Economic Organization of
The U.S. Feed Manufacturing Industry

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FOREWORD

This study of the feed industry would not have been possible without the extensive cooperation of a large number of persons associated with the feed industry who have closely followed the changes in this industry over many years. In addition to the persons cooperating in our survey, we want to express appreciation to Lee Schrader for interviewing managers at two companies for us, and to three industry reviewers, Ed McMillan, Norman Coats, and Marvin Laursen. Dale Dahl and Robert Wills provided very useful suggestions, as well. The authors retain responsibility for the views expressed and any errors that remain.
Introduction

Since its emergence as an outlet for by-products of the grain and livestock processing industries in the 1890s, feed manufacturing has become an important component of the agricultural sector in the United States. The feed industry is both a major supplier of production inputs and a major purchaser of farm products. Although this dual role is shared by other agricultural supply industries such as the seed industry, none approach the magnitude or relative importance of the feed industry in either role.

The manufactured feed industry produces some or all of the components of the feed used by most domesticated animals and birds in the United States. While most pasture and roughage and some feed grains are produced on the farm or ranch, purchases of feedstuffs from other sources were over 21 billion dollars in 1982. Of that amount, over 4 billion dollars were spent for pet foods, and over 17 billion dollars were spent for livestock and poultry feeds.

The structure and relative magnitude of the livestock and poultry industries have changed significantly over the last two decades. The size and technological sophistication of production enterprises has increased dramatically. The poultry industry has become concentrated in the hands of very large producers, often linked closely to input suppliers or processors through ownership or contractual arrangements. A small number of very large feedlots now account for a very large proportion of cattle feeding in the United States. Other parts of the livestock and poultry sector have had similar but less dramatic patterns of change. In addition, the growth in meat consumption has slowed dramatically in recent years, suggesting that we may be approaching "saturation" levels in total meat and poultry consumption.
Poultry products' share of the meat market has increased dramatically due to relative price advantages and, to some degree, health concerns about red meats.

Since the manufactured feed industry could be significantly influenced by the changing demands for meat and poultry products and the changing structure of livestock and poultry production enterprises, we undertook a study of the economic structure of the manufactured feed industry supplying the livestock and poultry industries.*

This involved investigating a) the location and market shares of the major competing firms, b) the industry's product mix, c) distribution systems, d) technological innovation and new product development, e) pricing, advertising and promotion strategies, and f) industry performance to the extent that information is available. For each of these areas, we analyze the primary changes occurring, evaluate the likely causes of these changes and consider their implications for the industry in both the near and distant future.

The analysis draws heavily from personal interviews in 1983 and early 1984 with marketing managers, market analysts, and a few nutritionists in 12 feed companies which typically account for approximately 30 percent of livestock and poultry feed sales in the U.S. In addition to this survey of approximately half of the largest feed companies in the U.S. (on a confidential, not for attribution basis), we draw extensively from secondary data published by government agencies (the U.S. Department of Agriculture,

*While the pet food industry has some overlap with the livestock and poultry feed industry (primarily the same largest supplier—Ralston Purina—and similar production technology for some products) the customers, size of product, distribution systems, advertising and promotion, and brand differentiation are quite different; consequently, the pet food industry is not considered in this report.
Bureau of Census, and the Federal Trade Commission), information in industry publications (e.g., Feedstuffs and Feed Management magazines), and a few interviews with smaller feed companies, feed industry suppliers, and market research organizations.

**Feed Industry Overview**

Feed for livestock and poultry is a major component of total production expenditures on U.S. farms. Table 1 shows these data for recent years. Feed is the largest category of farm expenditures in all years except 1979 when it was second to purchases of livestock and poultry. The slight downward trend in the percentage of expenditures accounted for by feed since 1973 was caused by increases in interest, rent and farm service expenditures rather than a decline in the prices or amount of feed purchased by farmers. This downward trend will likely continue.

The evolution of the primary livestock and poultry industries which purchase feed has had a significant impact on the functions performed by and products demanded from the feed industry during the last twenty years. The swine, dairy, poultry, and the cattle-feeding industries now consist of a smaller number of larger, more specialized and sophisticated producers. In addition, changes in production technologies (growth stimulants, hybrid animals, feed mixing equipment on the farm, etc.) have affected the type and quantity of feed demanded.

The most extreme changes in size and number of producers have been in cattle feeding and poultry production. In 1984, feedlots feeding over 1,000 head (only 3 percent of all feedlots) marketed 81 percent of all fed cattle marketed in the leading 13 states, compared to 46 percent in 1965. At the same time, a higher percentage of cattle feeding is now being done in Texas, Kansas, Nebraska, and Colorado, with less in the rest of the Cornbelt and California (Aldinger).
<table>
<thead>
<tr>
<th>Year</th>
<th>Feed Expenditures (Million Dollars)</th>
<th>Feed Percent of Total Farm</th>
<th>Year</th>
<th>Feed Expenditures (Million Dollars)</th>
<th>Feed Percent of Total Farm</th>
<th>Year</th>
<th>Feed Expenditures (Million Dollars)</th>
<th>Feed Percent of Total Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>89,247</td>
<td>18.2</td>
<td>1976</td>
<td>89,220</td>
<td>15.8</td>
<td>1978</td>
<td>68,921</td>
<td>16.4</td>
</tr>
<tr>
<td>1973</td>
<td>114,255</td>
<td>14.5</td>
<td>1979</td>
<td>114,216</td>
<td>9.4</td>
<td>1980</td>
<td>134,740</td>
<td>17.4</td>
</tr>
<tr>
<td>1972</td>
<td>177,999</td>
<td>13.3</td>
<td>1981</td>
<td>130,940</td>
<td>13.3</td>
<td>1982</td>
<td>128,348</td>
<td>13.6</td>
</tr>
<tr>
<td>1971</td>
<td>105,942</td>
<td>14.7</td>
<td>1983</td>
<td>104,379</td>
<td>11.7</td>
<td>1984</td>
<td>97,653</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Source: USDA Farm Production Expenditures, various issues.
Consumption of poultry meat has doubled since 1960, while egg consumption dropped. Commercial broiler production has long been almost completely vertically integrated by ownership (10 percent) or contracts (88 percent) and turkey and egg production have become extensively integrated too, often with feed companies as the integrator or contractor (Lasley). In addition, the number of farms producing poultry has dropped, and the largest producers now account for a large share of total production. The largest 47 companies accounted for over one-third of all layers in 1980, 36 percent of broiler producers accounted for 81 percent of production in 1978, and 304 farms sold half of the turkeys in 1978. The increasing concentration of poultry production in the South and beef feedlot operations in the Great Plains also has caused some significant changes in regional demand for their feed industry suppliers.

Different species of livestock and poultry have widely different nutritional requirements and nutrient utilization capabilities. Many species vary significantly in size, and their corresponding feed requirements for body maintenance, growth and production of meat, milk or eggs. Consequently, farmers' feed purchases vary from totally unprocessed forms such as pasture to the highly processed, mixed feed formulations which are the focus of this study.

Feeds are divided into two broad categories, concentrates and roughages. Concentrates are those feeds high in total digestible nutrients (grains, oilseeds, animal proteins and by-product feeds) while roughages are lower in digestible nutrients and high in fiber (pasture, hay and silage). Concentrates are subsequently broken into two categories, high energy (relatively high carbohydrate content) and high protein. Corn is the major high energy concentrate while soybean meal is the major high protein concentrate in the U.S.
These feedstuffs are used in a variety of ways to meet the nutritional requirements of different species. Since neither poultry nor swine can efficiently digest large amounts of roughages, their diets are primarily composed of concentrates, both high protein and high energy. Cattle and sheep, being ruminants, can utilize roughages for energy production and protein synthesis; consequently, they are fed a mixture of roughages and concentrates. Relative quantities of concentrates and roughages in ruminant diets vary with the animal's age, the intended function (e.g. breeding, meat or milk production) and the time of year. The relative importance of each species in concentrates and high protein feed consumption are illustrated in Figures 1 and 2. Table 2 shows the changes in the species consumption breakdowns from 1973 to 1983. Note the marked decline in both feed categories for beef cattle in feedlots and the increases for broilers and turkeys. Both 1973 and 1982 were years of high cattle and hog numbers, so they are roughly comparable.

The livestock and poultry feed industry's primary function is the production of concentrate rations by blending various feedstuffs. The industry's output is mixed formula feed products which are either fed directly to livestock or poultry as their entire feed source, or further processed and/or mixed with other feed ingredients (usually grains and/or soybean meal) on farms prior to being fed. Soybean processors or other producers of high protein feeds are not considered feed manufacturers in this study unless they use these products to produce a formulated feed. The feed manufacturing industry handles only a small amount of roughage because it cannot be economically transported over appreciable distances due to its high bulk.

As the primary customers for feed grains and oilseed products, the livestock and poultry industries, and the feed manufacturing industry
Figure 1: Concentrate Consumption by Species, 1982

By Species:

- Hogs (26.67%)
- Dairy Animals (18.30%)
- Turkeys (3.14%)
- Hens & Pullets (12.20%)
- Other livestock (5.58%)
- Other Beef (6.16%)
- Broilers (9.44%)
- Cattle on feed (18.01%)

Source: Feed Outlook & Situation, November, 1982, USDA, ERK, Washington, D.C.
By Species, 1982

Figure 2: High Protein Feed Consumption
Table 2. Percentage of Total Concentrate and High Protein Feeds Fed by Species, 1973 and 1982.

<table>
<thead>
<tr>
<th>Species</th>
<th>--Total Concentrates--</th>
<th>-----High Protein-----</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>15.95</td>
<td>18.30</td>
<td>10.16</td>
</tr>
<tr>
<td>Cattle on Feed</td>
<td>28.91</td>
<td>18.01</td>
<td>9.09</td>
</tr>
<tr>
<td>Other Beef Cattle</td>
<td>9.05</td>
<td>6.16</td>
<td>4.81</td>
</tr>
<tr>
<td>Hens and Pullets</td>
<td>10.98</td>
<td>12.20</td>
<td>17.65</td>
</tr>
<tr>
<td>Broilers</td>
<td>5.72</td>
<td>9.94</td>
<td>14.97</td>
</tr>
<tr>
<td>Turkeys</td>
<td>2.23</td>
<td>3.14</td>
<td>8.02</td>
</tr>
<tr>
<td>Hogs</td>
<td>21.85</td>
<td>26.67</td>
<td>23.54</td>
</tr>
<tr>
<td>Other Livestock</td>
<td>5.32</td>
<td>5.58</td>
<td>11.76</td>
</tr>
</tbody>
</table>

100.0  100.0  100.0  100.0

1 Includes oilseed meals, animal and grain proteins. Non-protein nitrogen such as urea is not included.

Source: Feed Situation, November 1978 and Feed Outlook and Situation, November 1982, USDA, ERS, Washington, D.C.
serving them, play an important role in the grain industry. In the 1982-83 marketing year (October 1982 - September 1983), 147.8 million metric tons of corn, barley, oats and grain sorghum and 19.2 million metric tons of oilseed meals were fed to livestock and poultry. This represented 58 percent of feed grain use (exports account for 21 percent) and 75 percent of oilseed meal use (exports account for 25 percent). Of the 187.7 million metric tons of total concentrates fed in 1982-83, the feed industry formulated 95.3 million metric tons or approximately 50 percent of the total. Farmers' expenditures on mixed formula feed from 1973 through 1982 typically accounted for well over one-half of their total feed expenditures.

The feed industry also plays several important roles in the rural economy—as a supplier of jobs, a consumer of capital goods and a taxpayer. Feed plants are typically found in or near the location of their primary customers—producers of beef, pork, milk, poultry and eggs. Figure 3 shows the geographic dispersion of feed manufacturing plants in 1984.

The export market for livestock and poultry feeds is not large, whether viewed relative to feed industry sales or U.S. exports of feed grains and oilseeds and their products. Total exports of feeds and fodder in 1982 was only $1.038 billion, or 5.9 percent of purchases by U.S. farmers. These exports accounted for only 5.3 percent of feed grain and soybean exports. Prepared feeds accounted for only $113 million, about one ninth of total feed and fodder exports.

Larger production units, advances in feed processing technology, and increased producer knowledge of both new technology and animal nutrition have made on-farm feed formulation economically and technically feasible in many instances. The result has been reduced sales of commercially mixed feeds.
Figure 3. Number of feed mills in each state, 1984

Source: Agricultural Stabilization and Conservation Service, U.S. Department of Agriculture
Table 3 shows the number of farms reporting expenditures for livestock and poultry feed and commercially mixed formula feeds as well as the percentage of farms purchasing commercial feeds for selected years. Note the dramatic decrease in both the number and percentage of farms buying commercially mixed feed between 1974 and 1978. The decline was much smaller in the 1978-1982 period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Feed for Livestock and Poultry</th>
<th>Commercially Mixed Formula Feed Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>1,804,331</td>
<td>1,256,441</td>
<td>69.6</td>
</tr>
<tr>
<td>1974</td>
<td>1,538,275</td>
<td>1,156,474</td>
<td>75.2</td>
</tr>
<tr>
<td>1978</td>
<td>1,614,036</td>
<td>733,398</td>
<td>45.4</td>
</tr>
<tr>
<td>1982</td>
<td>1,360,243</td>
<td>603,502</td>
<td>44.4</td>
</tr>
</tbody>
</table>


As the number of farms purchasing commercially mixed feeds have declined, the size of customers, measured in tonnage purchased, has increased. The 1978 Census of Agriculture shows that the percentage of all farms that purchased small amounts of commercially mixed feed declined, while the percentage of farms purchasing large quantities of mixed feed increased. This shift to larger purchases is likely the result of increasing size of livestock and poultry production units.

**Product Mix**

The feed industry has evolved in many ways in the last thirty years. One of the greatest changes has been in the mix of the products offered by feed companies.
Early feed manufacturers promoted complete rations as solutions to the needs of livestock feeders. This was a task that involved more than selling the product. Farmers first had to be taught that many traditional feeding methods failed to meet the animals' nutritional requirements and that complete rations would provide the nutrients needed to produce meat, milk and eggs more efficiently. As producers' knowledge of animal and poultry nutrition increased and the structure of livestock production changed, producers began asking for products which enabled them to use their home-produced grain to blend balanced rations. The first major change occurred in the 1950s when feed manufacturers introduced high-protein commercial supplement. In recent years, changes have continued as more farmers have begun using their own grinding and mixing equipment to mix their own grain with purchased oilseed meals and vitamin-mineral pre-mixes.

Complete feeds, supplements and premixes are three broad categories of manufactured feed products available today. Complete feeds are a ready-to-use product requiring no additional ingredients. Supplements contain all (or a substantial portion) of the protein, vitamins and minerals required in the final ration. These nutrients "supplement" the often-insufficient levels of protein, vitamins, and minerals found in feed grains in order to meet the animals' complete nutritional requirements. Supplements typically account for 15-30 percent (300-600 pounds per ton) of feed mixed by the producer. Premixes generally contain only vitamins and minerals (and sometimes limited amounts of protein) and comprise less than 100 pounds of a ton of feed. They typically are mixed with feed grains and a protein source (such as soybean meal) to provide the complete ration.

There is also a fourth category, micro-premixes, which usually represent approximately 5 pounds per ton. These are not considered in this study.
because they are most often sold to feed manufacturers rather than directly to livestock producers.

In each of these general product classes, most companies now offer formulations tailored to a certain size of animal or bird and production goal for each major species produced in their market area (e.g. pig starter, preconditioning rations for feeder cattle, etc.). This differentiation has paralleled research findings delineating the different nutritional needs for each type of livestock and poultry enterprise at each stage of the animal's life cycle.

Earlier, it was noted that livestock producers have become more knowledgeable about animal nutrition, and that better feed processing and handling equipment is now available for even relatively small operations to assist producers in applying this knowledge. In industry parlance, customers have become more "sophisticated", implying that they are more discriminating and demanding regarding product characteristics, and often have several feasible feed procurement alternatives (e.g. buy it, or make it themselves). The economic incentives to gain knowledge and adopt new technology have grown as the production units increased in size. Some large producers are able to buy ingredients in sufficient volume to secure prices which are competitive with feed manufacturers' purchases or use futures markets effectively to secure lower or assured prices long before actual use.

Larger enterprises, relatively efficient on-farm feed processing equipment and knowledgeable managers are the reasons for the most dramatic feed industry change of the last 20 years: the emergence and growth (in both volume and market share) of pre-mixes. This recent development applies especially to large swine and poultry enterprises in surplus grain producing regions. Pre-mixes require less out-of-pocket cash expense for producers who
grow grain, and reduce transport costs because grain does not have to be moved off the farm. Ease of handling, convenience, and the flexibility to develop unique feed formulations are other attractive features of pre-mixes. However, when users do not know the specific nutrient content of their grain and protein source(s), they may have problems using pre-mixes. And, in most cases, the user must buy sufficiently large volumes of oilseed meals to achieve bulk discounts and time purchases well to keep total feed costs equal to or below the cost of purchasing complete feeds from feed companies.

The use of supplements has also increased over the past 20 years, but not by as much as pre-mixes. Feed companies usually have better quality control capabilities than livestock producers and can often utilize multiple protein sources such as low-cost milling by-products more effectively than can on-farm feed mixers. These factors mean that supplements may offer a more uniform, higher quality finished feed which may be less expensive over time than one using pre-mixes. However, the ability of a feed company to better control the composition of complete feeds to more efficiently utilize by-products of food processors may be offset by other cost incurred by a large company (e.g., corporate overhead) or high profit margins built into its price structure.

In spite of the increased use of pre-mixes and supplements, complete rations are still a very important part of the feed industry's product mix, especially in grain deficit areas. Complete feed is the primary feed used in the broiler and layer industries, but it is typically produced in grower-owned mills or on a contract basis. Complete rations also are very important in the dairy industry and is usually provided by feed companies. Most feed companies believe they can formulate complete rations at a lower cost than can livestock and poultry producers unless the producers grow their own grain. This is due to lower raw material costs which arise from 1) the companies' purchasing
expertise and position as a large-volume purchaser of ingredients, 2) specialization and resulting production efficiencies and 3) expertise in using alternative feedstuffs such as milling by-products.

Estimates of the relative importance of each feed type in today's feed market varied and were often related to the regions and species served by each feed company. Our survey results indicate that purchased complete rations represent slightly less than 20 percent of feed tonnage fed nationally, supplements are used in approximately 55 percent of the feed fed, while pre-mixes are used in approximately 25 percent of the rations fed to livestock and poultry. A very small percentage of feed purchases involve either micro-pre-mixes or no manufactured ingredients (e.g., a scratch mix).

The catch-all category of "complementary products" is the final portion of the industry's product mix. It primarily consists of feed additives and animal health products. Most of these products are manufactured by pharmaceutical (e.g. Eli Lilly & Co.) or chemical companies (e.g. American Cyanamid) but a large number are marketed through feed companies and dealers. Table 4 shows estimated sales at manufacturer prices of these products. Being highly differentiated and proprietary products (due to patents and strong brand franchises), these products have long been a source of relatively high profits to both the original manufacturers and the feed industry. But, as more close substitutes are introduced by competing firms, they have become less profitable.

The use of many of these products in feed requires precise equipment, exact labeling and record-keeping, and stringent quality control due to regulation by the Food & Drug Administration. The rigidity of FDA controls on feed additives and pharmaceuticals corresponds closely to a company's product mix. For example, a pre-mix manufacturer using a drug must be very precise
Table 4. Animal Health Product Sales

<table>
<thead>
<tr>
<th>Class</th>
<th>1982</th>
<th>1977</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>$ 681.0</td>
<td>$ 306.2</td>
<td>236.4</td>
</tr>
<tr>
<td>Feed Additives</td>
<td>1,071.2</td>
<td>807.6</td>
<td>329.1</td>
</tr>
<tr>
<td>Antibacterials</td>
<td>248.5</td>
<td>151.0</td>
<td>NA</td>
</tr>
<tr>
<td>Nutritional</td>
<td>603.6</td>
<td>505.0</td>
<td>NA</td>
</tr>
<tr>
<td>Other</td>
<td>219.1</td>
<td>151.6</td>
<td>NA</td>
</tr>
<tr>
<td>Biologicals</td>
<td>149.7</td>
<td>91.8</td>
<td>66.8</td>
</tr>
<tr>
<td>Total</td>
<td>$1,901.9</td>
<td>$1,206.0</td>
<td>632.3</td>
</tr>
</tbody>
</table>

Source: Animal Health Institute
and keep accurate records of the drug's use. But a company using the drug-containing supplement to mix a complete ration must only follow the label directions and needs no special equipment or records. Due to these requirements, many feed companies (especially small ones) let specialized suppliers do the initial blending of "controlled" ingredients.

Feed additives, whether they are growth promoters, antibiotics or even flavorings, have led to a proliferation of new products or product variations offered by feed manufacturers in recent years. As each new additive has become available, many feed manufacturers have added several (sometimes many) new products to satisfy producers wanting the same basic feed with different additives. This proliferation of products is, at best, expensive and, at worst, almost unmanageable because of the large increases in product inventories and separate production runs required. Two major companies, Moorman Manufacturing Company and Farmland Industries, have recently introduced simplified product lines consisting of basic supplements and premixes and separate additive packets.

Individual feed companies offer product mixes which reflect the demands for feed products in their primary markets. One company may concentrate its effort on swine pre-mixes in the Midwest while another produces beef supplements in the High Plains and yet another specializes in complete dairy rations in the Lake States. Though some specialization does exist, most of the larger companies offer all three feed types. There are two major exceptions. Ralston Purina manufactures no pre-mix products. Its stated philosophy is to control as much of a ton of feed as possible in order to assure customers of high quality. Other industry participants point out, however, that Purina has a large number of large plants; any Purina emphasis on pre-mix production and sales would significantly decrease tonnage and idle
a great deal of this plant capacity. The other exception is Vigortone which specializes in pre-mixes, its initial business. It has not deemed it desirable to expand further than a small investment in the supplement business due to the large investment in plant and equipment which would be required to produce complete feeds or supplements.

**Relevant Market**

To appraise the competitive structure and behavior of a market, its product and geographic characteristics must be examined and its boundaries must be defined. The determination of the precise boundaries of a market involves specifying those products and plant locations which are close substitutes or strong competitors, respectively. To do this accurately and unambiguously in the feed industry is quite difficult.

Scherer (1980) states that the "ideal definition of a market must take into account substitution possibilities in both consumption and production." Firms are deemed competitors in a market if a) their products are good substitutes for one another in the eyes of buyers or, b) the firms employ similar skills and equipment and thus can quickly move into each other's product lines if the situation should warrant such action.

There are three possible criteria by which feed markets might be delineated. They are 1) product type, 2) the species being fed, and 3) the geographical location of the customers served by the plant or firm.

All of the product types (complete rations, supplements and pre-mixes) are available for the major livestock species. Different product types have correspondingly different equipment requirements for on-farm use. Producers using pre-mixes need grain and oilseed meal storage space and feed processing and handling equipment. Supplement users need similar processing equipment, the same handling equipment, and may need only grain storage. Users of
complete feeds need no feed processing equipment and little storage space, especially if the feed is delivered directly to the production unit. In the short run, a producer using complete rations cannot readily substitute supplements or pre-mixes due to the additional equipment required. But, a user of pre-mixes can easily substitute either supplements or complete feeds. Likewise, a supplement user can switch to complete feeds if relative prices make it attractive. In the long-run, however, the feed types are highly substitutable. Producers can acquire needed equipment and, if their decision is correct, recoup their investment through price advantages that may occur.

Therefore, there are few barriers to substitution among feed types, and these barriers are not very restrictive. For this reason all the basic product types are considered to be within the same relevant market, even though there may be some short run restrictions to substitution.

The second possible criteria is the species of livestock or poultry fed. Producers of beef cattle will not switch to using poultry feeds or vice versa. Therefore, from a producer's view, each species comprises a separate market for manufactured feed even if more than one species is produced on the same farm. However, feed companies can usually produce feed for almost any species produced in their geographic market area, and may not view their markets as being delineated by species of livestock except for short term pricing decisions, etc. on each product line. Given this ease of movement on the part of feed companies, the livestock species for which a feed is formulated is not a primary factor which can be used in delineating the competitive market for manufactured feed in the intermediate or long run.

Geographic location is the third proposed criteria for market delineation. There are hundreds of feed plants dispersed throughout the United States. These location differences cause transport costs for both
inputs and products to differ for various input supplier-feed manufacturer and feed manufacturer-livestock producer pairs. Differential transport costs and the presence of competitors somewhere "down the road" place economic limits to the market served by any given plant (see Bressler and King, 1970, p. 126). These limits change as prices and transport costs change and vary greatly with respect to product type.

The feasible geographic market for pre-mixes is the largest of the three feed types due to its lack of bulk relative to its value. Industry participants estimate that pre-mix plants can service customers within a radius of 600-800 miles. Supplement plants can effectively serve a 300-400 mile radius, while complete feed producers can usually only service customers within a 100 mile radius of the plant.

A feed company, therefore, faces as many geographic markets as it has product types and plants. For instance, Ralston Purina, Nutrena and Moorman, though considered "national" companies, operate in different, but overlapping, "regional" markets for pre-mixes, supplements and complete feeds from each plant. Each "regional" market consists of a group of "local" markets which are serviced by the major national and regional companies' dealers or representatives and independent local manufacturers. Local manufacturers will primarily produce complete feeds, whether from their own formula or using a national or regional company's supplement or pre-mix. One or two species may be the dominant customers of a given local market. The only product type which faces a market approaching "national" stature is pre-mixes. This is exemplified by Vigortone (specialized in premixes) supplying the entire country from three plants.

Thus, the primary determinant of the relevant market for this analysis is geographic customer service area, which varies by product type. Most
companies produce feed for each major species within a given geographic market. Therefore, discussions of market structure will emphasize the market shares of competing firms in various geographic markets for livestock and poultry feeds.

**Market Shares**

The relative size of competing firms in the major feed product classes and geographic market areas may offer some insights into the firm's potential market power. Thus, available information on the market shares held by the largest feed companies in various livestock and poultry feed markets, product classes and regions will be examined.

Responses to our survey showed that feed companies use many different measures of relative size. Not surprisingly, the criterion selected seems to be influenced by the "perspective" which ranks the respondent's company highest. For example, companies manufacturing complete or supplement feeds more often based their rankings on tonnage or dollar sales volume. Pre-mix companies prefer to rank companies based on the number of livestock using their feed (the proportion of the livestock population's vitamin, mineral, or protein needs supplied by the company). Since a small tonnage of premix would provide specific nutrient needs of a large volume of livestock or poultry, the rankings and market shares of companies under each volume measurement system differ dramatically.

Based on 1979 estimated manufacturing capacity (tonnage), the top ten feed companies are: 1) Ralston Purina Co.; 2) Allied Mills, Inc.; 3) Central Soya Co.; 4) Agway, Inc.; 5) Gold Kist, Inc.; 6) Farmland Industries, Inc.; 7) Cargill, Inc.; 8) Carnation Co.; 9) Moorman Manufacturing Co.; and 10) W. R. Grace Co (see Table 5). Note that these
Table 5. Top 30 Commercial Feed Manufacturers, 1979
(Estimated Maximum Capacity)

<table>
<thead>
<tr>
<th>Company</th>
<th>Annual Capacity (000 tons)</th>
<th>No. Mills (domestic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ralston Purina Co.</td>
<td>7,000+</td>
<td>61</td>
</tr>
<tr>
<td>2. Allied Mills, Inc. (Wayne Feeds)</td>
<td>3,000+</td>
<td>23</td>
</tr>
<tr>
<td>3. Central Soya Co.</td>
<td>2,500</td>
<td>32</td>
</tr>
<tr>
<td>4. Agway, Inc.</td>
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</tr>
<tr>
<td>5. Gold Kist, Inc.</td>
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<td>14</td>
</tr>
<tr>
<td>6. Farmland Industries, Inc.</td>
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<td>20</td>
</tr>
<tr>
<td>7. Cargill, Inc.</td>
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<td>33</td>
</tr>
<tr>
<td>8. Carnation Co.</td>
<td>1,000</td>
<td>14</td>
</tr>
<tr>
<td>9. Moorman Mfg. Co.</td>
<td>1,000</td>
<td>7</td>
</tr>
<tr>
<td>10. W. R. Grace Co. (Walnut Grove, Farr Feeds)</td>
<td>920</td>
<td>15</td>
</tr>
<tr>
<td>11. Kent Feeds, Inc.</td>
<td>850</td>
<td>9</td>
</tr>
<tr>
<td>12. International Multifoods</td>
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<td>18</td>
</tr>
<tr>
<td>13. Southern States Co-op</td>
<td>740</td>
<td>7</td>
</tr>
<tr>
<td>14. Hubbard Milling Co.</td>
<td>700</td>
<td>16</td>
</tr>
<tr>
<td>15. H. K. Webster Co.</td>
<td>650</td>
<td>8</td>
</tr>
<tr>
<td>16. Con-Agra, Inc.</td>
<td>600</td>
<td>8</td>
</tr>
<tr>
<td>17. Land O'Lakes, Inc.</td>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>18. MFG, Inc.</td>
<td>500</td>
<td>7</td>
</tr>
<tr>
<td>19. ACCO Feeds</td>
<td>500</td>
<td>5</td>
</tr>
<tr>
<td>20. Western Consumers</td>
<td>500</td>
<td>3</td>
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<tr>
<td>21. Pennfield Corp.</td>
<td>490</td>
<td>3</td>
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<td>22. GTA Feeds</td>
<td>412</td>
<td>10</td>
</tr>
<tr>
<td>23. Beacon Milling Co.</td>
<td>403</td>
<td>12</td>
</tr>
<tr>
<td>24. Tennessee Farmers Co-op</td>
<td>400</td>
<td>3</td>
</tr>
<tr>
<td>25. Murphy Products Co.</td>
<td>390</td>
<td>5</td>
</tr>
<tr>
<td>26. Chino (Cal.) Grain Co.</td>
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<td>2</td>
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<tr>
<td>27. Gooch Milling Co.</td>
<td>360</td>
<td>7</td>
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<td>28. Golden Sun Feeds</td>
<td>310</td>
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<td>29. Landmark, Inc.</td>
<td>300</td>
<td>4</td>
</tr>
<tr>
<td>30. Coast Grain Co.</td>
<td>300</td>
<td>4</td>
</tr>
</tbody>
</table>

1Capacity in most cases is based on 2 shifts, 5-days a week.

Source: Feedstuffs
figures are based on an earlier time period, and that the capacity utilization could vary dramatically among companies.

According to all industry participants interviewed in 1983, Ralston Purina is clearly the largest manufacturer of prepared feeds in the United States. Purina's national livestock and poultry feed market share was typically estimated to be 10%. Nationally, there are several other large feed companies, but the largest have less than one-half of Purina's market share. They are Wayne Feeds (division of Continental Grain)--3-5%; Central Soya (Master Mix)--3-5%; Agway--3-5%; Cargill (Nutrena)--3-5%; Farmland--2%; Land O'Lakes--2%; and Moorman--1-2%. Agway, Farmland, and Land O'Lakes are large farm cooperatives that are diversified farm input suppliers and farm product processors. Cargill and Continental Grain are large privately-held corporations that emphasize grain merchandising, Moorman's is a privately-held company involved only in the livestock feed and supply business, while Central Soya is a publicly-held corporation which has been heavily involved in soybean processing and merchandising. Note that these recent estimates take into account such happenings as mergers, divestitures and recent growth of some companies, and are based on sales volume, not capacity or tonnage.

Regional market shares are harder to discern accurately mainly because most firms interviewed were primarily knowledgeable about the market in the particular states in which they operated. Thus, comparable estimates were often not available from several companies. Nevertheless, there are some clear examples of geographical dominance. One example is the large market share held by Agway in the major dairy area in the Northeast. Two other cooperatives are major competitors in certain areas of the Midwest. Farmland Industries is a major feed supplier in the lower Midwest and the high plains of the central United States, while Land O'Lakes is a leading competitor in
the upper Midwest and Lake States' dairy regions. Moorman, Kent, and Vigortone account for large shares of the supplemental feed purchases in the major hog production areas in the Corn Belt.

Feed tonnage manufactured for hogs is led by Ralston Purina, which accounts for 9-10% of the market. This is comprised strictly of supplements and complete feeds. Moorman Manufacturing follows closely with 7-10%, comprised of supplements, pre-mixes and complete feeds. Other large hog feed producers, in approximate order of size include: Land O'Lakes (5-6%); Wayne (5%); Cargill (5%); Farmland (5%), Central Soya (5%), and Kent (4-5%). Premix feed companies may supply feed for as much as 25% of the market hogs fed; about 20 percent of all hog pre-mixes are produced by Vigortone, giving it a market share of approximately 5% on the basis of the number of hogs fed.

Ralston Purina and Farmland are the largest producers of feeds for beef cow herds. National market share estimates for these firms are approximately 10% for each company. Purina's share is derived from sales on a nation wide basis, while Farmland's comes from a much smaller geographic area which includes Texas, Oklahoma and Missouri, three of the leading states in beef cow numbers. Other companies' estimated national market shares are: Land O'Lakes--5-6%; Cargill--4-5%; Kent--3-5%; Moorman--3-4%; and Archer-Daniels Midland--3-4%.

There are also many local feed companies which, though not having even one percent of the national beef cow market, are strong forces in certain states (or parts of states). Some examples are Anderson, Clayton & Company in Texas; Stillwater Milling Company in Oklahoma; and Missouri Farmers Association and Tindle Mills in Missouri.

The beef-feedlot feed business has undergone dramatic change in the past 25 years as a result of generally increasing numbers on feed (until the
declines in the late 1970s) and the significant geographic shift of cattle feeding from small farmer-feeder lots in the Cornbelt to large custom feedlots in the High Plains. Feed industry members report that customer behavior is quite different in two feedlot size classes: those lots feeding fewer than 3,000 head, and those lots feeding more than 3,000 head. Small feedlots comprise a market for companies' standard mixed feed formulations for feedlot animals while most large feedlots buy mainly custom rations which are developed by a nutritionist—either a consultant or employee. Feed suppliers are then asked to offer bids for providing the custom ration for a specified period of time.

The small feedlot business is still concentrated in the Cornbelt region. All the major feed companies are active in this market. Ralston Purina, Moorman, Farmland, Cargill, Kent and Land-O'Lakes are considered the largest suppliers, each having approximately 8 percent of the market.

The participants in the large feedlot market segment are a relatively diverse mixture of major feed companies, specialized feedlot suppliers and small local feed mills. Ralston Purina and Cargill are the largest suppliers, each having 8-10 percent of the market. Farr Better Feeds (a division of W. R. Grace & Co.) is also a large supplier. An early entrant in the custom-ration business, Farr specializes in this market and holds an estimated 8 percent market share. Moorman Manufacturing has a 3-4 percent market share. Other private firms with market shares similar to that of Moorman include Worley Mills in Texas, Scott-Pro Inc. in Kansas, and Hi-Pro Feeds (a division of Friona Industries) in Texas. Small feed companies like these firms account for approximately 50 percent of the custom-ration feedlot business.

Liquid feeds are a relatively new development. Since first appearing in the late 1960s, they have been steadily improved in terms of consistency and
storage integrity. Ralston Purina and Loomix Inc. (California) are major suppliers of liquid supplements for cow-calf operations. Ralston, Cargill and three independent companies, Bieger Brothers of Shickley, Nebraska, Liquid Feed Commodities of Fremont, Nebraska and PMS of Sterling, Colorado are major suppliers of liquid feedlot supplements. Recent estimates are that 15 percent of all feedlot cattle are fed liquid feeds, with sharply higher percentages (approximately 30 percent of all cattle) in western Nebraska and eastern Colorado. Since molasses is the major component of liquid feeds, their use is usually concentrated near barge transport routes and sugar beet producing areas.

Dairy feed is manufactured by Land O'Lakes (8-10%), Purina (7-8%), Moorman (7%), Agway (7%), Central Soya, Wayne, Gold Kist, and many other smaller, local feed manufacturers. Thirty-five to forty percent of all dairy feed is sold as a complete ration with higher percentages in feed grain deficit regions (Lawrence, et al, 1985). High transport costs for complete feeds often allows local feed manufacturers to compete effectively against larger companies.

Specialty feeds such as horse feed, catfish food, etc. are dominated by Ralston Purina. Smaller companies cannot generate the sales volume required to economically produce such product lines.

Poultry feed manufacturing is typically a vertically integrated segment of the poultry industry. The broiler industry is the primary example of vertically integrated feed manufacturing facilities linked by ownership with hatcheries, grower units or broiler processing plants. In contrast, some of the largest beef feed lots, dairy and swine operations have their own feed plants but the feed manufacturing function is typically done by specialized feed companies. The broiler industry is dominated by 35 firms that account
for approximately 90 percent of total production (Feedstuffs; USDA Livestock and Poultry Outlook and Situation Report). The USDA estimates that 99 percent of broiler production is vertically integrated through ownership (10%) or production contracts (89%) to at least one other stage in the production-marketing process (Harrington). In either case, the feed is usually provided by the integrator from their own feed manufacturing plant or through a contract with an independent plant. These plants purchase all feed grains, protein sources and vitamin-mineral pre-mixes and formulate all feed. An example is Gold-Kist, the fifth largest feed company in terms of capacity and the second largest producer of broilers in the United States. A large portion of Gold-Kist's feed output is fed to their own birds.

Even when the broiler operation is part of a large feed company or a parent company that also has a feed subsidiary, the poultry operation is often a separate profit center. Thus, it typically is not a captive customer of its corporate parent or cousin but will buy feed and/or feed ingredients from them only if the price is competitive. Being competitive with large, producer-owned mills is often very difficult. Turkey and egg production has some degree of vertical integration (28% and 44% of production respectively), but production contracts in these industries typically do not involve feed supply. Thus, the portion of the feed market that is captive is much less in the turkey and egg industries.

**Barriers to Entry**

The maintenance of competition in any market or industry requires that the industry be accessible to new participants. Potential barriers to entry into the feed industry vary significantly with the scale of the proposed entry and the product type being considered.
It would be difficult for any company to enter the feed industry on a national scale due to capital requirements for many relatively large plants (perhaps $4-5 million per plant), the need for a large number of knowledgeable personnel, a sales force scattered throughout the country, and the difficulty of penetrating well-established customer-supplier relationships of competitors. But, entry into a local market on a smaller scale would not involve large capital expenditures (by industrial standards), may require only one person with a thorough knowledge of nutrition and salesmanship, and may well fill a gap between the primary marketing areas of surrounding feed companies. Therefore, there do not appear to be major barriers to small-scale entry, unless one is in an area where feed manufacturing is predominantly part of a vertically integrated business, like the broiler sector. Regional entry would involve restrictions intermediate to these extremes.

Entry into different species or product type segments is less difficult than entry into a geographic area because production equipment is basically the same across types and species. There are two notable exceptions to this statement. First, pre-mix production may require some specialized equipment. Second, specialty feeds (i.e., rabbits, mink, ornamental birds, etc.) may not comprise large enough sales volumes to justify product development, special mill runs and packaging and inventory costs in many small feed companies.

Sales, Marketing and Distribution

The distribution systems for manufactured feed are influenced most by the capital required for plants, the bulkiness of the products, and transportation costs. These factors in turn give rise to several sales systems.

There are six sales systems that feed manufacturers use to sell and deliver their products and related services:
1) Local—These companies sell locally, often in a 25-30 mile radius from their plant, and usually sell their own formulations. Often the mill is used as a feed grain storage facility for their feed customers. There is usually only a small sales force of one or two persons and limited technical assistance is provided to their customers.

2) Dealer Network—Independent dealers are the contact point between producers and the feed manufacturer, and company sales representatives call on dealers with local franchises. Sales representatives provide technical information and advice as needed by dealers in managing their feed business, or in assisting their farmer-customers. The company representatives also disseminate information regarding new sales promotions, new products and the like to their dealers. Some examples of this sales system are Ralston Purina, Kent and Wayne. These companies view their established dealer networks as their strongest link to the customer and the best way to promote a continuing supplier-customer relationship between the feed company and the livestock feeder. Other products are carried to influence farmer feed purchases and generate more income. For example, breeding stock, animal health products, and a newcomer to the scene—micro-computers and software—are sold by some feed company dealers. Many dealers perform such services as grain storage, grinding, mixing and delivery as part of their business.

3) Farmer-Dealer Network—Products are sold through large, well respected local farmers who might have a favorable effect on sales to local feeders. Often the product is delivered direct to producers but some may be warehoused by the farmer-dealer to serve immediate customer needs. The farmer-dealers earn the standard wholesale margin and quantity discounts on purchases for their own use. This system works very well for pre-mixes due to their
relatively small volumes and resulting small warehousing and transportation costs. Vigortone is the major company using this system. Farmer-dealers typically do not offer other services such as mixing and grinding.

4) Company Direct Sales—There are two types of company direct sales operations which differ primarily in the compensation system for the sales force. Moorman Manufacturing believes that moving their product takes people "out in the country" calling directly on the larger feeders rather than relying on an independent dealer who is not solely focused on feed merchandising. The company's feed sales must be at least the major source of income for the salesperson. Salespeople may carry small inventories but most shipments of product are direct to the farm from a company plant or warehouse. Compensation is based solely on volume and volume-related bonuses are a major sales promotion device.

Companies like Kent believe that to have the company's interests first, the representatives need a steady base income from the company. Thus, a portion of total salary is not related to sales volume. Occasional sales incentive programs are offered. Rewards such as trips or merchandise go to sales people that achieve specific increases in sales during the promotion period.

5) Dealer Sales Representatives—Some regional companies, such as Land O'Lakes, train representatives to promote feed sales at one or two dealer outlets (in this case, cooperatives). Although the salary and benefits come from the feed company, the representative's services are loaned to the local dealer(s).
6) Cooperatives--Other than Land O'Lakes, most regional cooperatives sell feed to "members" by having it available at local cooperative grain elevators. Technical assistance is available upon request but there is no sales force, per se.

There long has been a strong dichotomy between those companies which sell direct to producers and those which utilize a dealer network. Though still strong, this dichotomy has lessened over the last 20 years mainly due to the emergence of many livestock and poultry producers who purchase greater volume than do some dealers. A survey by Bruce K. Symonds Company (Feed Management, August, 1982) shows that 35 percent of the largest feed companies responding to their survey sold feed directly to farmers. Another 45 percent sold only through dealers, while 20 percent used both marketing systems. The last development is usually attributable to acquisition of another company and/or redefinition of "dealers" (i.e., calling a large producer-customer a dealer) to enable companies to offer the large producers lower prices and thus retain business which they would otherwise lose due to dealer markups, etc.

The feed industry has technically-proficient customers who are primarily concerned about product composition (nutritional characteristics and likely performance implications), prices and service (timeliness and technical advice). Brand names appear to influence purchasing decisions only inasmuch as they are perceived to imply combinations of these key characteristics. Brands appear to have greater influence on smaller, less sophisticated producers. Therefore, the marketing efforts of feed companies (i.e., product positioning, promotions, and sales efforts) involve different combinations of feed composition, price and service.
Advertising typically has not been a very important tool in marketing efforts. This can be seen from Federal Trade Commission line-of-business reports which show that feed companies spent only about one percent of sales on advertising in 1974-76 (the only period for which data is available). Nevertheless, the larger companies utilize some advertising in both the print (usually farm magazines) and television (rural-markets) media. The largest television advertising spender is clearlyRalston Purina which spent over $1.5 million on advertising livestock feeds on television in 1983 (Leading National Advertisers). Kent, Wayne, ADM and Vigortone each spent from $35,000 to $100,000 on television advertising in the same year.

Some industry participants who were interviewed indicated that the technical competence of and advice offered by their sales force is fast becoming the most important portion of the product-service package. The Symonds survey revealed that customers also viewed technical assistance as the most important marketing tool. This development is no doubt a result of customers' being more involved with feed formulation and their resulting need for more information on related technical issues and other general livestock enterprise management problems.

Pricing, Margins and Profitability

The pricing structure for feed products is based on several important contributors to product cost: 1) feed ingredient costs, 2) plant operating costs, 3) sales and distribution costs and 4) desired profit margin.

Feed type has significant impacts on ingredient, operating and distribution costs. Industry participants estimate that 65 to 85 percent of the selling price of a manufactured feed supplement is ingredient cost. For complete feeds, the proportion of total cost contributed by ingredients is
higher, while it is lower for pre-mixes. Complete feeds have higher blending and warehousing costs due to the inherent bulk of both ingredients and products, while pre-mixes have lower warehousing costs. The degree to which excess production capacity affects costs depends on the flexibility of the plant and on management’s ability to reduce non-ingredient variable costs when volumes decline. A plant that is unable to reduce its labor and other variable costs in proportion to its change in output is especially affected by low capacity utilization and may have to cut profit margins in order to compete in the short run. A plant without excess capacity and/or with the ability to reduce non-ingredient variable costs during volume down-turns tends to have higher and more stable margins. Many plants built 20-30 years ago were designed to take advantage of inexpensive transportation, mainly railroads. They produced complete feeds and relatively low-protein supplements (high tonnage products) and served relatively large sales areas. However, as transportation costs (both rail and truck) have increased and producers have demanded more supplements and pre-mixes (lower-volume products), smaller plants have gained an economic advantage and left the large, old plants with excess capacity. As a consequence, little investment in new plant capacity has occurred in the last decade, especially in areas where livestock production was stable or declining. New plants have been built but they have normally only replaced capacity of antiquated plants or were built in areas to which livestock or poultry production had shifted.

Estimated gross margins by industry participants are as follows: complete feed--10%; supplements--20%; pre-mixes--100%. Since firms consider line-of-business profit rates to be proprietary information, feed industry profitability and margins by firm are not available in detail. Industry
participants suggest that net profits before taxes for most industry members are approximately 5 to 6% of sales for both supplements and pre-mixes.

In response to questions about their company's return on assets, industry participants answers ranged from 5 to 40 percent. Despite this large difference, the survey results seem to be generally consistent with the 1974-1976 line of business reports by the Federal Trade Commission. Average profit rates or assets employed were 12.7% in 1974, 14.6% in 1975, and 17.7% in 1976 for large feed companies required to report line-of-business results. The three-year average of 15.0 percent on assets was lower than the closely-related pet food industry average of 19.3%. However, the pet food industry focuses on serving an unsophisticated customer buying relatively small quantities in a grocery store setting, so they have been in a position to develop strong brand franchises and more market power than has the commodity-type business of livestock and poultry feed. Table 6 shows rates of return on assets for several food-related industries in the mid-1970's. Note that those for animal feed were neither very high or low compared to the other food manufacturing industries.

Technological Change

Most recent changes in the feed industry can be attributed to new applications of existing knowledge and technology, not true innovation. Examples are the use of advanced testing of feed composition and computerized feed optimization programs to more precisely balance the amino acids in feed supplements and the use of added fat to provide extra energy (e.g., Ralston Purina's High Octane hog chews and others). These technologies have been known for some time, but have only been applied in the last 10 to 12 years.

1Trademark of the Ralston Purina Company.
Table 6. Food Manufacturing Industries Return on assets (1974-76) by line of business

<table>
<thead>
<tr>
<th>Food manufacturing industry</th>
<th>1974</th>
<th>1975</th>
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<tr>
<td>Animal Feed</td>
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<tr>
<td>Grain Food Products</td>
<td>16.9</td>
<td>21.1</td>
<td>22.6</td>
</tr>
<tr>
<td>Confectionary</td>
<td>16.7</td>
<td>18.2</td>
<td>13.9</td>
</tr>
<tr>
<td>Fats and Oils</td>
<td>17.2</td>
<td>12.5</td>
<td>11.7</td>
</tr>
<tr>
<td>Beverages and Misc.</td>
<td>11.6</td>
<td>13.4</td>
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</table>

Based on current knowledge of recent scientific developments, industry participants and observers do not foresee any major technological changes in the next decade.

A recent product breakthrough is the development of solidified liquid feeds by Purina, Hubbard, Kent and others. While a contradiction in terms, "solidified liquid" feeds are so-named because they are targeted as competitors to liquid protein supplements for cattle. The new product is superior to liquid supplements in that it requires no special liquid-handling equipment, is not damaged by water, and has a longer shelf-life (i.e., won't separate). It still retains the labor-saving aspects offered by liquid feeds over traditional dry feed products.

Government Regulation

Government regulation of the feed manufacturing industry falls into four basic categories. They are 1) registration and labeling, 2) manufacturing practices, 3) safety of chemicals, drugs and other additives and 4) workplace and environmental safety.

Feed registration and labeling laws are almost exclusively enacted by individual states. However, most states' laws are very similar because they are based on the "Uniform State Feed Bill" which was prepared and published by the Association of American Feed Control Officials (AAFCO, 1975). This set of guidelines defines terms, and specifics label, registration, test and guarantee requirements and procedures for both livestock and pet foods.

The "Uniform State Feed Bill" includes federal guidelines for good manufacturing practices of medicated feeds and pre-mixes. These apply to feeds containing various medications. But, if the feed is itself a drug (as defined in the "Uniform State Feed Bill"), it is subject to the regulation of the Food and Drug Administration (FDA).
The FDA plays the greatest role in regulating drugs, chemicals and feed additives used by the feed industry. Most of these regulations originated from concerns about these substances' effects on human health. Examples are sulfa residues in pork and residues from the use of diethyl stilbestrol in cattle. The degree to which FDA regulations affect capital and manpower requirements and day-to-day operation of a plant is dependent upon the types of ingredients the plant uses.

In general, those plants using highly concentrated ingredients to make products such as pre-mixes, micro-premixes, vitamin packs and drug packs are subject to more rigid regulations than those plants which use the above products to formulate supplements and complete rations. The reason for the differences is rather simple; plants of the former type have much less room for error because their inputs and products are highly concentrated. A slight error in the quantity of the inputs used or the blend uniformity could lead to significant differences in livestock performance or possible residue problems in meat or milk. Also, there is a greater chance of contamination of other feeds in amounts that would be potentially harmful. Thus, pre-mix and micro pre-mix manufacturers must meet rigid FDA requirements concerning product purity, clean-up procedures and quality control. Meanwhile, plants using these concentrated mixes are generally responsible only to abide by label instructions. Note, however, that 85 percent of pre-mixes have no drugs in them; a fact that lessens the role of government regulations.

Workplace and environmental safety are regulated by the Occupational Safety and Health Administration and Environmental Protection Agency, respectively. Control of dust is a major concern in order to prevent explosions and respiratory damage to workers.
Summary and Implications

The factors which have most profoundly affected the livestock and poultry feed manufacturing industry in the past 20 years are the structural and geographic shifts of its customer industries. We are confident that such shifts will also be the driving forces for changes in the years ahead. We expect the following changes in the livestock and poultry industry:

  o Dairy--Gradual reductions of government supports and increased productivity per cow due to introduction and use of new technology such as bovine growth hormones. These should result in significant reductions in dairy cows and feed purchases in major dairy states.

  o Beef Cattle--Continuation of stable or declining demand for beef and the shift of cattle feeding to the western Cornbelt and Southwest. Larger units will account for higher proportion of total fed cattle due to fewer farmer-feeders.

  o Swine--Large units will become more dominant but will remain in the Cornbelt. Demand for pork will continue to be steady or declining on a per capita basis.

  o Poultry--Continued growth of broiler and turkey production in the current primary production regions. We expect increased integration into feed manufacturing, probably through contracts, in turkey and egg production.

Fewer dairy cows, continuing decline in number of Cornbelt beef feeders and increasing size in hog operations all point to reduced commercial feed volume in the Midwest, Lake States and Northeast. The reduced number of dairy and beef animals will use less complete feeds and supplements. Larger hog units will tend to use more pre-mixes and super-concentrates at the expense of supplements or complete feeds. The corresponding reduced volumes will lead to
continued feed manufacturing over-capacity in these regions. Commercial feed volume may grow slightly in the Kansas-Nebraska area due to the shifts in the location of cattle feeding.

The only rapidly growing product area which is a customer of the feed industry is poultry and poultry products, but feed manufacturers are not likely to benefit from this growth. Broiler production is highly integrated into feed manufacturing and there is a very strong possibility that turkey and egg producers will do likewise, probably through contractual agreements. Feed manufacturers in Iowa and Minnesota may be able to participate in this move toward integration in the turkey industry through feed supply contracts, or leasing or selling feed plants to large producers.

Growth in customer size, regardless of species, implies that pre-mixes and super-concentrates will become an even more important part of feed companies' product mix. As pre-mixes increase their market share, the competitive market area expands dramatically, due to the economics of transporting pre-mixes and the increased capability of larger customers to buy full truckloads of supplements or pre-mixes and economically ship them over greater distances.

Fewer customers imply that competition will be keener among feed suppliers. Larger customers who could utilize a large part of unutilized plant capacity will be able to receive low-margin bids from many suppliers anxious for additional volume. Suppliers with plants in which costs can be reduced in close proportion to volume will have short-run advantages over plants with a higher proportion of fixed costs. Such short-run advantages may be critical to long-run survival. This fact must be considered in the design of any new or replacement plant.
A variety of sales and distribution systems will continue to co-exist. However, there will be a trend toward more direct sales to large customers. Technical support will continue to be a critical component of the marketing mix with computer services as a new, and possibly major, product or promotional tool offered by companies. Media advertising will maintain a relatively minor role in feed merchandising as a higher proportion of their customers become more specialized and sophisticated in feed ingredient purchasing and processing.

There appears to be little need for strong public policy initiatives with regard to this industry. The industry is not highly concentrated on a national basis. Based on admittedly sketchy information, rates of return on assets and sales appear to be in the mid-range of returns in other food-related industries. Together with the relative ease of entry for local companies, or farmers often able to do-it-yourself, these facts lead us to conclude that the industry is reasonably competitive on a national basis.

As with any industry, there may be isolated geographic markets in which a few firms hold some degree of market power. The effect of transport costs in determining spatial price differences will, however, place upper bounds upon the degree to which firms can capitalize upon their position. In the highly competitive environment which may exist in the next few years, such local monopolies may result from some plant closings. Still, we expect that ample competition from more distant plants anxious to more fully utilize excess capacity will usually be present in densely populated livestock and poultry areas.

Continued vigilance of government agencies is expected in the areas of feed additives and related human health concerns. Recent correlations between
human health and low-level drug use in livestock and occasional problems with
drug residues may result in more stringent regulations for feed manufacturers
and/or the livestock and poultry producers using the products
inappropriately.

As with most food and agricultural industries, feed manufacturing is a
mature industry. Declining volume is more likely than stability or growth.
Consequently, structural change and increased competition are likely in the
future. It will take innovative management to anticipate the changes that
will take place and creatively meet the evolving demands of the fewer, larger,
more sophisticated customers in the livestock and poultry industries.
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