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The Milling Industry: Recent Developments and Future Growth

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In recent years the milling industry has experienced a substantial shift in emphasis from production to selling. As stated by the National Commission on Food Marketing (NCFM):

> as incomes rise, consumers are less influenced by prices and are better able to indulge their individual tastes, liking for variety, and desire for service. Changes in the role of women and in family living accentuate the importance of convenience in food preparation.[1]

This strong demand for convenience foods has been an influencing factor in the decrease in the demand for flour.[2] The degree to which the demand for flour has changed and will change and the extent to which flour milling firms have adjusted and will adjust to change are the topics of this paper. First, the decline in per capita flour consumption, including a review of the factors that have caused this decline, will be discussed. To complete the demand picture, exports will be analyzed. Finally, flour production and the various adjustments that have been made and might have to be made to compensate for changing domestic and foreign demand will be considered.

DOMESTIC DEMAND

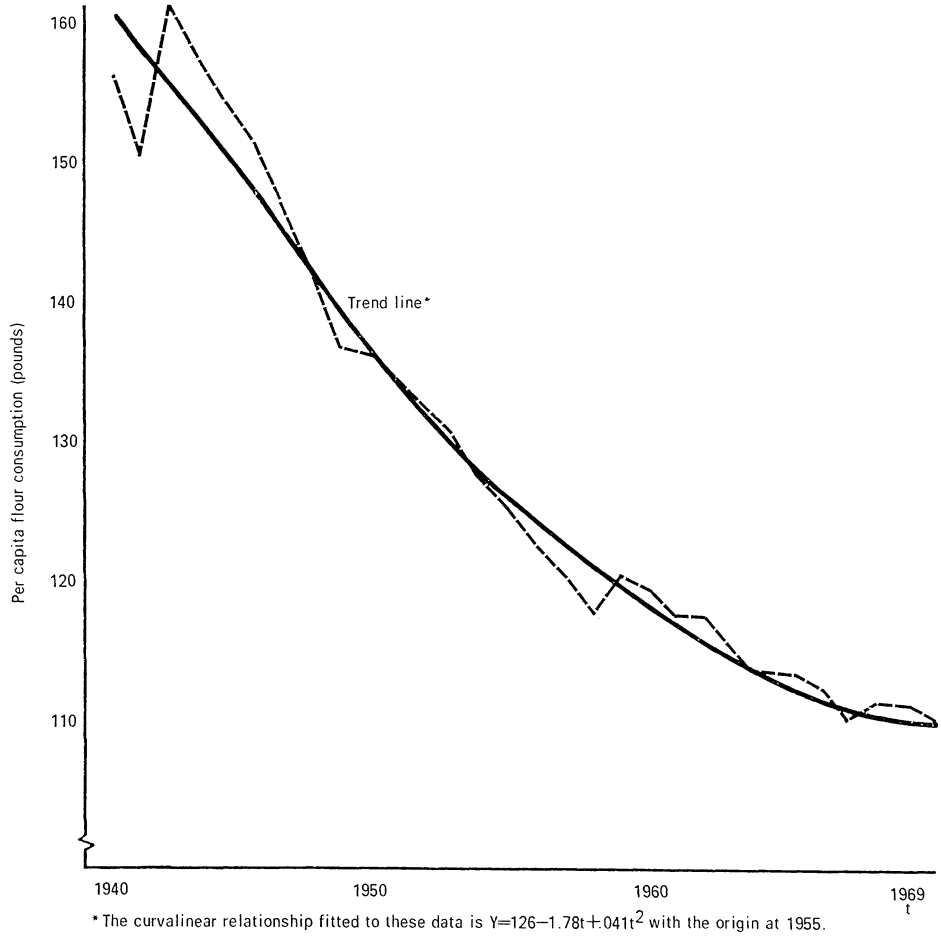
From 1940-69, per capita flour consumption declined an average of 1.80 pounds per year (figure 1). Increases in the price of flour, increasing incomes, population shifts, changes in income distribution, and changing tastes and preferences are all factors that have caused this rather drastic decrease.

The largest factor contributing to the decline in flour consumption has been the steady annual increase in per capita income — approximately $36 per year (figure 2). During this period, changes in income accounted for 80 percent of the variation in per capita flour consumption, and, for every 1 percent increase in per capita income, per capita flour consumption decreased .5 percent[3]

Changing flour prices have no doubt influenced flour consumption, but apparently they have not had a substantial impact on the decreasing demand for flour (table 1). In addition, population shifts from rural farm to rural nonfarm and urban areas, which have the effect of increasing incomes, changing tastes and preferences, and changing income distribution patterns, also have had an effect on flour consumption, but are very difficult to measure.[4] For these reasons and because increasing incomes explain most of the variation in flour consumption, only income is used here to estimate the future domestic demand for flour.[5]

The Population Research Center in Washington, D.C. estimated the compound annual population growth rate in 1968 to be 1.1 percent. If this growth rate continues, U.S. population in 1975 will be approximately 217,000,000. And, if the annual trend in increasing income continues, per capita disposable income will be in the neighborhood of $2,600 in

[1] *Food from Farmer to Consumer*, NCFM, p. 91.
[2] In this report, flour refers to white wheat flour.
[3] This estimate of the income elasticity of demand for flour was obtained by regressing the log of consumption on the log of income from 1940-69.
[4] Another factor, prices of related products, normally would be considered, but Brandow has shown in his *Interrelations Among Demand for Farm Products* . . . (Penn. State Univ. Bull. 680, 1961) that there are no close substitutes for white wheat flour.
[5] The demand model used for estimating the demand for flour was the Ohkawa equation, where the increase in flour consumption is equal to the change in population growth plus the product of changes in per capital income and the income elasticity of demand for flour.



*The curvalinear relationship fitted to these data is $Y=126-1.78t+.041t^2$ with the origin at 1955.

Figure 1. Historic changes in per capita flour consumption, 1940-69 (source: *The Northwestern Miller*, Jan. 1970, p. 20).

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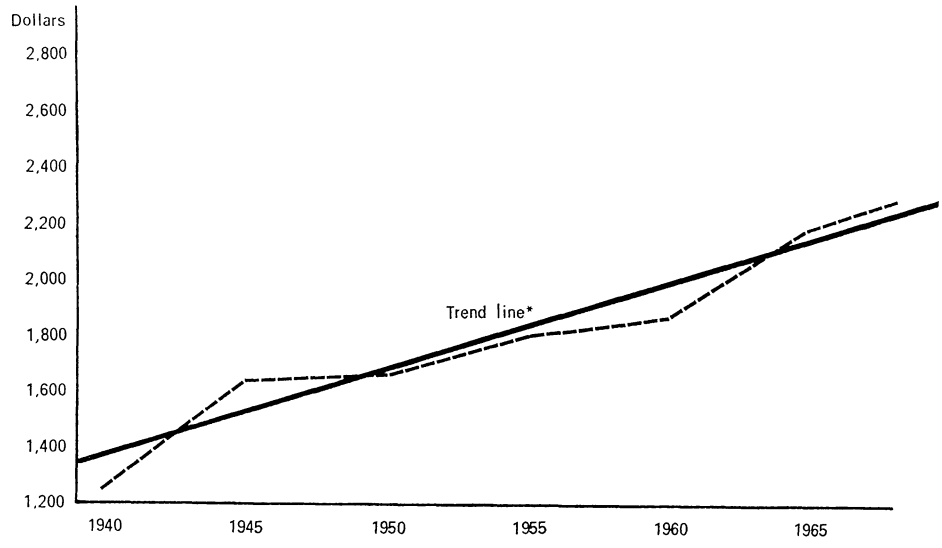

*The equation of this trend line is Y=1,272+36t. The regression coefficient is significant at the .999 level and the R^2=.93.

Figure 2. Historic changes in per capita income, 1940-68 (source: *Statistical Abstracts of the United States*, U.S. Department of Commerce).

1975. Using the —.5 income elasticity of demand for flour mentioned earlier, projected per capita consumption is 108 pounds per person per year 5 years from now. Multiplying this times estimated population, the total domestic demand will be 234,360,000 hundredweights (cwt.) in 1975.

EXPORT DEMAND

U.S. export totals indicate that exports typically have varied from approximately 10 to 20 percent of domestic consumption, with no historic trend being evident. While these totals do vary, changes do not appear to be erratic, as high and low levels generally are maintained for 3-4 years (table 1).

Wheat flour exports by major producers from 1952-68 (table 2) indicate that in recent years the major flour exporting countries (the United States, Canada, and Australia) have been supplying proportionally less to total world flour exports.

Table 3 shows what the total 1975 demand for U.S. flour will be, given the above projected domestic demand, under high, low, and average export demand assumptions. The implications of these figures will be discussed later.

DOMESTIC PRODUCTION

While changes in flour production are somewhat irregular, there was a general trend of increasing production from 1950-64, then a sharp decline with a subsequent increasing trend again in recent years. The decrease from 261,663,000 cwt. in 1964 to 250,384,000 cwt. in 1965 was due almost entirely to the closing of 9 of 17 General Mills plants that year.

A comparison of the changes in the number of mills (table 4) shows that although there has been a 33.6 percent decrease in the number of mills from 1950-68, average mill capacity has increased by 41.3 percent.

Transportation

Of the 18 new plants built from 1940 to 1965, 7 replaced old and/or destroyed facilities. Where new, other than replacement, mills are being built, the trend is toward locating them in areas of consumption rather than in areas of grain production. The reason, as pointed out by the NCFM and a recent marketing research report from the U.S. Department of Agriculture,[6] is the present disparity between rail costs for shipping wheat and flour. Until the late fifties, rail costs were the same for shipping wheat and flour, which provided an incentive for mills to locate near producing areas. In recent years, however, truck-barge transportation from some of these points has become cheaper than rail. Cost-reducing technology then was introduced for bulk rail wheat shipments, causing a reduction in rail rates for wheat. However, rates for flour have not been changed, providing an incentive for millers to relocate away from producing and transshipping centers to flour marketing centers.

Transportation rates for wheat that are below the corresponding rates for flour will not result in a complete relocation of mills because of the limited opportunity for millfeed disposal in urban areas. In the future, new mills probably will relocate at intermediate points adjacent to population centers where the benefits of lower wheat rates are available and where the backhauling of millfeeds can be avoided.

[6] *Regional and Sectoral Analysis of Wheat Flour Economy: A Transportation Study.* U.S. Dept. of Agr., ERS Mkt. Rpt. 858, 1969.

New Technology

Plant capacity expansion has resulted from the apparent economies of scale of plant expansion (figure 3).

Part of the improved efficiency of larger mills is the result of new technology. A recent innovation has been pneumatic handling of wheat and flour particles, which has the advantage of increasing efficiency through cooler sifting, in addition to saving on plant space. Another technological innovation that has been adapted in recent years is the impact grinding and air classification system. Within practical limits, it has made possible the production of cake flour from hard wheat and bread flour or high protein flour from soft wheat. Application of this process theoretically frees the miller from his dependence on dif-

Table 1. U.S. flour consumption, production, exports, and prices, 1952-68

Year	(1) U.S. domestic consumption	(2) U.S. exports	Total U.S. consumption	(2)÷(1)	Total U.S. production†	Flour prices‡
	thousand cwt.*			percent	thousand cwt.	dollars
1952	208,300	20,897	229,197	10.03	228,148	5.74
1953	205,800	17,444	223,244	8.47	222,177	6.36
1954	205,500	16,888	222,388	8.21	221,405	6.82
1955	204,900	21,548	226,448	10.51	225,648	6.22
1956	205,600	24,801	230,401	12.06	229,758	6.04
1957	205,400	33,989	239,389	16.54	238,888	6.10
1958	213,300	35,132	248,432	16.47	248,004	5.68
1959	213,800	37,152	250,952	17.37	250,568	5.44
1960	213,500	43,082	256,582	20.15	255,141	5.36
1961	217,300	43,311	260,611	19.93	260,316	5.70
1962	214,800	47,178	261,978	21.96	262,069	5.92
1963	215,900	44,443	260,343	20.58	260,007	5.52
1964	219,700	42,278	261,478	19.28	261,663	5.68
1965	220,100	30,317	250,417	13.77	250,384	6.01
1966	220,200	33,091	253,291	15.02	253,000	6.46
1967	224,500	21,057	245,557	9.37	245,240	...
1968	225,000	28,074	253,074	12.44	254,079	...

* Source: U.S. Department of Agriculture and other official agencies, compiled by Millers National Federation.

† Source: *Southwestern Miller*, Vol. 47-49, Feb. 1969.

‡Flour prices for Minneapolis Spring Wheat Standard Patent. Source: *Agricultural Statistics*, 1952-1969.

Table 2. Wheat flour exports by major producers, selected years*

Year	United States	Canada	Australia	Other countries	World total
			thousand cwt.		
1953	17,444	21,843	17,393	12,950	69,630
1956	24,801	16,822	15,009	19,540	76,172
1959	37,152	16,580	10,921	25,800	90,453
1962	47,178	12,991	19,646	26,850	97,665
1965	30,317	14,831	9,533	32,300	87,000
1966	33,091	16,142	6,446	29,000	85,000
1967	21,057	12,283	9,005	50,000	92,000
1968	28,074	11,228	7,875	45,000	82,000

* Source: U.S. Department of Agriculture and other official agencies, compiled by Millers National Federation.

Table 3. Projected total demand for U.S. flour in 1975 under low, average, and high export assumptions (cwt.)

Projected domestic demand, 1975	Estimated export demand, 1975			Total estimated demand for U.S. flour		
	Percent of U.S. consumption			Export assumption		
	Low (10 percent)	Average (15 percent)	High (20 percent)	Low	Average	High
234,360,000	24,190,000	36,285,000	48,380,000	258,550,000	270,645,000	282,640,000

ferent wheats. In reality, however, there is a problem in finding a market for the larger volume of low protein fractions at prices sufficient to justify installation of the special equipment. There are potential savings, nevertheless, as this new method eliminates a costly machine, the purifier, from the mill flow.

From 1960-65, the NCFM reported that 25 pneumatic and 4 air classification milling units were installed.

Future Production

If the number of mills were to continue to decline from 1968-75 as they have from 1963-68, there would be approximately 213 mills producing more than 98 percent of the nation's flour in 1975. If at the same time the present rate of increasing plant capacity continues at 2 percent per year, average mill capacity will be close to 3,800 cwt. daily. Assuming a 300-day running year (an average of 5.76 days per week), this capacity would amount to an annual production of 241,680,000 cwt. per year, which is considerably below the total estimated demand under the low export assumption. If the number of mills were to decline at a slower rate of 1 percent per year, half of the recent historic trend, there would be approximately 232 mills that could produce 264,480,000 cwt. in 1975. This production estimate falls about halfway between the low and average export assumption. If the number of mills were to remain constant at the present number, 250, annual production in 1975 would be approximately 285,000,000 cwt., which would more than meet the total demand under the high export assumption.

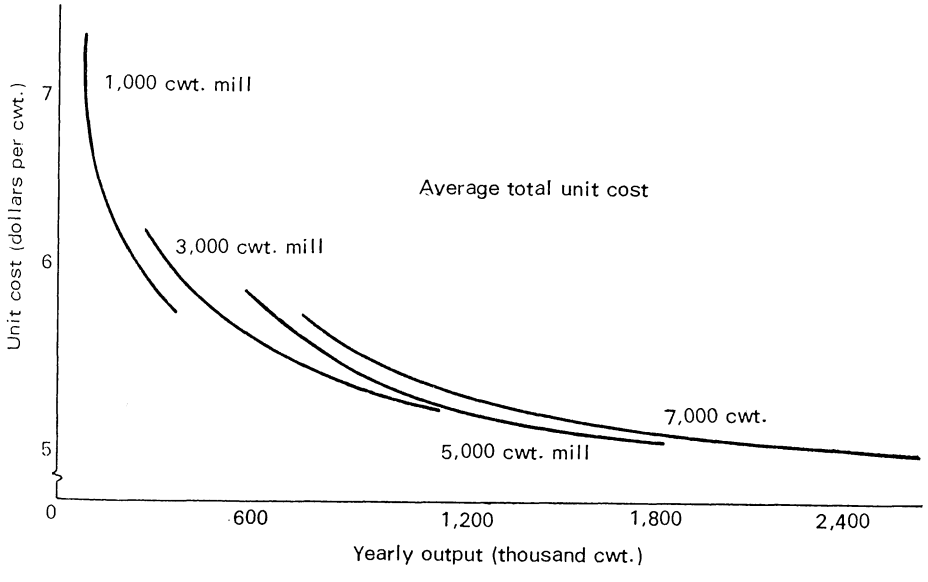

Figure 3. Shortrun cost curves for wheat flour mills of 1,000; 3,000; 5,000; and 7,000 cwt. daily capacity, 1963 (source: Haskell and Walsch, "Economies of Plant Size in Flour Milling," *The Northwestern Miller*, Feb. 1969.

Table 4. Concentration of U.S. flour mills by size, 1950-68*

Daily mill capacity, cwt.	1950	1958	1963	1968
401-1,600	193	117	108	85§
1,601-4,000	117	86	82	65§
4,001-6,000	30	39	40	41§
6,001-over	37	43	52	59§
Total number mills†	377	285	282	250
Average daily plant capacity, 24-hour cwt.‡	1,989	2,233	3,073	3,388

* Source: Bureau of Census, U.S. Dept of Commerce.

† Omits daily capacity of an unknown number of small mills 400 cwt. daily capacity or less. In 1968, this was less than 2 percent of total production.

‡ These figures assume 300 running days per year.

§ Estimated.

SUMMARY

Per capita flour consumption has decreased substantially in the last 20 years, due in large part to steady increases in per capita income. During this period, there also has been a decrease in the number of mills, with the remaining mills increasing their capacities to take advantage of economies of plant size. Up until 1965, the net result was that total production increases were greater than the net increase in domestic and foreign demand. This problem was alleviated to a large degree by the closing of several General Mills plants in 1965.

If the U.S. milling industry faces an average or somewhat less than average export market during the first half of this decade, there apparently will have to be a slowdown in the rate of decline in the number of mills, assuming that the present rate of average increase in plant capacity continues, if projected U.S. demand for flour is to be met. ■

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IN PERSPECTIVE

Food Product Development

D. C. Dahl and K. E. Egertson*

In face of the declining per capita consumption of many cereal and crop products, milling companies and other food manufacturers have been experimenting with product development strategies in an attempt to increase the consumption of their products.

These activities take several forms, but prominent among them are changes in the physical form and texture of the product and changes in the flavor and nutritive value of the food product itself.

Much past product development activity by food processing firms, particularly cereal and crop milling firms, has been limited to (1) maintaining the physical form and flavor of the "old" product, (2) maintaining the physical form but changing the flavor or taste appeal, and (3) shifting to the production of a convenience product while maintaining flavor. More recently, increased activity has been apparent in (4) substantially changing both the physical form and texture and the flavor of the original "old" product.

Activity in the first category has presented problems to food manufacturing firms, either because of consumers' changing eating habits or because of the product development strategies of competitors.

Product development in breakfast foods illustrates the activities taking place in the second category. The physical form and texture are largely the same, with changes in flavor and taste receiving the most emphasis.

One of the most striking examples of success in the change of the physical product to meet changing consumer preferences (the third category) is in the potato industry.

Potato consumption declined generally from 1928-58. But in 1950, due to the substantial efforts of food processors, potatoes were reintroduced into Americans' diets in different forms. The initial development was potato chips. The chip and dip fad became prevalent in a society that was switching its eating patterns from earlier in the day to evening.

Following this, potatoes were put into various flakes and bud forms to ease preparation. Presently, of course, potatoes also are available in a variety of frozen forms. The result of these efforts by food processors has been to reverse the downward trend in potato consumption. In recent years, there has been an overall increase in per capita consumption of potatoes.

Many milling and other processing firms have tried in recent years to change the taste and flavor as well as the physical forms of their grain products (fourth category). Their attempts have been to imitate products that are experiencing increasing demand. One example is the recent effort to develop spun protein from soybeans in an attempt to imitate fresh meat and meat products.

The eventual impact of these new products on the food industry is uncertain. Some clues may be provided by experience with product development in other substitute products and past activities in the fourth category. Consider the case of margarine and butter.

Per capita consumption of margarine surpassed per capita consumption of butter in the United States in the late fifties. This substantial increase in margarine consumption has been attributed to a substantially lower price relative to butter, margarine's near perfect imitation of butter, and the medical profession's endorsement of this type of product for people who want to restrict saturated fat intake in their diets.

Considered in relation to meat and fluid milk, these factors suggest some of the obstacles that have to be overcome in order to market such products.

For meat, a major question will be the ability of the new spun protein products to duplicate the form and texture of meat. On a flavor basis, many of these products already are equal to meat. On a form basis, imitation is not as easy. However, it also is both difficult and expensive to promote and advertise a new product. Therefore, if a competing product has an increasing demand and good consumer acceptability, it often is less expensive to try to duplicate it. This appears to be the case with synthetic meat products.

The initial costs of recovery on chemical research may cause prices of spun protein to be modestly high, but for long term and large-scale production, substantial cost reductions may be possible. We may find once again that there are less expensive ways to change physical form and flavor of a grain product than running the cereal grain products through animals. The question of whether it is successful or not will depend in part on the efficiency a livestock producer can achieve in converting grain to meat and on product acceptability by the consumer.

To meet changing consumer demands and eating habits, food processors will produce the foods consumers want at the lowest possible price and in the form that is most acceptable to them.

These future product development activities will mean new challenges for livestock producers and a number of interesting products for consumers. ■

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