INCREASING PRODUCTIVITY IN THE FLUID MILK PROCESSING SECTOR THROUGH CHANGES IN MARKET ORGANIZATION AND STRUCTURE

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It is well recognized that a number of factors, basically technological in nature but having significant economic effects, have made feasible a drastic restructuring of the fluid milk industry. This is the economic outgrowth of developments that have been shifting the economies of scale in processing sharply to the right, that have all but eliminated home route delivery, that have improved quality and shelf life of the product, and that have provided methods for handling and moving milk over wide areas at low costs. In response to these changes, the industry is undergoing substantial changes in the way it is organized for processing and distribution and for market coordination. These changes include rapid reduction in number of processing plants, the expansion of distribution areas, a shift from processor brands to private label by major food retailers, vertical integration into milk processing by many regional and national food retailers, the formation of strong regional producer groups and the vertical integration into milk processing by these producer groups [6, 7, 8]. It seems appropriate, therefore, that the industry and those working with it address themselves to the question of how these organizational changes can contribute to increasing productivity. One possible approach to the task is to identify the potential sources of increased productivity from organizational changes and then consider the structural implications of implementing these changes.[1]

CONSOLIDATION OF FACILITIES

Perhaps one of the most pervasive sources of increase productivity and a factor having major implications for organization is the economies of scale in fluid milk processing. Technologies have continued to shift the scale curve sharply to the right and have modified the transfer and distribution cost functions with the result that the minimum optimum scale plant has increased greatly in the last two decades. Not long ago, we regarded a plant with an operating capacity of 25,000 to 50,000 quarts per day as able to capture most of the economies. It appears now that this capacity may be some multiple of 100,000 depending on the market conditions.

In spite of the substantial amount of horizontal merger activity in fluid milk processing since World War II, there is evidence that much greater merger and consolidation must take place if the potential gains from scale economies are to be captured. Any merger activity to increase productivity must involve consolidation of facilities. The magnitude of this potential is indicated by the research of Kloth and Blakley [5]. Based on a delineation of the U.S. into roughly two market areas per state, each with a radius of about 200 miles, they estimated for the U.S. the total cost of the marketing bill for fluid milk from the farm, through processing, out to local demand points. In the more realistic model used for these estimates, plant size restrictions were imposed to

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[1] Increased productivity is used in this paper to mean greater output for a given bundle of resources.

insure at least two plants but no more than six in each principal market area. Estimates of total costs under this organizational structure were about 14 percent less than the estimated cost under the organization existing in the mid 60's, a reduction of some $12,000,000 annually. To accomplish this, however, the model called for a reduction in plant numbers from the 3,550 then existing down to only 240.

CONSOLIDATION OF SALES AREAS

Conner and McCullough [1] have demonstrated in a different way the gains from increased productivity through extension of sales area and modification of distribution methods. The findings support area delineations of 200 mile radii as feasible fluid milk distribution areas. A reduction in number of plants is implied. Under reasonable sales densities of 2-1/2 to 3 quarts per square mile, the findings indicate a plant can reduce its average unit costs for processing and distribution by extending its distribution area up to 200 miles using a system of direct distribution with limited service to larger volume wholesale outlets and using distribution substations for the remaining outlets. Reaching out in this manner to attain a volume of 300,000 to 400,000 units daily reduces the average processing and distribution cost about one cent per quart below what it would be if operations were restricted solely to a home market of 20,000 units (Figure 1). If the plant chose to serve only the larger outlets in outside areas, its average total costs would decline about 4-1/2 cents per quart as it reached out 200 miles for a volume of 200,000, a lower volume since only part of the market is served and assuming no change in sales density.

There is thus a strong tendency for the market to become segmented with the development of direct distribution to large volume outlets by either the vertically integrated or non-integrated processor from some distant market. A local processor losing these

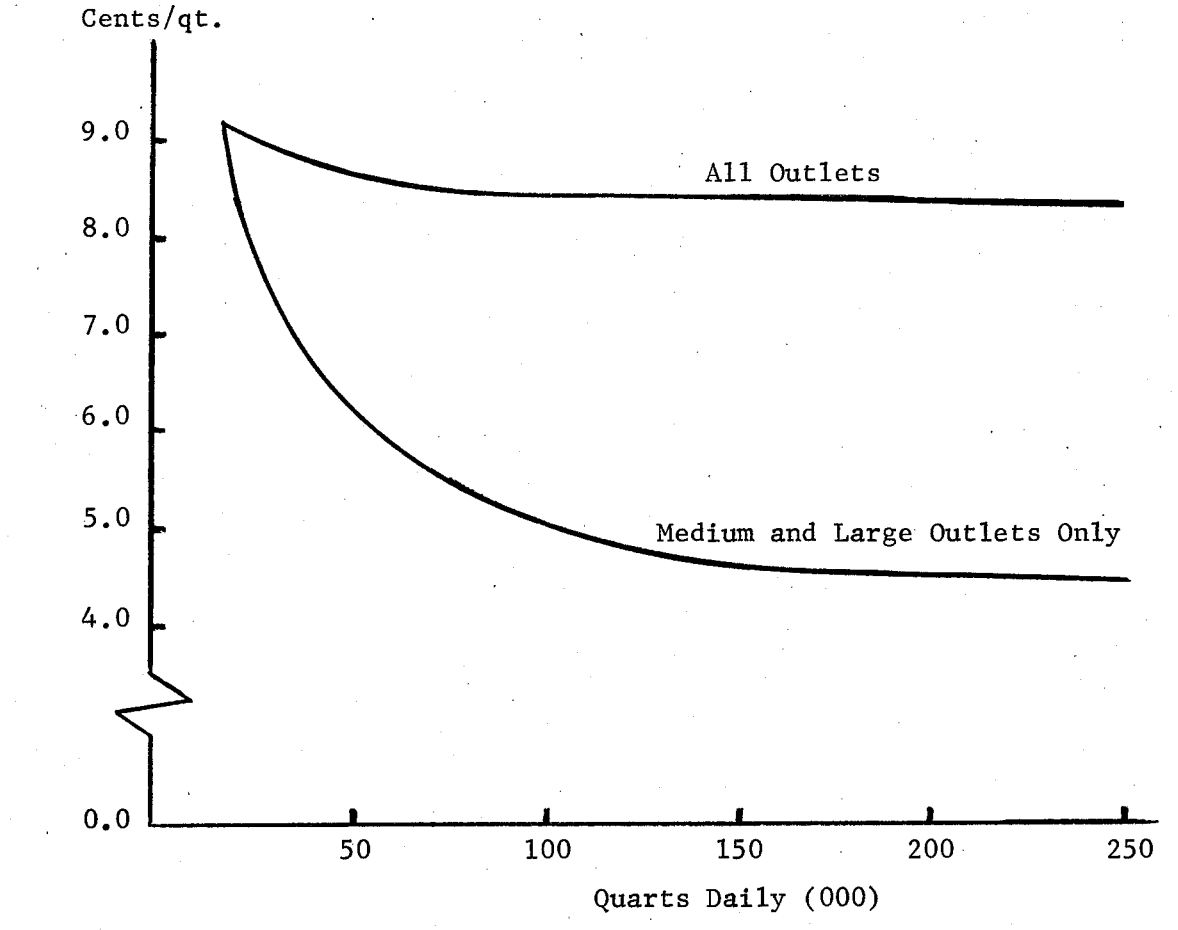

Figure 1.COMBINED PROCESSING AND DISTRIBUTION COSTS FOR PACKAGED FLUID MILK WHEN SERVING OUTSIDE MARKETS UP TO 180 MILES DISTANT.

larger accounts faces higher average costs on remaining sales because the remaining outlets are associated with higher costs and plant output is reduced. The cost differential in serving the different categories is likely to widen with segmentation of the market, however, there is less opportunity to subsidize distribution to special and small volume outlets with the distribution economies inherent in large volume outlets as has occurred in the past.

HORIZONTAL INTEGRATION

The preceding observations are directed at the potential gains from the reduction in number of processing plants. They are not addressed to the role of horizontal integration as a productivity factor. What contribution horizontal integration in and of itself can make is not quantitatively documented. It is rather obvious, however, that the process of consolidation of plant facilities to gain economies from scale can be accomplished more readily for groups of plants within a market area which are horizontally integrated than for independents. In addition a horizontally integrated firm is in a position to rationalize its distribution system so as to eliminate overlap and cross haul as means of reducing costs. Again, since most fluid plants are multi-product operations, some product specialization by plants may be implemented more readily by horizontally integrated firms than by independents. Access to adequate capital at more favorable rates may be a gain from horizontal integration.

VERTICAL COORDINATION

Coordination of seller-buyer transactions, sometimes referred to as the transaction function, is a second major source from which industry reorganization may derive improved productivity. In executing the transaction function in the real world under a market exchange system, costs are involved for such things as maintaining sales contacts, keeping informed on market conditions, negotiating terms of trade, coordinating inter-area movement and processing output with requirements, and bearing market risks. Given certain product and market characteristics, these activities may be performed more efficiently through partial or complete reliance on non-market or internal coordination. Two well recognized ways of accomplishing this at the processor-retailer interface is contractual arrangements involving private label and vertical integration through ownership.

Contractual, private-label arrangements are one means of coordination used by many major food retailers under centralized milk purchasing programs. Under these arrangements cost reductions are obtained by concentrating larger volumes in supplier plants, by dealing with fewer suppliers, by instituting limited service delivery, and through economies in sales promotion [3]. Under this method of coordination, the private label processor often supplies the processor brand for the same store. This provides some distribution economies compared to a vertically integrated system requiring a separate delivery of processor brand if one is handled. The multiplant processor under private-label contracts presumably is able to adopt a least cost pattern of supplying the outlets covered. If such a system is to survive, however, it probably is necessary that the firm's volume of output be large relative to any single private-label contract as a means of reducing the impact of uncertainty to an acceptable level. This has implications for both the degree of consolidation within a geographic area and the extent of horizontal integration that might be warranted [4].

As noted above, vertical integration is another approach to non-market coordination. The most prevalent type at present is the backward integration into processing by the multiple store food retailer. In a sense the processing plant in this situation has captive outlets enabling it to establish rather firm output projections and to match plant capacity to such estimates. Likely the food retailer can dovetail much of the special delivery services into its operation without additional costs. It may be able to avoid most of the selling costs to wholesale outlets incurred by nonintegrated firms since these costs are principally for the purpose of capturing a larger share of the market from competitors rather than expanding the market.

The potential cost reductions through this type of integration may be partially or wholly offset, in terms of aggregate costs of the system, by the pattern of plant location that is likely to evolve. Presumably each chain retailer locates its integrated plant so as to minimize costs for serving its particular group of outlets. Where two or more chains are involved in an area, the result will be either an increase in cross hauling or duplicated hauling over long distances, depending on whether the plants are dispersed or in the same area. It is significant to note that the integrated milk plants for two major chain food retailers in the Southeast are located in North Carolina within 25 miles of each other and each serving much of the Southeast. An integrated plant for a third chain is located not far away.

Possibly there is a second offsetting diseconomy in the aggregate that results from processor-retailer integration. As the major food retailers integrate into processing the market becomes more strongly segmented. Large volume outlets are pulled out of the market. The sales volume remaining open to the nonintegrated processor is reduced and consists largely of deliveries to small volume or specialized outlets not feasible for direct distribution over long distances such as small volume retailers, restaurants, schools, hospitals and home delivery. If they are to be served, it will be by either a local small scale processor or a larger scale plant with an extended distribution area involving distribution substation facilities. In either case the marketing costs for this segment are increased by the division of the market. In some sense this process occurs also where there is no integration as the large processors capture many of the larger volume outlets. But no one is rigidly locked in as occurs under vertical integration by ownership.

At the other end of the marketing spectrum we note the possibility of producer-processor vertical integration. Given a regional organization of producers encompassing a high proportion of producers in the region, the expected pattern of plant location would be quite different under this type of integration from that likely under processor-retailer integration. If producer-processor integration became widespread, plant location would be determined in the context of serving the total market in a particular geographic area instead of segments of several market areas. Thus under this organization, the three plants noted above under processor-retailer integration in the Southeast, would be located not in close proximity to each other, but possibly one in Georgia, one in the Carolinas and one in Virginia. We could expect a high proportion of the output to be under private-label contracts through which much market coordination detail would be negotiated. Implied in this system is a high level of concentration providing opportunity for capturing scale economies and rationalizing both plant location and transfer and distribution systems to minimize costs.[2]

IMPACT ON DISTRIBUTION ELEMENTS

At this point we should place in a structural context three productivity factors related to distribution efficiency. Three interrelated factors, volume of product per delivery, the level of delivery services, and the density of individual firm sales in a given market area, have a significant impact on milk distribution costs. In a recent study of California conditions, Courtney and Brooks [2] show that, based on a limited service delivery, the delivery cost per labor unit, roughly a quart equivalent, is more than 2 cents lower for a 100 case delivery than a 6 case delivery. The cost difference between a 6 case *full* service delivery and a 100 case *limited* service delivery is more than 4 cents a unit. With reference to sales density, the work of Conner and McCullough [1] demonstrate that doubling the sales density from 1.5 to 3.0 units per square mile reduces the average distribution costs 1/2 to 3/4 cents per quart for a plant extending its distribution area sufficient to pick up a total daily sales of 100,000 units.

The factors just mentioned are relevant in our present context since improved productivity through either of these factors is interrelated with organizational changes in the market. Thus, given the population density and distribution, the density of sales by an individual firm is a function of market share which in turn is related to the number of firms serving an area. Reduction in number of plants, therefore, increases sales density for the remaining firms. This suggests that the economies estimated by Kloth and Blakley from structural reorganization would be increased even further if the factor of increased sales density were taken into account.

In like manner, volume per delivery to major food retailers would be expected to increase with structural reorganization that brings about a decline in processor brands in a given outlet. Again, this potential gain was not accounted for in the Kloth-Blakley study.

Finally, it appears that delivery under limited service arrangements with its cost reducing impact is most likely to prevail under private-label contracts or full vertical integration of processor and food retailer.

PRICING EFFICIENCY

Thus far our discussion has revolved around operational productivity or efficiency as influenced by the organizational structure of the industry. Some attention should be directed toward pricing efficiency aspects which surely must be reckoned with.

There is reason to surmise that a low level of pricing efficiency prevailed in the transactions function between the milk processing and food retailing sectors and that this was the single most important factor in launching the movement to

[2] The term concentration may be a source of some confusion since it is a market structure concept but is used here to refer to share of sales in a geographic area without any attempt to define a market.

vertical integration. Prices at which products exchanged between processor and retailer failed to reflect the attainable, differential costs for delivery to the varied types of outlets in the market. A number of factors contributed to boxing the processing industry into this situation. No doubt the strongest factor was the labor union contracts providing a commission basis for paying deliverymen in a large portion of the industry. Secondly, fair trade laws and/or resale price fixing prevailed in many areas and were slow to make adjustments. However, in recent years, some resale price fixing agencies have devised reasonably sound differential pricing schemes at the wholesale level. But attempts at fixing the consumer price face insurmountable problems. And lastly the processing industry has been slow to recognize the attainable, differential costs among outlets and was somewhat resistant to change in pricing practices.

The other side of the pricing efficiency coin relates to the impact pricing efficiency has on distribution of gains from increases in productivity. With nonintegrated processors operating under labor contracts the gains often have gone largely to labor which lessened the incentive for firms to devise delivery systems for increased labor productivity. On the other hand where processing is vertically integrated, there appears to be a tendency in many instances for the food retailer to retain a major portion of gains from increased productivity. The pattern, however, varies widely among areas depending no doubt on many conditions. In general it may be that if the competitive fringe must, by the nature of things, operate under high cost conditions involving outlets requiring high cost services, then the oligopolistic core (mainly major food retailers) may not compete vigorously in a way to pass along to the consumer the full gains from efficiencies.

Pricing efficiency might also be viewed in terms of the level of profits as influenced by monopolistic elements. It appears that a degree of spatial monopoly can hardly be avoided in attaining high level operational efficiency. However, the low cost methods of distribution now available to some outlets in the market would provide severe restraint on any exploitation of this condition.

STRUCTURAL IMPLICATIONS

The difficulty of establishing acceptable geographic delineations that prescribe a market in an economic sense under present day technologies and marketing systems is a major obstacle to identifying market structure in the dairy industry. Without this delineation it is difficult to establish the nature of the structure and the appropriate limits within which organizational changes may occur without modifying structure to the extent of affecting adversely industry performance.

The observations made here suggest that the organizational changes needed to realize increased productivity lead to large scale plants, to high levels of concentration in given geographic areas, and to non-market methods of vertical coordination. Does it follow that the resulting market structure would lead to less satisfactory performance?

It is not clear that the minimum efficient scale of plant of today, though large absolutely, is larger relative to the relevant market than the plant of earlier years to its market. The Kloth-Blakley model calling for as few as 240 plants for the U.S. would mean substantial concentration by areas, but, with low cost product movement systems, would still provide sufficient sales area overlap to avoid a high degree of spatial monopoly.

Conditions of entry have undergone changes that reduce their role as barriers. Formerly large capital requirements and access to markets were major barriers to entry to fluid milk processing. Today, the food retailer making entry via vertical integration finds these conditions no obstacle. Legal barriers between jurisdictions have broken down to further ease entry. On the other hand, whereas formerly a potential entrant had ready access to raw milk supplies, today this could well be a barrier in the face of strong regional organization and substantial vertical integration of producers.

It is apparent that the tide is running high toward *processor-retailer* vertical integration geared to serving the major food retailers. A substantial movement toward *producer-processor* vertical integration is emerging as a strategic factor in the processing complex. Finally, the remaining components of this sector are the more conventional processors - nationals, regionals and independents - who are confined largely to serving those outlets of the market not served by the vertically integrated system. This share of the market is substantial, amounting to near 60 percent at present according to some estimates but is likely to be reduced further by encroachment from both sides [5].

If the non-vertically integrated segment of the processing sector is to remain a strong competitive factor able to operate efficiently, major organizational changes that would permit attainment of maximum economies are essential [4]. With a ubiquitous supply, very weak product differentiation and no effective barrier to entry by major food retailers, there would be little opportunity for the

non-vertically integrated processing sector, even though of large scale operating in an area of high concentration, to extract returns much above normal. In the vein of Schumpeter, the potential competitor would be the crucial restraint to unsatisfactory performance.

On the basis of this brief evaluation, it is suggested that a substantial improvement in productivity hinges on adopting a public policy that encourages the development of the non-vertically integrated processing industry into a more viable, competitive segment through extensive merger and consolidation. This would be a reversal of past policy which restricted both area concentration and market extension mergers. Furthermore, if such a policy succeeded in establishing the conventional processing sector as a more viable component of the present day market, there would be less need to consider imposing public restraints on vertical integration whether by chains or cooperatives.

In summary it is the contention of this paper (1) that major organizational changes can bring about both operational and pricing efficiencies in processing and distribution, (2) that these changes require extensive consolidation and merger of facilities and even high concentration in localized geographic areas or subregions and (3) that these changes, though modifying structure, leave it workably competitive.

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