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TECHNOLOGY—TORCHBEARER OR TASKMASTER

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Food processing industries have lagged many others in adapting to technology necessary for industrialization. However, in recent years a technological revolution has hit the food processing industry. In fact, this revolution has had such an impact that one lesson stands out—a food processor must make technology his Torchbearer or it will become his Taskmaster.

In the United States fluid milk industry this whirlwind pace of innovation has brought drastic changes in firm size, distribution patterns, and competitive structure. Firms wishing to survive in such an environment are constantly forced to innovate rapidly and wisely. Laggards are quickly swallowed up in the sea of competition. Leaders usually ride a crest of profits—the reward for an early and prudent innovator.

Some Recent Innovations in The United States Fluid Milk Industry

These five areas have seen special innovations for United States fluid milk firms: IN-PLANT MATERIALS MOVEMENT, PROCESSING, PACKAGING, SANITATION, and TRANSPORTATION.

In IN-PLANT MATERIALS MOVEMENT, bulk handling has become increasingly important. This has not been as spectacular as in milk procurement. Yet, when all of the pieces are added together, the record is amazing. Palletization has now been employed by numerous plants. With this system, products and raw materials can be moved rapidly and with a reduced labor force (1 & 2).[1/] Individual handling of cases inside the plant can be cut from as many as six times with manual handling to as few as two times with the pallet system. Truck loading and unloading time can be cut by as much as two-thirds (3). Integrated conveyors and automatic stackers have in some instances eliminated much of the cold room labor, and automatic packing has brought similar reductions in bottling operations (4). Automated order make-up systems promise to reduce materials handling cost still further (5).

In PROCESSING, the foremost technological developments are those that have made possible the shift from batch operations to continuous, assembly-line-type operations. Pasteurization, tradiationally done by the batch method, has now become a continuous process with the use of HTST pasteurizers. In addition, automatic temperature and flow diversion valve instrumentation in these and similar units, has given a precision of control over the temperature and path of milk that is not obtainable by direct human effort. Standardizing clarification and homogenization, also continuous processes, have been important

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1/ References cited at end of article.

factors in quality improvement. Resultant uniformity of butterfat content and "non-creaming" of milk have been significant elements in non-price competition. Automation of some plant processing operations has brought marked labor reductions and increased plant capacity (6). Closed circuit television improves supervisory control (7). Experimentation in quick butterfat testing could give increased efficiency in procurement. Nuclear gauging systems applications may soon include control of level of fill in milk bottles and ice cream packages, control of the moisture of cheese curd, and control of fluid milk processing by using continuous, very sensitive, density measurements (8). Improved freezing techniques for homogenized milk and new developments in fresh concentrated milk are recent additions to the rapidly growing line of dairy products(9 & 10).

In PACKAGING, improvements center chiefly around improved glass bottles and paper packages, and their attendant high speed bottling and packaging machines (11 & 12). The heavyweight glass bottle of earlier years has been replaced to a large extent by lighter, square bottles with resulting economies of labor and space. Gallon jugs and multi-quart containers have gained in prominence in recent years. Most phenomenal, however, has been the growth of paper packaging. Introduced in the prewar years, paper packaging did not shed its diapers until the late forties. Currently, paper packaged milk accounts for up to 75 percent of the total pack in individual markets (13). Estimates place it at about 50 percent of the total pack for the nation as a whole. Bulk dispensers have become important in the restaurant trade, and have recently been introduced into private homes (14). Milk vending machines are not in excessively large number, but are increasing in number regularly (15). Newest packaging innovation now enjoying significant use is tetra pak--a process by which a roll of paper is transformed into a chain of regular tetrahedra packages (16).

In SANITATION, improvements have come through gradual technological improvements in building materials, plant design, and cleaning and processing equipment and techniques (17). Several studies indicate that bulk handling of milk permits improved milk quality. Purification by the principle of ion-exchange has improved water supply conditions. Improved cleaning agents and germicides, in combination with specially constructed stainless and glass pipe lines, have in many cases revolutionized cleaning through in-place cleaning. New fogging techniques completely sterilizes tanks thus eliminating tough and tedious "crawl inside" cleaning chores (18). Even cleaning equipment has undergone significant changes as evidenced by mobile cleaning units with power driven brushes. Milk plant waste disposal, once a formidable problem, can now be handled simply and economically by the recent bio-oxidation process (19). Use of radioisotopes in such maintenance problems as locating underground leaks in water mains is but one of the latest atomic applications.(8)

In TRANSPORTATION, good roads, modern trucks, and advancements in refrigeration have made possible increasingly wider milk procurement and distribution areas. Direct bulk handling of milk from farm to processor has reduced milk procurement and receiving costs and has given considerable flexibility to processor procurement patterns. Refrigerated delivery trucks have improved quality levels of dairy products and in combination with paper packages have permitted distribution of packaged milk up to several hundred miles (11).

The Effects From Innovation

Generally, increased efficiency arising from improved technology shows up in decreased inputs required for given product outputs. The fluid milk industry has experienced about a two percent decline in inputs requirements each year during the last few decades. Manufactured milk industry has had similar reductions. Savings in resource use have correspondingly amounted to close to one percent per year (20).

Technological changes have had great effects in the area of industry structure. Here increased optimum firm sizes with rapidly changing distribution patterns are significant. Small volume operators often experience marked cost disadvantages. Many of the materials movement, processing, packaging and sanitation innovations show decreasing costs per unit as output is increased. Also, a number of these innovations such as automatic packaging, automatic stacking, automatic case conveying, and palletization are feasible only in large-scale operations. This tendency toward increased firm size has resulted in the current merger pattern. Recent research indicates that many of the mergers involve the small and medium sized firms (21).

Radical changes in delivery and sales patterns of fluid milk can be explained largely in terms of processing innovations. The expansion of milk delivery areas, for example, is closely associated with increased use of paper containers, although improved roads and court actions have also had their influence.

Wider markets have brought increased competition in many instances. Where formerly there may have been a local monopoly in a particular market, outer-market delivery has meant that several firms may be competing in that market. However, operations, endeavoring to "meet competition" with a full product line, may be placed at serious operating cost disadvantages, particularly in the case of paper bottling equipment. Both small and medium-sized independents with only one market can be "bled to death" if a large regional organization is able to reduce prices below local costs and subsidize the local plant from outside for a prolonged period of time. Moreover, strategically placed milk vending machines have had important ramifications in delivery and pricing patterns.

Paper packaging and multi-quart containers have been important factors in increased store sales since these sales require large containers and primarily paper cartons. Individual market store sales now run as high as 80 percent of total fluid sales with the national average often estimated at about 50 percent of total fluid sales.

Adjustment problems arising from these changes are many and difficult. The recent rapid decline in firm numbers is but one indication. The need and opportunity for constant adjustment to changing technology, changing market demand and competitive action of other dealers, is of prime importance irrespective of the firm size. The current wave of bulk handling, in-place cleaning, paper packaging, and other innovations, is being closely followed by another wave of plastic packaging, new product development, price wars, and at the crest, automation.

Two methods of technological adjustment in the fluid milk industry can be taken. The first one is concerned with increased efficiency of entire markets requiring concerted actions by all firms in the market (22). Such joint action requires self-discipline among dealers and must usually be supplemented by some public direction.

The second approach deals with increased efficiency of individual firms irrespective of concerted effort. Here, management is concerned with firm problems of plant layout, delivery and load out scheduling, product pricing and promotional programs (23). Yet, the complex of bulging product lines and constant technical and competitive change make efficiency decisions increasingly difficult. Here at Purdue University, we have found use of certain mathematical tools and an "electric brain" to be particularly useful in analyzing the complex interrelationship of such firm problems (24).

What Can You Do?

Some of our answers (partly from the "electric brain") are encouraging. Probably technology can bear your torch. Try the following ideas and you can probably operate in the light, rather than the shadows, of that torch:

1. Cut Costs--Irrespective of the state of technology, this is one of the most important areas in profit maintenance:

   For plant operations:

   a) Reduce labor force as work load decreases. Be especially careful of departments exceeding two men.
   b) Balance machines and men.
   c) Even out work load among departments.
   d) Maintain efficient plant layout. Check this after each remodeling.
   e) Use preventive machine maintenance and check efficiency of maintenance labor.
   f) Schedule crews.
   g) Schedule arrival of supplies.
   h) Secure quantity and cash discounts.
   i) Guard against excessive "quality" inputs on packaging materials.
   j) Institute rigid policies relative to miscellaneous items such as cleaning supplies.
   k) Be sure you know your raw product and materials loss.
   l) Take time to manage.

   For delivery operations:

   a) Increase individual route volume.
   b) Increase volume per customer.
   c) Increase number of customers per mile.
   d) Minimize service and frequency of payment where consistent with competitive conditions.
   e) Institute a tough returns policy for glass.
   f) Know your trippage on glass.
   g) Price in line with service rendered.

2. Avoid bottlenecks--You cannot afford to operate with serious bottlenecks. Recent research gave these impressive figures when cold room, working capital, and plant labor became limiting. Under rather conventional restrictions, this particular operator could afford to pay

$2790 per square feet of cold room, 59 percent on working capital, $7.80 per additional man-hour of plant labor in order to eliminate the respective bottleneck.

3. Meet competition.—You must usually meet competition. Changes in product line do not affect profits greatly unless product changes are drastic. Usually, you cannot afford to lose sizeable amounts of sales because of failure to meet product competition. Important exceptions exist, however, in case of small and specialized operators.

4. Avoid excess capacity.—Excess capacity is costly. We cannot over-emphasize importance of proper balance of resource inputs. In a plant recently studied, a decrease in volume of 20 percent decreased profits over 10 percent.

5. Use proper promotion.—Generally promotion is more effective if used for specific products rather than for general good will. It should be directed towards high returns products.

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