effects of the explanatory variables of successful unions as opposed to unsuccessful unions. Other variables may be relevant to explaining the relationship between actions of the unions and their success in marketing. Finally, it would be very useful to draw together and quantify issues such as risk, marketing programs and land tenure, reflecting both the producers and consumers of milk since the inception of the dairy cooperatives in India .

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