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## IMPACT OF MODERNIZATION OF DAIRY INDUSTRY ON THE ECONOMY OF KAIRA DISTRICT

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By modernization we mean a change in the traditional methods in any or all of the processes involved in dairy industry which extends on one end to production of milk at the farm level and on the other end to sale of milk and milk products to consumers. One of the effects of modernization is the satisfaction of wants of consumers who are physically quite away from the producers.

In good old days of village economy in India, the distance between the producers and consumers was more or less governed by the area boundary of the village or a group of villages. This distance used to decline with the type of commodity. The more perishable the commodity the smaller was the distance between the producer and the consumer. Milk being a perishable commodity, the sale of whole milk and milk products such as curd and butter was restricted to the village or to a nearby village or town. Only less perishable milk products such as *mava* or ghee could be sold to consumers situated away from the producers.

### HISTORICAL ASPECTS OF MODERNIZATION

In Kaira district of Gujarat, modernization of milk business started in the last decade of the nineteenth century with the introduction of a cream separator in Anand. With the establishment of the Government Central Creamery in the camp area of Ahmedabad city, the demand for cream went up. Several cream separators came into existence in Anand, Mehmedabad and Nadiad. The impact of this movement was so much that the agents of dairies which collected milk for separating through cream separator came to be popularly known as "Sanchavalas." During this period only cream was exported and the separated milk was thrown away in the streets of villages. This whole period in the development of the dairy industry in Kaira district was aptly named as "Era of Waste" by Mr. Rieves who spent his life-time in dairying in the district.<sup>1</sup>

World War I gave a boost to the dairy industry in the district. Mr. Kolar, a German came to the district in 1911 and started the business of manufacturing casein from the separated milk. This brought an end to the Era of Waste. The casein manufacture gave a further boost to the dairy industry. Formerly only 400 cans (one can=30 litres) of cream were being exported. By 1914 about 1,000 cans of cream were exported.

In 1914, Mr. Rieves started a dairy in Nadiad. He manufactured ghee, butter, milk powder and milk sugar. Not only did he start the business of milk products, but he started the business of supply of pasteurized milk to Bombay. About two

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\* We are very much thankful to Shri G. S. Godbole, Dairy Development Commissioner, Maharashtra State for his valuable suggestions, which we have incorporated in our article.

1. Chandrakant Shah, "*Jillano Dudh Udyogno Prerak Itihas*" (History of Dairy Industry in the District) in Gujarati (1956).

wagon loads of pasteurized milk was exported daily to Bombay. By 1916-17, about 25,000 pounds of butter were manufactured per year.

After World War I, there was a big slump in the dairy industry. Prices of dairy products began to fall. Exports dwindled as the demand went down. Several creameries in the district were closed down. The period from 1922-29 was one of decline of dairy industry in the district.

The real modernization of dairy industry in an organized way started with the setting up of Polson Modern Dairy in 1930. In this paper we have tried to evaluate the impact of modernization of dairy industry from 1931 onwards.

Mr. Pestanji Polson invested Rs. 7 lakhs in putting up a modern dairy at Anand. In the year 1934 certain changes were made in the manufacturing process of butter and the vacuum pasteurizer was introduced. It was for the first time in the East that a vacuum pasteurizer was installed in a dairy plant.

It was after twenty years in 1955, the second large scale factory to handle and process milk in a modern way was set up under the co-operative sector by 'Amul'—a (Rs.) fifty lakhs dairy factory. The start of the co-operative endeavour to handle milk can be traced to the year 1946 when the farmers of the Kaira area organized themselves into the Kaira District Co-operative Milk Producers' Union Limited, and started supplying pasteurized milk to the city of Bombay 266 miles away, with the blessing of the late Sardar Vallabhbhai Patel. The Union started in a small way pasteurizing and despatching 500 litres of milk per day to the Bombay Milk Scheme. Soon they were confronted with a serious problem of surplus milk during winter season. This necessitated setting up a dairy plant to convert surplus milk into products. The "Amul" factory came into being with the assistance of UNICEF under the Colombo Plan. "Amul" started manufacturing milk powder, condensed milk and baby food. It is the first factory in the world which has prepared cheese from buffalo milk. The success of Amul has been so great that it has become the leader of the modern dairy industry in India.

#### IMPACT OF MODERNIZATION OF DAIRY INDUSTRY

We have tried to evaluate only that part of the impact which could be easily quantified by us. We have, therefore, not tried to quantify the impact which is either in intangible form or which is difficult to quantify. For example, it is well known in the district that a large section of milk producers who belonged to poor communities now gets a square meal a day which was not available before the organized dairy industry came into existence. There is a definite change in the clothings of the children of milk producers. The housing conditions have also changed. Many more *pucca* houses were built in the milk area after 1931 than before. Although it is difficult to attribute all these changes solely to dairy industry, it is certain that a large contribution is made by the dairy industry in bringing about these changes.

We have, however, evaluated the impact in two forms : (1) direct impact, and (2) indirect impact. The direct impact included the following items : (1) value added due to sale of milk and milk products through the organized

sector; (2) investments in dairy industry; and (3) direct employment created by the industry. The indirect impact includes: (1) creation of transport facilities; (2) impact on cattle feed and organization of cattle feed industry; (3) improvement of cattle; and (4) impact on crop production.

### *Direct Impact*

#### (a) Value added due to modernization (on current price basis)

Before the modernization of dairy industry took place, it was estimated that of the total production of milk in the district about 28 per cent was consumed as whole milk, 5 per cent was converted into *mava*, another 5 per cent was used for preparation of milk sweets whereas the rest 62 per cent was converted into ghee. Mehmedabad, Mahudha, Kapadvanj, Kathaval, Anklav, Nadiad and Balasinor were the important ghee centres. Of all the centres, Mehmedabad was most famous. It is reported that before 1945, about 32,40,000 pounds of ghee were annually exported from Mehmedabad alone.<sup>2</sup>

In order to estimate the value added by modernization of dairy industry in the district we have assumed that if modernization had not taken place, milk which was handled by the modern dairies would have been converted into ghee. It is also assumed that whey (*Chhas*) which was consumed by the family could not be sold within the village or outside and hence did not have market value and hence it is not evaluated. The value of the quantity of ghee was obtained by using the prevailing prices of ghee. We have worked out the value of milk products produced by the modern dairies by applying the prevailing prices of the milk products. This includes liquid milk processed by the modern dairies and sold within or outside the district. We have then compared these two sets of figures from the year 1933 onwards (Table I). The data were obtained from the Polson Modern Dairy

TABLE I—VALUE ADDED BY MODERNIZATION OF DAIRY INDUSTRY IN KAIRA DISTRICT

(Current Price Basis) (in thousand rupees)

Year	Value of ghee from equivalent quantity of milk sold to modern dairies	Value of products manufactured by modern dairies	Difference between columns 2 and 3	Percentage of col. 4 to col. 2
1	2	3	4	5
1933	2,71	6,33	3,62	134
1942	10,09	32,57	22,49	224
1951	43,18	72,96	29,78	67
1955	46,78	1,10,91	64,14	134
1956	44,00	1,08,71	64,71	147
1960	1,36,07	3,11,71	1,75,63	129
1961	1,67,14	3,76,29	2,09,15	125
1965	3,58,88	9,68,79	6,09,91	170

Source: Amul and Polsons Factories.

2. Chandrakant Shah, *ibid.*, p. 4.

and Amul Dairy. In relative terms the value of milk which would have been sold as ghee has been increased by more than double by modernization in most years from 1933 onwards. The relative advantage of modernization over traditional method was much pronounced in the first ten years, *i.e.*, 1933-1942. This helped in the rapid growth of modern dairy industry. After 1942 although the relative advantage had dropped, the pace of modernization went up as can be seen from the trend of the absolute value of products manufactured by modern dairies. The great boost in the modern dairying came after 1958, *i.e.*, after setting up the modern dairy plants by Amul. During the period of 32 years, the value of products manufactured by the modern dairies in Kaira district has increased 160 times (from a meagre amount of Rs. 6.33 lakhs to Rs. 968.79 lakhs). The modernization of dairy has contributed more than Rs. 6 crores in the year 1965-66 on the current price basis. As the trend indicates this will go on increasing. These phenomenal increase in the value of contribution of the modern dairies to the economy of Kaira district is due to two kinds of movements in the dairy industry : (1) substitution of new milk products such as butter, milk powder, baby food, cheese, etc., for traditional products such as ghee, and *mava*, and (2) increase in the productivity of milch animals.

Although we do not have exact data to show how much modernization of dairy industry has contributed to the improvement of milk productivity in the district, it is obvious that with the special efforts made by Amul for improvements in breeding by artificial insemination, in feed management by providing nutritious cattle feed and developing a special fodder programme, the productivity of milch animals must have improved; some indications are available to this effect, which we have discussed later.

In order to estimate the share of the total milk production in the district handled by the modern dairies, we used the average milk yield per animal obtained from the recent surveys conducted by Amul and the Agro-Economic Centre of Vallabh Vidyanagar and cattle census figures from different quinquennial census from 1950-51 onwards. We calculated the total milk production in the district from 1950-51 onwards. Table II shows the percentage of milk processed by modern dairies to total milk production in the district. It is a great tribute to the organizers of the modern dairies in the district that within a span of 15 years about 45 per cent of the total milk production was handled by them.

TABLE II—RELATIONSHIP OF MILK PROCESSED BY MODERN DAIRIES TO TOTAL MILK PRODUCTION

<i>(in thousand tonnes)</i>			
Year	Total buffalo milk produced in the district	Milk procured by the factories	Percentage coverage
1950-51	112	13	11.28
1954-55	116	18	15.14
1955-56	117	17	14.11
1959-60	135	30	22.45
1960-61	139	33	23.43
1964-65	158	71	45.06

Source: Polsons and Amul Factories.

We have tried to relate the contribution of modernization of dairying with the percentage coverage of milk production of the district from 1950-51 onwards as follows :

$$Y_1 = A + bx + Ct$$

where

$Y_1$  = contribution of dairy industry due to modernization at current prices,

$X$  = percentage coverage of milk production, and

$t$  = years.

The data are presented in Table III. The numerical value obtained by fitting the function was as follows :

$$Y = -125.7333 + 12.3683x + 2.8193 t.$$

TABLE III—RELATIONSHIP OF VALUE ADDED AND PERCENTAGE COVERAGE OF TOTAL MILK PRODUCTION AND TIME TREND

Year	Value added by modernization (in lakh rupees)			Percentage coverage (x)	Time (1957-58 origin) (t)	
	$Y_1$	$Y_2$	$Y_3$			
1950-51	..	18	18	19	11	-7
1951-52	..	30	27	30	12	-6
1952-53	..	42	42	42	15	-5
1953-54	..	50	48	47	13	-4
1954-55	..	47	41	46	15	-3
1955-56	..	64	50	64	14	-2
1956-57	..	65	53	69	16	-1
1957-58	..	56	58	76	21	0
1958-59	..	102	67	96	26	+1
1959-60	..	224	132	188	22	2
1960-61	..	176	118	153	23	3
1961-62	..	209	143	180	31	4
1962-63	..	330	217	284	41	5
1963-64	..	462	289	397	48	6
1964-65	..	605	376	444	45	7

$Y_1$  = Value added at current prices.

$Y_2$  = Value added deflated with weighted aggregative price index.

$Y_3$  = Value added deflated with cost of living index.

The value of explained variation ( $r^2$ ) was .87. The interpretation of this function is that the marginal increase in the value added due to modernization of dairy industry is nearly Rs. 12.37 lakhs with every one per cent increase in the coverage of total milk production in the district by the modern dairies. There is also an increasing trend with respect to time for the value added due to modernization. Over the base year of 1957-58, there has been an average increase of nearly Rs. 2.82 lakhs per year. For policy makers this relationship has a very important meaning. The greater the coverage of total milk production the greater is the value added to the Kaira economy by modern dairies. The extra expenditure incurred in getting additional one per cent of total milk production will be more than compensated by the additional income of Rs. 12.37 lakhs generated by the process of modernization.

#### Value added due to modernization (1952-53 price basis)

So far, we have estimated the contribution of dairy industry due to modernization evaluating both traditional products and modern products at current prices. This raises the question whether this difference was real or was partly due to the differences in the inflationary trends of prices. It is difficult to sort out this aspect. However, we have attempted to compare the data of both series of values : (a) value of traditional products and (b) value of modern products at 1952-53 price level basis. For this we have used two different types of indices.

#### 1. Weighted aggregative chain index<sup>3</sup>

This index method is used when the product basket is changing. In case of modern dairy products, many new products have been added over the years. We have taken 1952-53 as the base year. Taking the quantity of 1952-53 as weights, the index is worked on the following formula :

$$I_y = \frac{\sum P_y Q_0}{\sum P_0 Q_0} \quad \text{where } y = \text{year} \\ 0 = \text{base year.}$$

When the number of commodities included in  $Q_0$  changes the new weights are obtained by including the quantity of the new commodity and the aggregate value obtained by inclusion of this commodity is given the same index number as the index number arrived without this commodity on the old weights basis. Using this index number the index for the next year is constructed.<sup>4</sup> This index was used to deflate the value of the modern dairy products calculated at current prices.

In the traditional products as we had considered only ghee, we used the simple price index taking 1952-53 as the base year. The value of ghee calculated at current prices was deflated by using this index. By this deflation the overall difference (which we have termed as value added due to modernization of dairy industry) has reduced from about Rs. 6 crores to about Rs. 3.76 crores.

3. Croxton and Cowden : Applied General Statistics, Second Edition, 1958, Chapter 18.

4. The actual mechanics of constructing this index for the value of the modern dairy products has been worked out separately but is not included in this article.



We have tried to relate this difference from 1951 onwards with the percentage coverage (X) and the time (t) as we did in the case of value added calculated at current prices. The data of value added on this basis ( $Y_2$ ) are given in Table III. The regression equation was as follows :

$$Y_2 = -66.7 + 7.59 x + 1.4 t.$$

The interpretation of this equation is that with every one per cent increase in the coverage, the value added would be of the magnitude of Rs. 7.59 lakhs and with 1958 as basis the trend value would be Rs. 1.4 lakhs per year.

## 2. Cost of living index (Ahmedabad)

In order to compare the values of traditional products and modern dairy products on a common basis, we used the cost of living index of Ahmedabad city assuming that this would reflect the inflationary trends in prices of milk products. The cost of living index for the year 1952-53 was made as the basis (100) and the new index was constructed. The values of traditional and modern dairy products calculated at current prices were deflated by these indices. By this method the value added has reduced from Rs. 6 crores to Rs. 4.44 crores in the year 1964-65.

Fitting the functions as we did in earlier two cases, the regression equation was as follows :

$$Y_3 = -80.4 + 9.465 x + 2.978 t.$$

In this case, the contribution to value added by one per cent additional coverage of potential milk production by modern dairies works out to Rs. 9.46 lakhs and the trend value is Rs. 2.97 lakhs. The data of  $Y_3$  are given in Table III.

## (b) Investment in dairy industry

The modernization in dairying has not only increased the income but it has attracted investments in the dairy industry in the district. We have already noted that Mr. Pestanji invested Rs. 7 lakhs in 1934 in setting up the Polson Dairy. The Kaira District Co-operative Milk Producers' Union which has set up the Amul Dairy has been able to attract funds from the UNICEF, OXFARM, Government of New Zealand, Government of Gujarat and Government of India for investment. The total investments in the dairy industry in the district amounted to Rs. 134.35 lakhs upto 1964.<sup>5</sup>

The modernization of dairy has not only attracted capital from outside the district but also helped in the capital formation within the district. Milk pro-

5. The composition of investments is as follows : Rs. 7 lakhs for initial investment by Polsons' Dairy 'Vaccrator' (vacuum pasteurized added to Polsons) (1930-34); Rs. 35,000 for Amul's first pasteurizer (1949); Rs. 50 lakhs for new dairy factory for 'Amul' with the assistance of UNICEF and New Zealand Government (1955); Rs. 15 lakhs for the expansion of Amul's dairy factory to manufacture sweetened condensed milk (1958); Rs. 31 lakhs for the expansion of baby food cheese manufactured by 'Amul' (1961); and Rs. 31 lakhs for Amul's feed mixing plant (1964). Source: Polsons and Amul Factories.

ducers who own the Amul Dairy have been able to raise their own share capital. The participation of milk producers in the Kaira District Co-operative Milk Producers' Union has increased substantially. The number of societies affiliated to the Union increased from 8 in 1947-48 to 107 in 1955-56 and further to 518 in 1964-65. The number of farmer-members of the Union similarly increased from 432 to 22,828 and further to 85,000 during the corresponding period. The contribution of share capital by milk producers to the Union increased from Rs. 40,000 to Rs. 3.17 lakhs and further to Rs. 12.60 lakhs during the same period.<sup>6</sup>

(c) Direct employment created by the dairy industry

As there are only two factories in the dairy industry of the district their effect on employment is negligible. However, the number of workers employed by dairy industry has increased five-fold from 127 in 1956 to 625 in 1964.<sup>7</sup> The impact of dairy industry on employment is more due to its effect on transport, cattle feed, cattle improvement and productivity at the farm level.

*Indirect Impact*

(a) Creation of transport facilities

The impact of dairy industry on transport can be judged from the development of roads in the district. The road development work in the district is an indirect effect of the pressures generated by the dairy industry. Table IV gives the details of progress of road development work from 1958-59 to 1961-62. What kind of impact dairy industry has on road development can be easily seen from a compari-

TABLE IV—ROAD DEVELOPMENT IN KAIRA DISTRICT

Year	Metalled	Non-metalled	Total	Road per sq. mile
1958-59	483.62	393.37	877.49	0.33 miles
1959-60	513.57	385.08	899.25	0.34 „
1960-61	568.47	452.45	1,021.12	0.38 „
1961-62	635.70	428.74	1,064.44	0.40 „

Source: Gujarat Basic Statistics, Bureau of Economics and Statistics, Government of Gujarat.

son of two talukas, one with a large number and the other with a small number of milk societies. We have selected Borsad representing the former category and Balasinor for the latter category. The comparison of road miles shows that the taluka having a large number of milk societies had nearly 7 times better road facilities (Table V).

6. Source: Amul Dairy.

7. Source: Bureau of Economics and Statistics, Government of Gujarat.

TABLE V—COMPARISON OF ROAD DEVELOPMENT IN DAIRY AND NON-DAIRY TALUKAS OF KAIRA DISTRICT

Year		Metalled	Non-metalled	Total	Road per sq. mile
1958-59	Borsad .. .. .	3.26	57.50	60.76	0.28 miles
	Balasinor .. .. .	3.49	4.96	8.45	0.03 „
1961-62	Borsad .. .. .	4.00	60.00	64.00	0.30 „
	Balasinor .. .. .	4.49	4.96	9.45	0.04 „

*Note* : Number of Milk Societies operating : Borsad 85 Balasinor 17

*Source* : Gujarat Basic Statistics, Bureau of Economics and Statistics, Government of Gujarat.

Apart from the road development, the modern dairy industry has an impact on transport vehicles. As the collection of milk progresses year by year more milk routes are opened covering large milk areas. Table VI gives the details of this progress from 1962-63 onwards. During the last four years the number of milk routes and the trucks plying on them for collection of milk have almost doubled. The number of miles covered has also more than doubled. The number of villages covered by the milk routes increased from 316 in 1962-63 to 568 in 1965-66.

TABLE VI—TRANSPORT ROUTES AND TRUCKS USED IN MILK TRADE

Year	Number of routes (milk collection)	Number of trucks used	Miles covered	Villages covered	Total number of trucks in the district	Percentage of trucks in milk business
1962-63	34	34	2,947	316	1,600	2.2
1963-64	36	36	3,494	453	1,710	2.1
1964-65	52	52	5,506	482	1,850	2.8
1965-66	60	60	6,329	568	2,736	2.2

*Source*: Amul and Polsons Dairies.

#### (b) Impact on cattle feed

Although Kaira is a milk producing area, the most surprising thing is that it neither produces adequate green fodder nor does it produce raw materials for cattle feed. It is the enterprising nature of the farmers which is responsible for developing the dairy industry in the district. The traditional feeds which milk producers use are cotton seed, groundnut cake, pulse proteins, rice bran and *kodara* husk. None of these products are produced in adequate quantities re-

quired for milk production in the district. We have tried to estimate only the requirement of cotton seed by the milk producers for supplying milk to the modern dairies. This requirement is then compared with the production of cotton seed in the district (Table VII). It is clear that even to satisfy the needs of milk producers supplying milk to modern dairies about 30,000 tonnes of cotton seed are required to be imported from outside the district. If this quantity is evaluated at Rs. 500 per tonne, the amount contributed by the modernized dairy sector of the district by way of purchase of cotton seed alone amounts to Rs. 1.5 crores annually.

TABLE VII—COTTON SEED REQUIREMENT OF MILK SOLD TO MODERN DAIRIES  
IN KAIRA DISTRICT

Year	<i>(in tonnes)</i>							
	Milk pro- cured by the fac- tories	Cotton seed requirement for milk supply to modern dairies	Total cotton seed pro- duction in the district	Cotton seed available as cattle feed	Estimated quantity o cotton seed imported from outside the district			
1955-56 .. .. .	16,563	8,200	7,600	6,100	2,100			
1959-60 .. .. .	30,323	15,000	7,500	6,000	9,000			
1960-61 .. .. .	32,693	16,400	6,500	5,200	11,200			
1964-65 .. .. .	71,065	35,500	7,600	6,100	29,400			

The Kaira District Co-operative Milk Producers' Union Limited realized that the milk producers had to spend substantial amount for the purchase of cotton seed and other cattle feeds. The price which the milk producers have to pay for cotton seeds and other products varies from Rs. 600 to Rs. 700 per tonne. In order that the milk producers could purchase more quantity of cattle feed at a cheaper rate, the Union decided to start a modern cattle feed factory. In the year 1964, a cattle feed factory was started at Kanjari with the investment of Rs. 31 lakhs. The annual capacity of the factory is 60,000 tonnes. During the year 1965-66, the factory sold 16,000 tonnes of cattle feed at the average price of Rs. 450 per tonne. This has saved the milk producers an amount of Rs. 150 per tonne. On an aggregate an amount of Rs. 24 lakhs is saved. When the factory reaches its full production capacity, an amount of Rs. 90 lakhs to Rs. 1 crore will be saved.

(c) Improvement of cattle

The modernization of dairy has helped the district not only in monetary terms but it has significantly contributed in the improvement of cattle wealth. The managers of Amul Dairy have paid serious attention to the problems of cattle health. Table VIII gives the details of progress of veterinary work undertaken by the Kaira District Co-operative Milk Producers' Union Limited, Anand. The number of cattle receiving veterinary aid increased from 7,836 in 1956-57 to 81,879 in 1965-66.

TABLE VIII—PROGRESS OF VETERINARY WORK IN THE KAIRA DISTRICT CO-OPERATIVE MILK PRODUCERS' UNION LIMITED, ANAND

Year	Number of village societies	Number of mobile veterinary dispensaries	Cases treated by first aid veterinary workers in villages	Cases treated by veterinary officers of mobile veterinary dispensaries	Number of special visits (emergency calls)	Total
1956-57	.. 107	2	—	7,816	20	7,836
1960-61	.. 195	4	—	16,874	421	17,295
1961-62	.. 219	4	10,829	18,811	907	30,547
1965-66	.. 518	7	44,000	31,777	6,102	81,879
Total for the period 1956-57 to 1965-66			1,58,551	1,84,124	1,71,72	3,59,847

*Source:* Kaira District Co-operative Milk Producers' Union Limited, Anand.

The improvement of cattle is planned not only through the improvement of cattle health but also through a systematic breeding programme. The Union introduced artificial insemination programme with a small starting of 578 animals being inseminated in the year 1950-51. By 1965-66 about 42,000 animals were inseminated. During the same period, the number of artificial insemination centres increased from 5 to 261. The number of pregnancy cases diagnosed increased from 50 to 28,718 and the number of cases treated for infertility increased from 45 to 85 during the same period; in 1963-64, as many as 683 cases were treated for infertility. During the period 1950-51 to 1965-66, a total number of 1,77,452 animals were inseminated, 1,14,784 pregnancy cases were diagnosed and 3,013 animals were treated for invertility.<sup>8</sup> It is difficult to evaluate the contribution of this programme in monetary terms. Although no systematic survey is conducted to find out the impact of all these efforts on the productivity of the milch animals, the figures obtained from the 1961 census<sup>9</sup> of 199 villages carried out by 'Amul' show that these efforts have increased the daily milk yield per animal from 6.31 lbs. in case of non-members to 7.21 lbs. in the case of members. The overall daily milk yield per animal was 6.81 lbs.

#### (d) Impact on crop production

Contrary to normal expectation, the modernization of dairy industry has not created any visible impact on the cropping pattern of the district. Normally we should expect a shift towards fodder crops because of the progress of dairy industry in the district. On the contrary, we find that the area under fodder crops has declined. Milk producers use bye-products of cereals and pulses for fodder such as bajra stalks, rice straw and *tur* leaves. One would expect that the area under cereals and pulses would increase with the increase in milk production in

8. *Source:* Kaira District Co-operative Milk Producers' Union Ltd., Anand.

9. The Kaira District Co-operative Milk Producers' Union Ltd., Anand (Amul) carried out a cattle census of 199 societies and 44,736 members between 14-3-1961 and 15-4-1961. An abstract of cattle census is available for reference.

the district. This has also not happened. On the contrary, the area under cereals and pulses has actually declined. This means that at the farm level, milk production is a complementary business which does not compete with the activity of crop production and also increases farm income. At the farm level, cash crops (tobacco, cotton, groundnut) are competitive to cereals and pulses. The overall effect of this competition can be seen in the aggregate data of the areas (a) under cereals and pulses and (b) under cash crops at the district level. The former is declining whereas the latter is increasing (Table IX).

TABLE IX—AREA UNDER CROPS IN KAIRA DISTRICT

*(in hundred acres)*

Year	Area under crops		
	Cereals and pulses	Fodder	Cash crops
1949-50	8,84,9	1,68,5	2,28,3
1950-51	8,40,8	1,94,1	3,12,3
1951-52	7,88,9	1,66,7	2,65,5
1952-53	8,86,5	1,49,7	2,87,3
1953-54	9,24,7	1,25,8	2,94,7
1954-55	8,67,2	1,31,0	3,59,6
1955-56	7,98,7	1,52,5	3,90,8
1956-57	8,15,0	1,35,0	4,07,2
1957-58	7,73,3	1,26,8	4,06,5
1958-59	7,98,4	1,25,6	4,13,7
1959-60	7,80,7	1,41,3	4,35,9
1960-61	7,15,7	1,27,5	4,78,1
1961-62	7,72,0	1,08,1	4,55,5
1962-63	8,00,3	96,7	4,61,7
1963-64	7,95,0	1,02,3	5,21,2

Source: Department of Agriculture, Gujarat State.

The comparison of the relationships between (a) area under cereals and pulses and (b) area under fodder crops with the number of breeding buffaloes in the better milk and lesser milk area of the district confirms our observation that milk business in Kaira district has not changed the cropping pattern. Instead of more land resource being utilized for milk production in the better milk area, actually less land resource in terms of (a) area under cereals and pulses and (b) area under fodder crops per breeding buffalo is being utilized than in the lesser milk area (Table X).

TABLE X—COMPARISON OF RELATIONSHIPS OF AREA UNDER FEED AND FODDER CROPS WITH BREEDING BUFFALOES IN BETTER MILK AND LESSER MILK AREA OF KAIRA DISTRICT

Year	Total Number of breeding buffaloes (in '000)	Total area under cereals and pulses (in '000 acres)	Total area under fodder crops (in '000 acres)	Ratio between	
				area under cereals to number of breeding buffaloes (acres/bree- ding buf- falo)	area under fodder to number of breeding buffaloes (acres/bree- ding buf- falo)
<b>Better milk area of the district</b>					
1956	155	386	79	2.5	0.51
1961	155	391	52	2.5	0.34
1966	157	391	52	2.5	0.34
<b>Lesser milk area of the district</b>					
1956	89	429	57	4.9	0.64
1961	89	379	58	4.2	0.65
1966	95	379	58	4.0	0.60

*Note:* The better milk area is covered by Anand, Borsad, Nadiad, Mehmedabad and Petlad talukas.

The lesser milk area is covered by Balasinor, Cambay, Kapadvanj, Matar and Thasra talukas.

#### SUMMARY AND CONCLUSIONS

The story of modernization of dairy industry in Kaira district in Gujarat is of a short period of only 35 years. The real momentum in modernization has come only in the last decade with the efforts of the Kaira District Co-operative Milk Producers' Union Limited. This has helped the economy of the district in terms of a cash flow of about Rs. 9 crores per year at current prices. It has helped in increasing the cash flow by about Rs. 6 crores per year over the traditional methods of handling milk and milk products. In terms of deflated value at 1952-53 prices the value added worked out to Rs. 3.76 crores—Rs. 4.44 crores. The increase in the market share of the modern dairies in the potential milk production would increase the contribution in terms of value added considerably. It has been shown that with every one per cent increase in the coverage of the potential milk production by the modern dairies, the value added would increase by about Rs. 7.59 lakhs even if it is valued at 1952-53 prices.

The modernization of dairy industry has attracted investment of about Rs. 134 lakhs in the district. Although it has not created any visible impact on direct employment in dairying, the indirect impact on employment due to increase in transport facilities, and the impact on dairy machinery and equipment industry, cattle feed industry and greater utilization of available family labour at the farm level remain to be measured.

Contrary to what one would expect, the dairy industry has not changed the cropping pattern in the district. Between the alternatives of buying or producing cattle feed materials at the farm level, the milk producers have preferred to buy cattle feed. The modernized sector of the dairy industry has helped them in this activity by providing a cheap and more nutritious cattle feed. It has been estimated that the requirement of cotton seed alone for milk supplied to modern dairies would be around 35,500 tonnes. The available cotton seed within the district being only 6,100 tonnes, the rest 29,400 tonnes are required to be imported. This will create a cash outflow of Rs. 1.5 crores per year from the district.

What strikes most while studying the impact of modernization of dairy industry is that although no special attempts are made by the milk producers to use their farm resources in the production of fodder and feed which are most essential for milk production, the district has become one of the best dairy districts in India. This speaks volumes for the entrepreneurial nature of milk producers in making the best use of the available family labour in milk production with the help of purchased inputs of cattle feed. It is a great tribute to the talents of the managers of the organized dairy sector that they are able to channelize the entrepreneurial ability of milk producers in a proper way and develop dairy industry in a manner unparalleled in India.