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ENVIRONMENTAL AND STRUCTURAL
CHARACTERISTICS OF THE DAIRY SUBSECTOR

by

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The raw material supply in the dairy subsector is characterized by a high degree of product perishability and a long biological cycle. Because of the perceived importance of dairy products to consumers, government involvement and regulation is pervasive within the subsector, especially in sanitary and environmental regulations and price and income policies. The influence of producer cooperatives is extremely important. Dairy plants are decreasing in number and increasing in size in recent years, and the markets for butter and cheese tend to be dominated by few large manufacturing, assembling, and marketing firms with well established brand franchises. Producer cooperatives have integrated into dairy manufacturing, while large retail chains have integrated backward into dairy processing, primarily fluid milk processing.

Environmental Characteristics

There are two primary environmental characteristics that play an important role in the dairy subsector. Milk production is essentially a continual process once the cow begins lactation, but the time lag between the birth of a heifer calf and that heifer beginning milk production is usually 2-1/2 years. Thus, there is a significant biological lag which influences milk supply responses. Milk production tends to fluctuate in a 3 to 4 year cycle, in response to net returns to the dairy enterprise, which in turn are heavily influenced by the prices for milk and dairy products and the price and availability of roughage

and feed grains (which in turn are quite susceptible to weather adversities). Milk production also varies seasonally in response to the availability of feed and the effect of seasonal temperature variations.

Another important environmental characteristic of the dairy subsector is the pervasive influence of government regulations throughout the subsector. The importance that the general public places on a safe, regular, and ample supply of milk has led to a significant involvement of the political system into many facets of the dairy subsector at the local, state, and federal levels, affecting sanitation standards, supply, price regulations, industry structure and behavior.

Product Characteristics

Fluid milk is one of the most perishable food products. This perishability has a very profound effect on the economics of farm production and on every stage of processing and marketing thereafter, as very stringent product specifications and inspections must be satisfied throughout the distribution system.

Because fluid milk is very bulky and perishable, the high relative cost of transportation has caused many regional markets for fluid milk to develop, with limited milk movement among regional markets. Manufactured dairy products are less bulky and perishable, and are typically distributed in a national market.

At the consumer level, fluid milk used to be differentiated by the services provided when home delivery was the dominant marketing method. In recent years, fluid milk products have been modestly differentiated primarily by packaging differences, especially new types of containers, and the extensive use of retailer private labels and manufacturers' own brands. Within manufactured milk products, there is significant product differentiation (for example, the types and varieties of cheeses produced

from milk, variety and flavors of ice creams, yogurt cultures and flavorings available, etc.). Yet, only a few strong dairy manufacturing firms appear to have significantly differentiated their products (e.g. Kraft in cheese, Land O' Lakes in butter, Dannon in yogurt, etc.).

SUBSECTOR ORGANIZATION

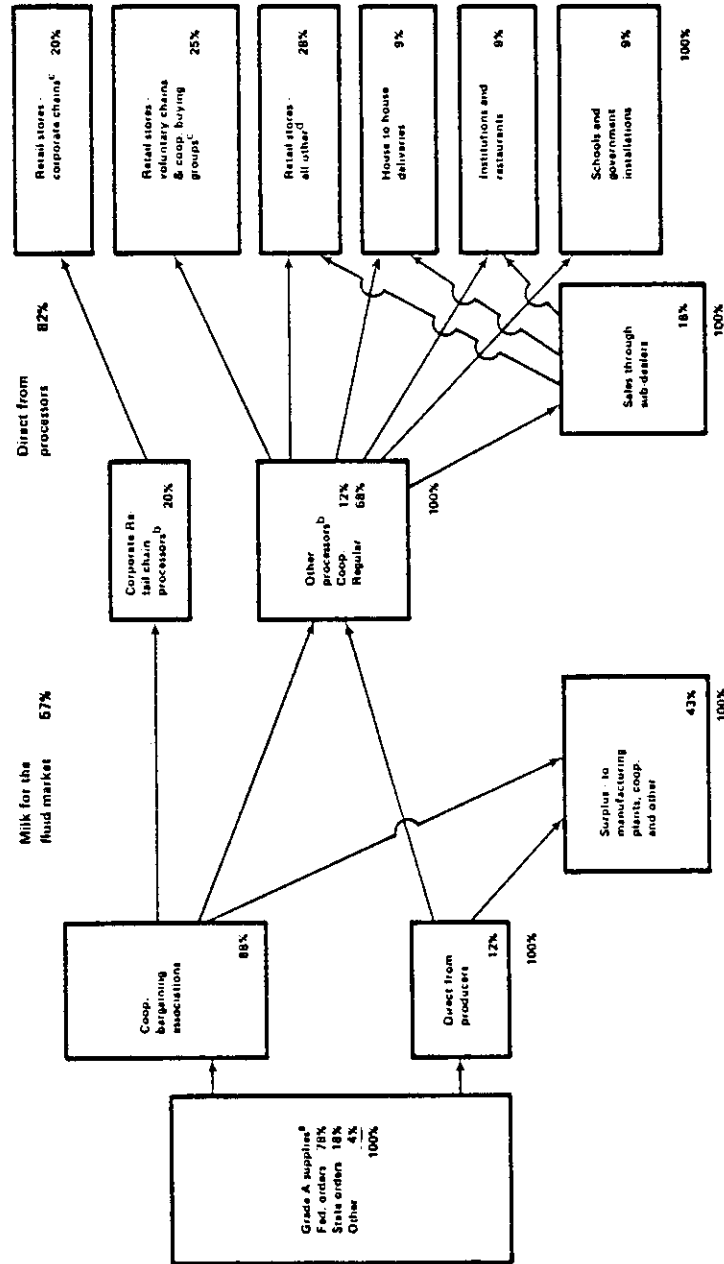
Figures 1 through 4 are simplified flow charts for the main stages and channels in the dairy subsector.^{1/} Figure 1 shows the general flow of Grade A milk (inspected for drinking) as it is processed into fluid milk items and moved to consumers. The other charts show the channels for the principal manufactured (hard) products which are butter, nonfat dry milk, and American cheese. Vertical integration in fluid milk is most significant (a) between farmers and their cooperatives in bargaining, performing service functions to processors, and in their manufacturing, and (b) between corporate food chains and their processing facilities. In cheese, butter, and powder there is much vertical integration on the part of co-ops and private concerns in manufacturing, assembly, and the various intermediate functions such as packaging, branding and physical distribution.

Market Concentration in the Dairy Subsector

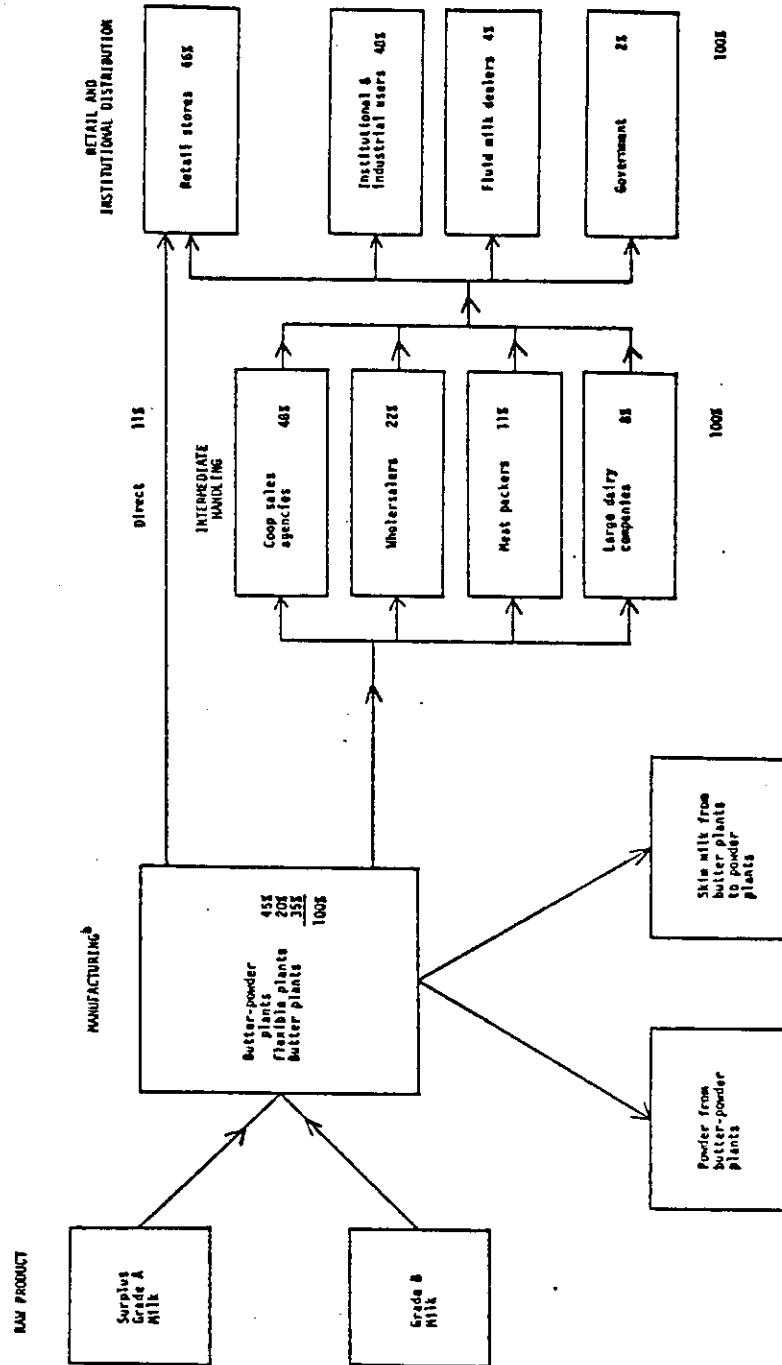
Although milk is produced in all regions of the country, an increasingly large proportion of milk is produced in the northeast, the Lake States, and California. The structure of dairy farms can be characterized as a large number of small, atomistically competitive producers. Most dairy farms have 30 to 100 cows, and have become larger and more specialized over time.

^{1/} Cook, Blakley et al.

Figure 1. Flow Chart for Grade A Milk from Farmer Producers through Bargaining Associations and Processors to Retailers or End Users.



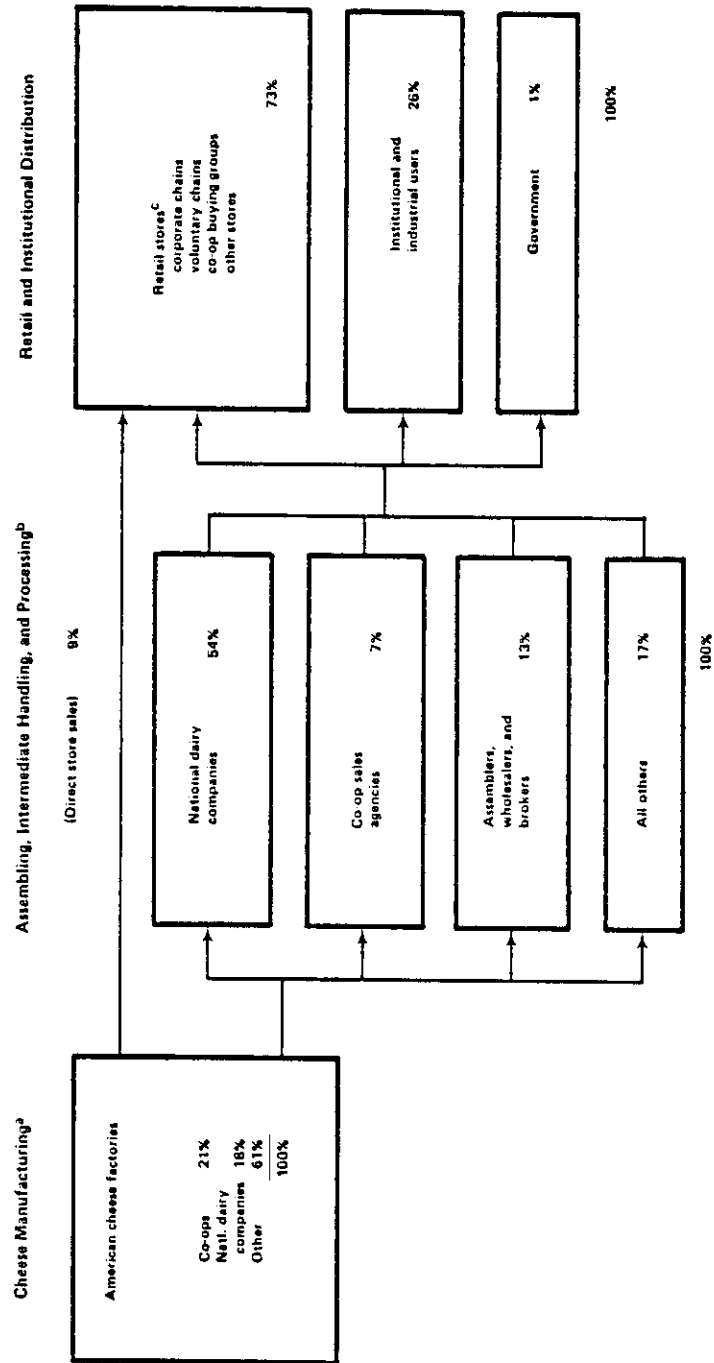
- a 80% of U.S. supply.
 b Four largest of all processors had 18.8% of fluid milk shipments in 1972. Fifth through eighth had 8.5%.
 c Largely private label.
 d Convenience stores, dairy stores, vending machines, independent supermarkets, etc.

FIGURE 2. PRODUCT FLOW OF CREAMERY BUTTER^a

^a Most data are estimates from earlier studies, adjusted for apparent trends.

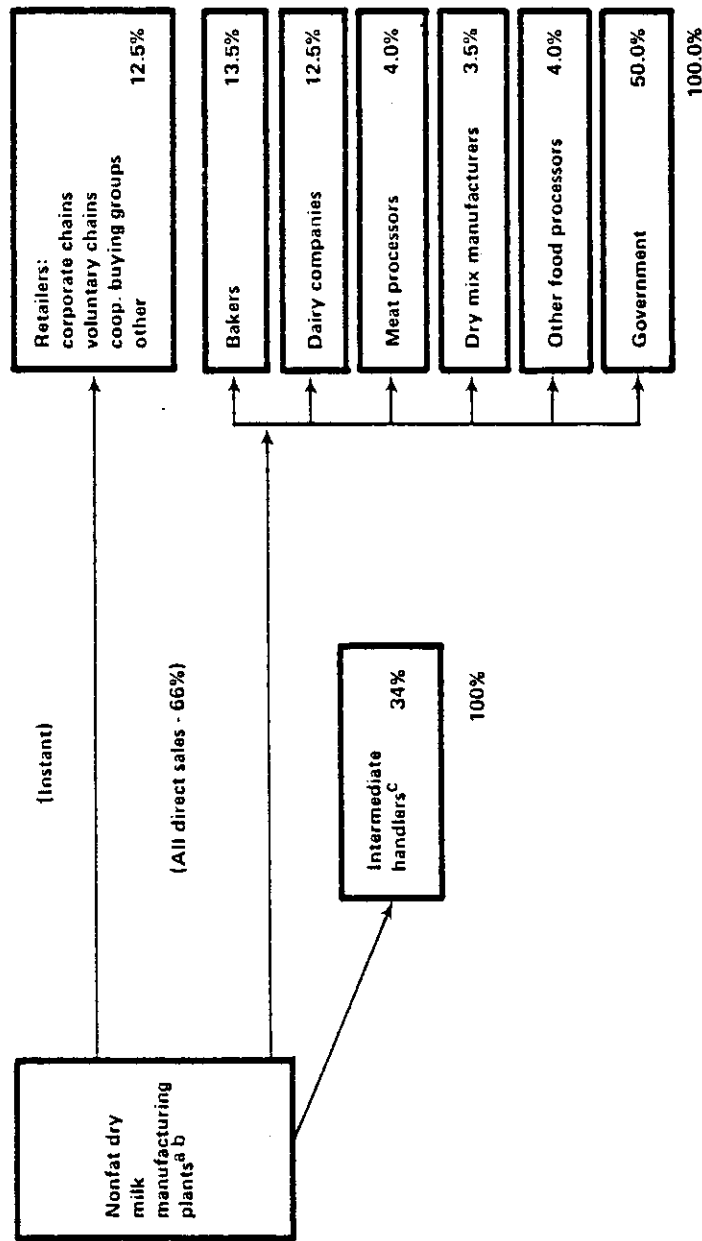
^b Four largest manufacturers had 465 of all butter shipments in 1972. Fifth through eighth had 135.

Figure 3. Product Flow for American Cheese



- a Four largest manufacturers had 42% of all cheese shipments in 1972. Fifth through eighth had 11% of all cheese shipments.
- b Four largest processors had 60% of shipments in 1972. Fifth through eighth had 14%.
- c A large percent is private labeled, probably 35%.

Figure 4. Product Flow for Nonfat Dry Milk (Including Instant)



^a Skim milk supplies may be either Grade A or Grade B, and are received chiefly from butter factories or flexible operations.

^b Four largest manufacturers had 45% of shipments in 1972. Fifth through eighth had 14%.

^c Land O'Lakes, Sugar Creek Foods, Weldon Farm Products, etc.

In the last two decades, producer bargaining cooperatives have become dominant influences in the dairy subsector. In approximately two-thirds of the federal order milk markets in the United States, the largest cooperative now has two-thirds or more of the producers as members. That number is enough to approve or disapprove a Federal marketing order in a producer referendum.

The number of first handlers and processors of fluid milk exhibited a significant decline during the above time period, while their processing capacity increased. While the share of national fluid milk sales by the four largest dairy processors in 1972 was only 17%, Manchester estimated that the average market share of the four largest firms was 46.9% in 1970 in the smaller relevant geographic markets in which fluid milk plants can effectively compete, (approximately 250 miles distant from each major metropolitan area).

Concentration in butter and cheese manufacturing is moderate with the largest four companies manufacturing 45 and 42 percent of these products, respectively, in 1972. However, concentration is much higher at the intermediate handling stage for both of these products. At this stage, companies such as Kraft (which manufactures some cheese) buy cheese from other manufacturers, transform natural cheese into processed cheese products, and cut, package and distribute both natural and processed cheese. Kraft is estimated to market about 50 percent of the cheese in the United States (Hayenga, p. 8).

Similarly in butter, Land O'Lakes buys butter from other manufacturers as well as making some themselves, and cuts, packages and distributes butter at the intermediate handling stage. Land O'Lakes is estimated to control over two-thirds of the butter that moves through retail channels in the U.S.

Thus, with both butter and cheese, the concentration of sales at the intermediate handling level is very high with one strong company/brand being the dominant factor for each product. The relevant geographic market for butter, cheese and other manufactured products is national.

Product Differentiation and Entry Conditions

The capital barriers to entry in most areas of the dairy subsector are not high. The investment required to get into manufacturing of cheese or butter-powder or the processing of milk with a medium level of technology would be only 2 million dollars or so. However, the future outlook for such plants is not attractive due to the decline in the markets served by many of these plants and/or the competitive advantages of larger plants with more advanced technology. Entry that will be viable in the long run would require a much larger investment.

The dominant market for processing and distributing packaged milk, ice cream and other fluid products is and will likely continue to be supermarket accounts. Most supermarkets are organized into chains, either corporate, voluntary or cooperative. They often prefer to do business with a processor large enough to supply their supermarket units over a wide area. They demand a private label and expect the processors' brand itself to be well advertised. A plant serving supermarket chains would need one or more blo-mold machines, adequate paper packaging equipment, and probably should be prepared to supply at least 15 to 20 million pounds of product per month. The costs of acquiring or developing the sales accounts and costs of differentiating the products by advertising (supported by rigorous quality control) could be high -- perhaps on the order of 10 to 50 million dollars.

American cheese and butter-powder can be sold to the government in unlimited quantities under the price support program. Prices were especially good between October 1977 and April 1981 when prices were guaranteed at 80% of parity. However, plants faced heavy competitive pressures on farm pay prices with premiums paid by American cheese factories as much as 45 cents above the Minnesota-Wisconsin price series. Companies responded by rapidly adopting advanced technology to reduce costs, especially the labor component. The advanced technology (such as the continuous butter churn, the 35,000 pound cheese vat, the 45,000 pound enclosed vat, the automatic cheddaring equipment, fully mechanized stirred curd handling for barrel cheese) called for greatly increased quantities of milk and large plant investments.

The profitability of selling cheese and butter-powder to the government has declined with the drop in government support levels. Future opportunities for cheese manufacturers appear to lie in:

- (a) manufacturing to the specifications of an intermediate handler such as Kraft or Armour.
- (b) manufacturing private label for supermarket accounts.
- (c) integrating into intermediate handling and building a brand name.

An intermediate handler who contracts for a large part of a plant's output often will have quality and volume requirements that require substantial investments. The demands of the supermarket accounts may be similar to their demands on the processor of the fluid line. To integrate into intermediate handling, a plant probably should be fully automated and equipped to make processed cheese, cheese foods, and spreads. It should have slicing and packaging equipment and storage capacity. However, the cost of plant would be far less than the cost of building a

brand name which could run to tens of millions of dollars per year.

The manufacturers of Swiss and Italian cheeses have other alternatives but do not have the choice of selling to the government. Until recently, both types have tended to pay more for milk than American cheese manufacturers. This was especially true of Italian cheese manufacturers who profited from the growth of the pizza market. But this has changed in recent years. Imitation mozzarella (which is said to have a manufacturing cost, including milk, of about half the natural product) is offering a grave threat to mozzarella manufacturers. Imported Swiss cheese from some countries in 1981 is being offered for 25 cents a pound under domestic Swiss. Most Wisconsin Swiss factories have closed in recent years and there is virtually no entry. Swiss factories also are disadvantaged in a period of high interest rates by the cost of holding inventory for the required 60 days. Some Italian and Swiss cheese factories have converted to American cheese manufacturing to gain access to government purchases. Most of the manufacturing capacity for these cheeses is highly automated.

For a butter-powder operation the future opportunities are similar to those for American cheese. However, the demand for both butter and powder is low and a much larger percent of the total output is sold to the government than is true for cheese. Both products are chiefly manufactured by large plants, mostly cooperative, and sold through co-op sales agencies. About half the powder finds its way to industrial users, with only about 20% going to housewives through the retail stores. Approximately one-third of the latter sales are private label.

A viable butter-powder operation should be equipped with the advance technology of one or more large continuous churns with soft printers after the churn. This processing equipment is said to make and print butter for 1/3 to 1/4 of the cost of batch churns, when there is an adequate

supply of cream. Plants so equipped probably would require around a billion pounds of milk annually, and the cost of building up such a supply under competitive conditions could be very high. Three or four large drying plants would be needed for the skim milk byproduct.

As with cheese, entry is clearly easiest into the private label market or via contracts with large intermediate handlers. Building a brand name and developing a sales organization to service the individual supermarkets over a wide territory in the way that is done by Land-O-Lakes would require very large investments.

In summary, product differentiation results from a program of substantial advertising over a long period of time. But this advertising must be supported by high quality products with innovation in containers, flavors, butterfat and other solids content; by service; by volumes adequate to supply large accounts; and by production technology to achieve competitive costs. Thus, the barriers to entry into markets dominated by such firms as Kraft, Borden, Land O'Lakes, and Kroger can be high relative to the height of barriers in other food businesses. There is a significant amount of market power lodged with a few dominant marketing firms in the manufactured dairy products marketing system, while large producer cooperatives and large volume retail chains have the greatest market power in the fluid milk marketing system.

Although concentration in the manufactured dairy products markets is pronounced, the largest national dairy marketing firms are quite diversified outside of dairy, much more than was true two decades earlier. Most of the eight largest dairy marketing firms now have less than one-half of their sales accounted for by dairy products and some have less than one-third. At least in part, this is due to restrictions on dairy processing

mergers in the 1960s and the low profitability in some dairy processing operations relative to alternative lines of business. Thus, many dairy processing firms chose to expand via diversification into other product lines or businesses.

VERTICAL COORDINATION SYSTEMS AND THE DAIRY SUBSECTOR

To market effectively a highly perishable product like milk, the establishment of formal vertical linkages between various levels of the marketing system has been necessary. Enduring vertical linkages in the milk industry have been established through cooperative membership agreements, full supply contracts between cooperatives and processors, and vertical integration into milk and dairy product processing by retail chains and producer cooperatives. In addition, the government price support program and the Federal market order program for milk play an important role in coordinating the marketing process in the dairy subsector.

The coordination task in dairy is made easier by the multiple uses of milk--some of which are storeable. Hence, compared to beef or broilers, temporal coordination of supply and demand is easier to accomplish without large price changes. In beef or broilers, a marketing order system such as in dairy would be much less effective because of the relative lack of manufactured product options for surpluses. Manufactured dairy products act as a cushion to balance fluid milk supply and demand.

Contractural Linkages

Contracts in the dairy industry are extensive, although many are verbal. Supply contracts exist at four primary levels in the dairy subsector:

- (1) Most dairy bargaining cooperatives have a written contract with the producer, usually requiring the producer to deliver his entire milk production to processors designated by the cooperative. The length of these is normally short and they can be readily renegotiated but they are required by law for producers to be eligible to vote under federal market order provisions.
- (2) Contracts between cooperatives and processors establish the proportion of processor milk needs that will be supplied by the cooperative. These contracts normally extend over a year, and have been the subject of considerable debate and litigation (since some persons argue that they potentially foreclose the independent producer from the market).
- (3) Contracts or agreements frequently exist between manufacturers, including cooperatives, and major distributors of manufactured dairy products. Such contracts generally call for independent manufacturing plants to deliver all of their production to the marketing firm. Typically the prices for butter and cheese delivered under those contracts are established under a "formula pricing" arrangement relating to the National Cheese Exchange price or the Chicago Mercantile Exchange butter price.
- (4) Supply contracts have become prevalent between fluid milk processors and retailers of fluid milk who require an assured supply of fluid milk to be packaged under their private label.
- (5) In addition to formal contracts, there are accepted pricing systems which will determine the settlement price for a

product shipment unless otherwise specified. For example, a bulk condensed skim milk sale will be priced at the Chicago powder price for the solids test, multiplied by a standard price adjustment. Similarly, payment formulas for 40% Grade B cream for ice cream, butter and powder are often used for settlement. There are many "understood" pricing systems that aren't formally in a contract or even discussed frequently, just standard operating procedure between long term buyers and suppliers.

- (6) An important feature of the dairy system is the extensive public information available, with unusual variety and accuracy which is virtually unsurpassed in any other commodity market. These include federal-state statistical reports, federal and state market order data, market reports from cheese and butter exchanges, BLS price data, and other market news and reports.

Government Price Support Program

Two basic government programs provide the coordination required for orderly marketing in the dairy industry, the price support program and the federal marketing order program. The price support program provides an underpinning for all dairy prices by supporting the price for manufacturing milk and the purchase prices for butter, nonfat dry milk, and cheese. When milk production is larger than the aggregate quantity demanded at prevailing prices, the excess supplies can be manufactured into one of the products with support prices, and ownership is transferred to the government. Alternatively, when production is smaller than the aggregate quantity demanded, supplies can be purchased from government stocks when there are any on hand, to dampen

price increases on butter, nonfat dry milk or cheese (indirectly affecting other products as well). Import control legislation, which restricts dairy product imports, is a related government program helping to insulate the domestic price support system from foreign supply-demand imbalances.

Marketing Order Programs

The second major government program influencing coordination in the dairy subsector is the Federal Milk Marketing Order Program. The dairy industry faces a relatively inelastic demand for fluid milk and a more elastic demand for manufactured products: thus, a classified pricing system can enhance total revenues for producers (Babb and Bohall).

Milk marketing orders stratify the prices that processors are required to pay producers depending on the use they make of the milk purchased. The price for fluid milk use is based upon the price for manufactured grade milk plus a fixed differential established through a hearing and referendum procedure. While producers are not regulated per se, the marketing orders prescribe rules for regulated processors. The ultimate price received by the producer is directly affected by the rules for distributing among producers proceeds from the sale of milk.

Approximately 80% of the fluid Grade A milk produced in the United States is now priced administratively under one of forty-seven federal milk marketing orders existing in 1979. Producer cooperatives are responsible for marketing most (92%) of the milk sold to processors who are regulated by milk marketing orders. Dairy producers have thus relied heavily on their cooperatives to perform marketing functions and to represent their interests in establishing prices and other terms of trade.

Producer Cooperatives

Farmer cooperatives are very significant in the dairy subsector, where they are especially needed to represent the interests of producers, and to expedite referendums. Co-ops are more prominent in the handling of Grade A milk than in manufacturing milk.

Producer cooperatives have undergone considerable consolidation into large regional cooperative organizations. These large regionals include Associated Milk Producers Inc., Mid-America Dairymen and Dairymen Inc. (all centrally merged in the late 1960s) and Land O' Lakes federated much earlier but greatly enlarged in scope in the last two decades. The large regionals are concerned with bargaining as well as performing other functions which include manufacturing.

Concentration of producers in bargaining cooperatives appears high in some federal order markets. As of December 1974, in two-thirds of the 61 federal order markets, the largest cooperative had around two-thirds of the producers, which is enough to approve or disapprove the order in a referendum. However, for the purposes of bargaining for over-order premiums with handlers, even a fairly small percentage of producers who are determined to be "free riders" (nonmembers who benefit from the bargaining of the cooperative), either in a rival cooperative or outside any cooperative, often can undermine effective bargaining by the principal cooperative if these producers sell to aggressive small handlers.

The larger milk co-ops have become symbols to the antitrust agencies, some elements of Congress, the press, and others of the "abuse" of power given to farmers under the Capper-Volstead Act. Three co-ops were charged in the early 1970s with monopolization and predatory behavior. Two of these signed a consent decree and the third case has not been completely settled. Concerns about "undue price enhancement" by cooperatives are still being discussed.

A direct relationship exists between the size of the cooperative and the number of services it performs for producers. For example, the larger ones do more research and development to improve dairy product demand and more "political education" concerning price support levels.

Since some of these costs often cannot be recovered by a specific charge to the processing plant the larger co-op may have a higher service cost. Many of these services benefit all producers, whether members of that specific cooperative or not, and may result in a higher producer price in the entire market. Some producers may choose to belong to no cooperative or a smaller cooperative, pay the lower service cost and get the benefit of the higher general price.

The vertical coordination roles of dairy cooperatives are briefly summarized below:

- (1) They take primary responsibility for seeing that the markets which they serve are adequately supplied with milk. To do this they usually operate superpools outside the federal or state order mechanism. This means that nearly all the bargaining co-ops in each market bargain through a marketing-agent-in-common for necessary charges to cover services performed, which are paid into the superpool uniformly by all dealers in the market (exceptions may be necessary for hardships to particular dealers). These payments are frequently somewhat more than actual costs for services performed. Announcements of the Supervisor of Central Milk Producers Co-op (the superpool) in Chicago seldom show more than 2% to be paid producers, after costs and adjustment, and usually this is around 1%.
- (2) They perform the "balancing function" for milk supplies which may require short period storage, milk movement and/or surplus manufacturing. This benefits dealers and the market as a whole.
- (3) They represent the interest of producers at hearings on federal orders or state milk regulations; administration of

orders would be difficult without strong, responsible co-ops.

- (4) Cooperatives are vertically integrated into primary manufacturing and are especially prominent in butter-powder manufacturing. They are important, but less so, in cheese manufacturing.
- (5) Some co-ops are vertically integrated into intermediate handling of butter, powder and cheese, involving labeling and branding for butter, and processing or slicing, packaging and branding natural cheese. They do some research and development, advertising and servicing of retail food chains. All large co-ops pack some private label products. In general Land O' Lakes is more involved in intermediate handling than other co-ops.
- (6) Only 5 or 6 co-ops have had much success in processing and distributing bottled milk and fluid milk products as their primary activity, although several have added it as a minor operation to manufacturing. In total, co-ops handle less than 10 million pounds of processed product per day.
- (7) Many bargaining co-ops guarantee the producer an outlet for his milk.

PERFORMANCE

The dairy subsector generally can be characterized as a very stable, well coordinated subsector providing an adequate supply of high quality perishable products to consumers. Of course, this performance must be partly attributed to the governmental programs and regulations which have greatly influenced short term and long term behavior in this subsector.

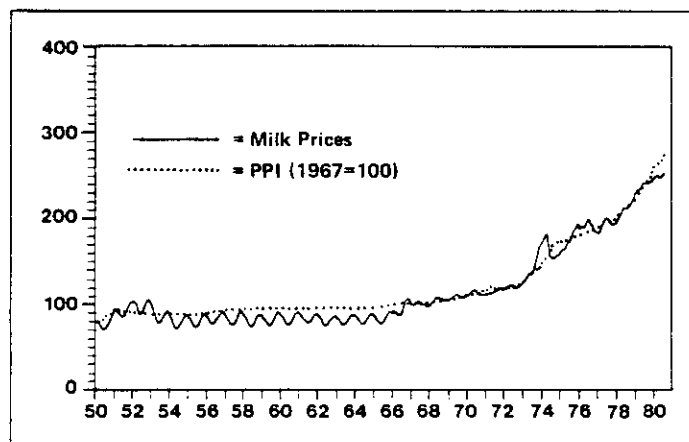
The combination of the government price support program, the federal marketing order program, and the permissive legislation (the Capper-Volstead

Act) which allows the producers to form cooperatives, together provide greater long term and short term stability in milk production and prices. Some short term price enhancement occurs when shortages develop, but little long term price enhancement compared to a competitive market structure (because of the inability to control production response.)

Figure 5 compares producer all-milk prices with the Producer Price Index (PPI) for all commodities, farm and non-farm, from 1950 through 1980, (both indexes being expressed as a % of 1967). Variation in milk prices are low, whether month to month, over 6 month periods or over 12 month periods.

Similar analyses of the prices of steers, hogs, broilers, corn, potatoes and oranges show much more price variability. Monthly price variations are less than 3 percent for milk, 12 and 13 percent for potatoes and oranges, and the other commodities in between. Over 6-month periods, price variations average 9 percent for milk, 24 percent for oranges and 37 percent for potatoes, with the others in between (steers 10 percent, corn 11 percent, broilers 12 percent and hogs 15 percent) (H. Cook and B. Marion).

Figure 5. Index of Prices Received by Farmers for All Milk, 1950-1980.



Source: H. Cook and B. Marion

Profitability

The best data at hand for comparing farmer returns from dairying with alternative enterprises is from Illinois for the 1971-75 period and the years 1977 and 1978 (Table 1). For 1971-75, these data show lower returns to dairying than from grain, hogs, and beef on medium size farms, and less than grain and hogs on small farms. However, during the latter part of the 1971-75 period, the prices of each of the other commodities inflated faster and further than the price of milk, which very likely affected the relative returns. By 1977, the prices of grain, hogs, and beef had receded, whereas milk prices had continued upward. That year, dairy was the only one of these alternatives to show a positive return to labor and management in Northern Illinois. By 1978, there had been some recovery in non-dairy markets but dairy showed higher returns to labor and management than any, except hogs. In Southern Illinois, grain and hogs showed a positive return, as well as dairy, but dairy was highest both in 1977 and 1978.

The point to be stressed from this comparison is the relative stability of earnings from dairying, in part due to the government programs described above. Although dairy enterprises usually show relatively low returns to labor and management, they appear to vary less, and at least in the 1970's appear to have been consistently positive.

The reasons why farmers carry on the dairy enterprise may be summed up as follows:

- (a) Stability of earnings,
- (b) More complete use of family labor,
- (c) Permits use of lower quality land suitable primarily for hay and pasture,
- (d) Frequent and regular pay checks.

Table 1 - Operators Share of Labor and
Management Earnings (wage) by Size and Type of Farm,
1971-1975 Average, 1977 and 1978

<u>Northern Illinois</u>	<u>1971-75</u>	<u>1971-75</u>	<u>1977</u>	<u>1978</u>
Acres of tillable land	218	429	--	--
Farm Type:				
Grain	\$11,105	\$20,942	\$-5,752	\$13,428
Hog	16,987	25,063	-3,791	34,407
Beef	7,313	13,213	-21,615	15,353
Dairy	7,707	12,592	6,244	17,545
All	10,936	19,105	--	--
<u>Southern Illinois</u>				
Acres of tillable land	213	437	--	--
Farm Type:				
Grain	\$14,859	\$21,684	8,231	13,048
Hog	20,804	37,039	15,263	27,990
Dairy	11,666	18,230	15,535	35,051
All	15,424	25,534	--	--

Source: D. F. Wilken, Farm Economics Facts and Opinions, Dept. of Ag. Econ.
Urbana, Illinois. Oct, 1976.

Also: 1978 Summary of Illinois Farm Business Records, Circular 1173,
College of Agriculture, University of Illinois, Urbana.

Profits reported for dairy processing firms in the last twenty years appear generally comparable to those reported for all food manufacturing firms, as well as those for retail food chains. Profits as a percentage of stock holder equity range between 10 and 12 percent in the 1960 to 1973 period, though diversification of some firms may make those figures slightly misleading.

Though there are some good, fairly recent studies of individual dairy industry segments, the profits cannot be computed as a percent of equity. Indeed they are not very comparable in any respect. Jones and Lasley found that net margins per dollar of sales of fluid milk processor-distributors were 2.48 and 2.67 cents in 1977 and 1978. The USDA (Ag Econ report No. 391) found that 2.11 cents of the 8.12 cents per pound manufacturing cost for butter in 1975 was profit before taxes (perhaps 12% after taxes). Babb found that return on equity before taxes was 19.7%, for a sample of 44 Wisconsin cheese plants in 1978.

It is nearly impossible to sample dairy manufacturing businesses in such a way as to show costs of manufacturing individual products. This not only is because of diversification but also because of integration backward into other stages in procurement, and forward into other stages of wholesaling. Various firms are integrated to different degrees.

Based on a qualitative appraisal, it seems likely that cheese is the most profitable part of dairy business, followed by butter-powder manufacturing, with fluid milk distribution coming in last. However, comprehensive profit analyses are not available to fully document this judgement.

Although market concentration appears fairly high in each of these processed dairy product markets, there appears to be little "monopoly profit" because:

(a) The market power of the retail food chains tends to countervail the processor's power. Several corporate retail chains are vertically integrated backward into processing their own fluid milk products. The threat of other chains following suit may pressure processors to price so as to forestall vertical integration by chains.

(b) Corporate and other types of retail food chains (voluntary and cooperative) demand and obtain a major portion of their manufactured products under their own "private label." Chains obtain fluid milk products with private labels if they do not manufacture their own. All processors and manufacturers, except Kraft, are packing private label products, so retail chains have many alternative sources of supply.

(c) Another structural element tending to limit the monopolistic behavior of dominant processing firms is the size distribution of the "middle tier" of firms. In nearly every product line, there are several reasonably large and efficient middle tier firms, usually with good brand names, which can compete effectively with the largest firms for all but the largest chain store accounts.

Capacity Utilization

The dairy subsector has exhibited both seasonal and long term excess capacity. Much of the seasonal excess is necessary in view of seasonal production patterns and the highly perishable nature of milk, which must be manufactured in order to be stored. Demand for each product is relatively uniform. Even fluid milk plants must have some excess capacity because of 5-day bottling schedules. Some of the longer run excess capacity has resulted from the nature of competition, though most of it appears to have resulted from technological change

and from the rapid restructuring of the various industries within the subsector. In a 1970 study of dairy industry organization and competition, technological developments of particular concern to dairy marketing industries were classified into five categories as shown in table 2. Evaluations were made of the effect of these developments on the optimum volume for the affected type of dairy enterprise. Of the 82 developments considered for the period 1875 to 1966, three-fourths were evaluated as having had the effect of increasing the optimum volume of business, and 44% as having a pronounced effect.

Table 2 Evaluation of the Effect of Technological and Institutional Development on Optimum Volume in Various Dairy Enterprises for Period 1875-1965, U.S., 1970

Development	Total Developments (number)	Had No Effect or Decreased Optimum Volume (number)	Some Increase In Optimum Volume (number)	Pronounced Increase In Optimum Volume (number)
New product or product modification	21	6	4	11
New technique or equipment for processing and manu- facture	21	1	8	12
New technique or type for packaging	13	2	5	6
Developments in refrigeration, storage and transportation	14	4	8	2
Changes in merchandising	13	7	1	5
Number	82	20	26	36
Percent	100.0	24.4	31.7	43.9

Source: Sheldon Williams (et al).

Plants have seldom been used at less than capacity to influence prices; instead many plants were built with excess capacity in hopes of capturing a larger market share, either of raw materials or of product.

Plant numbers have declined rapidly, and much of the longer run excess that now exists is closing rapidly. Some of this industry restructuring has been technologically induced, some due to changes in government programs and regulatory actions, and some has resulted from rapid consolidations or mergers, especially of co-ops in recent years.

The sharpest decline in numbers has been among fluid milk distributors and especially among producer-distributors (Tables 3 and 4). These are farmers who distribute their own milk (and possibly some from others) directly to customers. Taken together the number of fluid milk distributors fell from 19,711 in 1948 to 1,439 in 1976.

Table 3 : Number of Plants Manufacturing
Principal Dairy Products, U.S. Selected Years 1944-79.

	Butter		Amer- ican		Italian		Evap. & Cond. Whole		Nonfat Dry	
	No.	%	Cheese	%	Cheese	%	Milk	%	Milk For	%
	No.	1944	No.	1944	No.	1944	(Canned)	1944	Human Food	1944
1979	276	6.9	486	22.7	185	117.1	21	13.1	112	22.6
1974	389	9.7	608	28.4	189	119.6	32	20.0	159	32.1
1969	727	18.1	827	38.6	188	119.0	48	30.0	233	47.0
1964	1227	30.5	899	41.9	185	117.1	64	40.0	394	79.4
1959	1775	44.1	1060	49.4	186	117.7	83	51.9	452	91.1
1954	2477	61.6	1406	65.6	134	89.8	112	70.0	459	92.5
1949	3141	78.1	1682	78.5	156	98.7	139	92.5	459	92.5
1944	4022	100.0	2144	100.0	158	100.0	160	100.0	496	100.0

Source: "Dairy Products," various annual summaries, IA2-1 Crop Reporting Board, ESCS, USDA.

Table 4 : Number of Fluid Milk Distributors
U.S. Selected Years 1944.

	1948 No.	1965 No.	1976 No.	% 1948
Processor-distributors	8,392	3,920	1,439	17.1
Producer-distributors	<u>11,319</u>	<u>1,677</u>	--	
	19,711	5,597		

Source: "Organization and Competition in the Dairy Industry," Tech. Study No. 3, Nat. Comm. on Food Marketing, June 1966.

Distributors have not had their margins protected by price support programs, though the Federal Order Program has meant that their minimum pay prices for milk are the same as their competitors. The number of producer-distributors fell partly because the Federal Order Program forced them to make heavy payments into the producer settlement fund of the pool since all or nearly all their milk was used in class I. However, all distributors were pressured by other technological and institutional factors. These were capital requirements for pasteurization and homogenization and later for the paper packaging technology, the blo-mold equipment for single service quantity containers, and necessary plant size to get the large supermarket chain accounts. Since most were in ice cream, they needed the continuous freezer to replace the earlier batch type.

Though margins for butter, powder, and American cheese have been protected on the down side by the price support program since the Agricultural Act of 1949, the numbers of butter and cheese plants likewise have fallen, though not as sharply as for fluid milk. Government purchases of these 3 manufactured products was at prices which returned to milk producers, on an average, the minimum percentage of parity specified by Congress. But many plants were forced out of business as they paid competitive milk prices while their operating costs were higher than average.

Continuous advances in cost-reducing technology and other factors caused butter plants to decline from 4022 to 276 between 1944 and 1979, a decline of 93.1%. The shift from sour farm-separated cream to sweet cream butter from whole milk coupled with the growing demand for sweet cream butter and for products from the nonfat portion of milk speeded up the demise of the specialized butter factory. By 1964, all the specialized

sour cream butter factories were closed. In the last 15 years, the continuous churn and soft butter printing technology, especially as used by the regional co-ops as they were being put together, and their country grading, printing and branding programs, and sales forces have all speeded the decline of the butter factory numbers.

In powder, the numbers of plants for making spray process powder for human food declined from 496 in 1944 to 112 in 1979. Spray process powder was preferred and encouraged by the government to replace rollers from the early years of WWII. Usually spray equipment was in the same plants (or at least the same companies) that made sweet cream butter. It was not until the last half of the 1960's that powder plant numbers began to decline sharply, though total powder volume kept on the increase. The spray drying technology constituted a vast advance over the roller, and also kept improving, coupled with dramatic increases in quality and declines in costs of manufacturing.

In the American cheese industry, plant numbers declined from 2,144 in 1944 to 486 in 1979, a decline of 78.3%. Half of this decline was before 1960, when the small 1 and 2 vat family-cheese operation was being shaken out by the impact of the rindless block technology and competition for milk from Grade A plants and large scale butter-powder plants. Since the mid-sixties, demand for cheese has strengthened greatly and automation has sharply increased the average size of plants and reduced labor costs in large plants.

Numbers of canned milk plants have declined to 13% of 1944 levels because of declining demand, added to the fact that canned milk has not been bought for price support purposes (except for one brief early period).

The major period for co-op consolidation into the large regionals came in the late 1960's, which speeded the closing of manufacturing plants.

Progressiveness

Productivity increases at the farm level have been rapid. Average U.S. milk production per cow nearly doubled from 1955 to 1975. From 1959 through 1974, labor input in the farm dairy enterprise declined by 67%, while for all farm work it declined by 47%.

In manufacturing, processing, and distribution, many products and services could be called new, such as the low fat items, processed and rindless block cheeses, sweet cream butter, sterile milk and cream, homogenization, paper packages, quantity containers, supermarket sales, and others. Most innovations have been in response to changes in consumer tastes. For dairy companies, value added by manufacture per production worker ranks high among food industries, as does new capital expenditures per company.

There has been something of a historic protectionist posture by dairy producers and handlers, evidenced by resistance to standardization of milk, to changes in butter definitions, and resistance to substitute products. However, there is evidence of new initiatives, and on the whole, the record of progressiveness seems to compare well with other agricultural and food industries.

Government Program Costs

Since 1949, the U.S. Department of Agriculture has played an important role in affecting the prices of fluid and manufacturing milk through price support activities. In the greatest period of surpluses during the mid '50's and early 1960's, between 8 to 14 percent of all

dairy products (on a solid-not-fat basis) were removed from the commercial market by programs of the USDA. During 1980, surpluses again ran high with over 7 percent of all milk being purchased by the U.S.D.A. at a cost of about \$1.3 billion. Thus, from time to time, there has been a substantial governmental cost required to purchase and store those commodities and maintain prices at desired levels for producers.

Milk marketing orders also have been challenged, with allegations that these orders unduly raise the price of milk to producers and for consumers. For example, a study by Kwoka alleged that orders raised the price of milk more than 20% above competitive levels in 1970, resulting in a social cost to consumers of eight hundred million dollars per year. However, an extensive quantitative analysis by Dobson and Buxton indicates that the net social cost of marketing orders is approximately 13.2 million dollars per year, roughly 2% of the Kwoka estimate. In addition, some analysts have estimated that bargaining cooperatives have been able to contribute an incremental return to producers above the probable free market price, with estimates ranging between 1 and 5 percent of the milk price.

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