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## INCREASING COORDINATION IN THE PLANT AND PLANT PRODUCT PROCESSING AND HANDLING SECTOR

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**B**y the end of December 2010, the U.S. Department of Justice and U.S. Department of Agriculture will have held five hearings on competition and regulation in agriculture. The objective of the workshops is to “address the dynamics of competition in agriculture markets, including buyer power (monopsony) and vertical integration. They will examine legal doctrines and jurisprudence, as well as current economic learning, and will provide an opportunity for farmers, ranchers, consumer groups, processors, agribusiness, and other interested parties to provide examples of potentially anticompetitive conduct and to discuss any concerns about the application of the antitrust laws to the agricultural sectors.” The purpose of this article is to conduct an industry analysis of the U.S. plant and plant products sector of the food economy with a focus on processors and handlers. It provides an overview of issues that impact the competitive situation in these industries as noted by the U.S. Department of Justice and U.S. Department of Agriculture. Figure 1 provides an overview of how the data was collected that was used to analyze the five forces and drivers of change since 1997.

### Five Forces Model for the Plant and Plant Products: Processors and Handlers

The five forces model—developed by Professor Michael Porter at the Harvard Business School—is a common and well-known step in conducting an industry analysis. It is comprised of five forces: 1) Internal rivalry between firms, 2) Threat of entry by potential competitors, 3) Presence of substitute products, 4) Power of sellers or suppliers, and 5) Power of buyers. A five forces model essentially is a process for a manager to understand how the conduct and performance of firms in an industry might be determined by changes in its structure over time.

#### *Internal Rivalry between Firms*

One measure of firm concentration in an industry is the Herfindahl-Hirschman Index (HHI). The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The U.S. Department of Justice defines an industry as being moderately concentrated with an HHI between 1000 and 1800 and horizontal mergers above an HHI of 1800 must be reviewed. The HHI ratios suggest that concentration is increasing in fats and oils refining and blending; frozen food manufacturing, frozen fruit, juice, and vegetable manufacturing; dried and dehydrated food manufacturing; retail bakeries; commercial bakeries, frozen cakes, pies, and other pastries manufacturing; and other food manufacturing. The HHI has decreased in flour milling; fruit and vegetable canning; bread and bakery product manufacturing; and roasted nuts and peanut butter manufacturing. Industries with HHI's greater than 1800 were: malt manufacturing, soybean processing, breakfast cereal manufacturing, beet sugar manufacturing, specialty canning, tortilla manufacturing, and snack food manufacturing.

The data suggests that new entrants have been primarily farmer-owned cooperatives entering an industry—

**Figure 1**

**Description of the Data Used**

An extensive database was developed to prepare this article. The U.S. Department of Commerce conducts an economic census every five years to collect information on the U.S. economy. The North American Industry Classification System (NAICS) is used for the economic census. Within the Manufacturing data (NAICS 31), there are data on Food Manufacturing (NAICS 311) which were used to determine specific industries to serve as the horizontal boundaries for plant and plant products processors and handlers. The data relevant for this study are grains and oilseeds milling, sugar and confectionery product manufacturing, fruit and vegetable preserving and specialty food manufacturing, bakeries and tortilla manufacturing, and other food manufacturing. Within these six broad categories, there are 28 different industries. The choice of these industries was limited to those using agricultural inputs provided principally by U.S. farmers and producers.

Firms that report to the U.S. Securities and Exchange Commission publish a variety of reports and data, including annual 10-k reports which were examined for each of these firms for the 1997 to 2010 time period. This information was supplemented by an extensive review of industry and trade publications including Bakery and Snack, Biofuels Business, Food Business News, Milling and Baking News, World Grain, and Food Technology for the 1997 to 2010 time period. Of these articles, 211 are relevant for this study. These articles are written for the practitioner audience.

A second set of data was refereed articles written by agricultural economists and designed for the academic audience. These included case studies published in Review of Agricultural Economics, International Food and Management Review, Food Distribution Research Journal; and relevant cases published by the Harvard Business School Press. In addition, the University of California's Giannini Foundation of Agricultural Economics has funded research on various agricultural industries at different times. The number of articles in this data was 37. This extensive review helped illuminate changes in the industrial organization of these industries over the 1997 to 2010 time period. Finally, using industry contacts, the author interviewed at least one individual in each industry—31 interviews in all, to review the industry analyses and drivers of change.

two cooperatives were formed in the soybean processing industry which may account for its HHI decrease from 2035 to 1817; four cooperatives entered the other oilseeds industry—or a firm buying into that industry. Unlike these cooperatives, very few new plants were identified as having been built by an entrant into the industry. The overwhelming majority of changes in ownership have occurred between existing firms in these industries adding additional capacity through acquisitions, mergers or changes in ownership patterns—for example, Pinnacle Foods, a frozen foods company acquiring Birds Eye Foods, a frozen vegetables firm; J.M. Smucker, maker of spreads and other products, acquiring Jif peanut butter from Procter and Gamble.

Excess capacity is difficult to calculate but some data exists for flour milling and new construction announcements with capacity data may be tracked for many industries in trade and industry articles as long as what actually gets built can be determined and announcements of plants being closed—it is important to check actual closure. Industries where excess capacity might exist during this time period include wet corn milling, flour milling, breakfast cereal manufacturing, dry pasta manufacturing, and various industries in the fruit and vegetable preserving and specialty food manufacturing sector. The rationale for these observations is that per capita consumption has declined in these industries over the 1997 to 2010 time period and plant closure announcements decline in fixed increments where a decline in consumption occurs continuously. But it is important to note that excess capacity has many costs and it appears that firms are quick to make the adjustments to reduce capacity through reductions in shifts or actual plant closures.

Actual empirical studies of demand are limited in the plants and plant products processing and handling sector. One way to measure a component of demand is via the U.S. Department of Agriculture's Economic Research Service Food Availability (Per Capita) data system. These can be used in conjunction with U.S. Department of Commerce Bureau of Labor price data to plot a demand curve over time. It is limited in that the prices and industries do not match up perfectly but it is one way to better understand changes in demand in certain industries at various points in time. While data are unavailable for all industries—for example, per capita tortilla wholesale disappearance—what data does exist provides some generalities. It appears that flour for use in bread, processed sugar, corn sweetener, frozen vegetable, canned fruits, and canned vegetable demand have declined over the 1997 to 2007 time period, while frozen food demand has increased.

While there is no good proxy variable for buyer switching, there is no obvious reason why buyers cannot switch, at least in the long run. Some contracts specify six to twelve month increments with competitive bidding; for example, corn sweetener contracts for soft drinks. Probably the biggest situation where it may not be so easy to switch is in industries where a buyer has leased a plant they owned to another firm with whom they then sign a supply agreement. Those agreements can be longer than one year, but the new plant owner may not have another buyer for its products if it becomes unhappy with the terms of the agreement over time. Such contracts provide legal remedies, but there may be some short-term switching costs.

It is readily apparent that there has been an increase in differentiation including ingredients such as use of organic ingredients, use of ingredients with antioxidant properties, or use of whole grains; changes in the texture of the food, such as reduction in carbohydrates or sodium; changes in packaging or product volume, such as reductions in portion size, use of recycled paper, less air in the package, pull off tops on steel cans; and product variety, such as, more microwaveable foods, more individual serving size packaging; and similar efforts that are familiar to the reader. However, an increase in quality is more problematic to measure in plant food products due to lack of data. But there is little doubt that the adoption of six sigma quality management techniques has improved quality—for example, metal filings are practically unheard of in packaged food—and increased standardization—for example, packaging is designed to optimize space in trucks or railcars or oceangoing vessels. Note that this is different than food safety standards which are a regulatory issue that all firms must achieve.

### ***Threat of Entry by Potential Competitors***

As noted earlier, farmer cooperatives have entered a number of industries including wet corn milling, soybean processing, and other oilseed processing—for example, sunflower seed processing and dry edible bean processing. However, consider breakfast cereal manufacturing. Variables such as the fixed costs of building a state-of-the-art plant with the needed research and development as well as various temperature controlled facilities, strong brand preferences exhibited by many buyers, capital requirements for the research and development needed to substitute whole grains in place of previous product formulations and maintain the same or better taste profile, experience in working with wholesalers in packaging and shipping product, and experience in working with retail supermarkets in product placement, and before and after sale service are very high barriers for entering firms. It would be highly unlikely that a new firm would enter this concentrated industry except through acquisition or joint venture.

On the other hand, industries that are closer to the perfectly competitive norm of many firms with similar sizes as evidenced by a low HHI may have much smaller barriers to entry. Consider retail bakeries which have the smallest HHI at 7.2 with 7,079 firms in 2002. There are many stores that make bakery products from flour, not prepared dough, in their store and this is a fairly standardized process with few barriers to entry and low volumes.

A number of industry segments saw an increase in entrants over the 1997 to 2002 time period—rice milling; wet corn milling; cane sugar refining, caused by the divestiture of individual plants by a multinational firm; beet sugar manufacturing, caused by the divestiture of individual plants by a multinational firm; dried and dehydrated food manufacturing; retail bakeries, caused by more retail supermarkets putting in bakeries; and roasted nuts and peanut butter manufacturing.

Government regulation is important in food manufacturing. Food safety regulation is an obvious example. Less obvious to many consumers are regulations governing product packaging and labels. The standardized nutrition labeling information took time to implement and it is conceivable that it will undergo another change if the glycemic index is mandated for inclusion.

### ***Presence of Substitutes***

Identifying substitutes can be problematic when comparing between industries using broad data. For example, pasta is made from durum wheat and is similar in nutritional composition to potato or rice. These are not substitutes, but rather other types of pasta are substitutes. Pasta with reduced carbohydrates—for example, Dreamfields brand—is a substitute for pasta with a typical amount of carbohydrates—for example, Barilla, AIPC, and Dakota Growers. It is fairly easy to switch products although some performance features may create some differentiation—for example, Birds Eye steam-in-a-bag frozen vegetables, Campbell's pull off soup can, a pizza crust that rises—but generally, there are many substitutes in plant-based foods.

Substitutes are increasingly based on product attributes as opposed to brand attributes and these are linked to calories, carbohydrates, nutritional benefits, saturated fats, and similar attributes. Ultimately, these may be associated with national brands as store-brands or private label brands may not be as quick to adopt these product attributes. Considering the growth in private label or store brands, it is apparent that substitutes are increasing.

### ***Power of Suppliers***

There is little to suggest that sellers of plants have much influence on price. There are many sellers of food grains, tree fruits, fruits and nuts, and other agricultural products. Many fruits and nuts are sold through cooperatives, brokers, and family-owned businesses that may be vertically integrated into production or control a large percentage of the production — for example, almonds and prunes. In general, it may not be costly to switch from one supplier to another because imports exist in most of these commodities. Marketing orders and bargaining cooperatives in some industries help growers achieve increased prices. Inputs are not generally short in supply because they can be stored, although there may be some seasonal issues which are short-term in nature with an occasional exception such as pumpkins available for canning.

Differentiation is generally not an issue although the supply of organic products was not sufficient for demand midway during this time period. In general, the percentage of total value that is attributed to the cost of the input is low. There is little vertical integration in this industry except in certain segments in fruits and nuts. Most vertical coordination is in the form of production contracts and these have been increasing in agriculture. Locally-produced foods, although relatively small compared to all foods, are increasing. The ability to source inputs from outside the United States further limits supplier power.

### ***Power of Buyers***

Consumers are able to switch from one brand to another fairly easily, but the development of store brands or private label brands have increased in retail supermarkets. There are several wholesalers that a retail supermarket can purchase from, though some retailers may bypass wholesalers by vertically integrating this function internally. Buyers in this sector are diverse. Integration has not occurred although processors and handlers face a more integrated wholesale grocery and retail supermarket sector. Information about the product is fairly well known as evidenced by the fact that many store brands or private label brands look similar and taste similar to their branded counterparts. Some buyers have moved to national, single desk purchasing of products. It is apparent that buyers have a lot of influence in this sector.

### ***Drivers of Change***

Growing buyer preferences for differentiated products was the most widely discussed driver of change during this time period which increased competition and provided increased profitability for processors that can produce and market such products. Many of these products were already discussed. Changes in the inputs or their characteristics used to produce the foods made from plant and plant products included less saturated fat, lower sodium, fewer carbohydrates, lower caloric content in foods and beverages, adoption of low sugar, foods supplemented with vitamins, increased use of whole grains, and increased marketing of health benefits reinforced by research. Suppliers must have the ability to control the plant production practices and handlers must segregate the inputs in order for processors to create the highest value for the use of such plants.

The second most identified driver of change was an increase in uncertainty and business risk which has helped increase profitability for firms that are engaged in hedging, marketing contracts, or supply contracts linked by price. The increase in input prices such as energy, packaging, and food inputs was widely mentioned. It is difficult to know the true impact on the finished good price of an increase in the price of wheat, since the contribution of the price of wheat to the value of a bakery product is small, or the impact of an increase in the price of a barrel of oil. But the 1997 to 2010 time period included a period of high input prices—caused by weather issues in 1996, the downturn in the economy after 9/11, and government policy changes regarding the corn-based ethanol mandates—and low input prices in the late 1990s and early 2000s. Finally, exchange rates and the strong dollar, which helped firms' source inputs globally, were discussed.

Regulatory influences and government policy changes were almost as widely discussed as the increase in uncertainty and business risk. Regulatory influences included implementation of new food safety regulations,

increase in nutritional label regulation, adoption of the corn-based ethanol mandate, proposed requirement to minimize climate change, increased regulations on transportation due to biosecurity, local government regulation of fast food, and other issues. These have added increased costs in this sector.

Globalization has brought many opportunities for firms to identify new suppliers and new buyers. While its impact is also included in the driver of business risk through exchange rates, the number of articles addressing globalization justifies its inclusion as a fourth driver. The most widely cited geographic markets were Asia, especially China and India. The benefits from trade agreements were widely discussed in many articles. Most of the discussion focused on the availability of inputs from outside the United States. Trade was widely mentioned as one of the key benefits for plant and plant products processors and handlers. However, the potential to expand profitability in a mature food sector by exports is not likely to occur for much of these differentiated processed food products.

### **Concluding Comments**

The U.S. Department of Justice and U.S. Department of Agriculture's hearings on competition are likely going to recognize that the increased demand for these types of plant products is going to require closer vertical coordination between plant producers and those handling and processing these plants into food products. Such coordination requires more information about the plants being produced and sold to handlers and processors. If market power exists, it is likely going to be in retail supermarkets and food service where the demand for such products is known and can be communicated by price to processors and handlers, and ultimately to producers.

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