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## MARKET FORCES AND CHANGES IN THE PLANT INPUT SUPPLY INDUSTRY

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The plant input supply industry is composed of many diverse segments and companies that supply farmers with seed, nutrients, pesticides, machinery, capital, labor, and many other inputs. These segments, companies and their markets are both domestic and international, so any review of market forces needs to have a global focus in how they will likely continue to evolve into the future. Since we do not have space in this article to cover every segment of this large industry in detail, we explore the impact of the major forces driving change using examples from the different segments and companies of the plant input industry.

### Rivalry among Existing Competitors

The plant input industry has seen a dramatic reduction in the number of competitors. But the lower absolute number of suppliers has not diminished the price competition between industry players. Most of the plant input suppliers have high fixed cost structures in land, capital equipment, and significant permitting, approval, and regulatory costs. This gives existing competitors a strong economic incentive to strive for market share more aggressively than if they had low fixed costs. Each additional percent of the market allows them to spread their fixed costs and brings a better net margin. Given the regulatory and technological requirements to stay competitive in these sectors, the high fixed cost aspect of market share competitiveness will only continue to be a prominent feature.

Another aspect of rivalry is market segmentation. Within each plant input sector, similar aspects of segmentation make internal rivalry a complicated dynamic. For example, in the agricultural finance sector, a limited number of firms have the capital and expertise to make loans in excess of \$10 million, but literally thousands of local banks and credit unions can make loans under \$10 million. Even though we might expect it due to the fewer number of firms, competition is not diminished even in the large loan segment, due to electronic communication making market information available to borrowers and the ability and willingness of large borrowers to seek better terms beyond traditional geographic areas.

In the case of plant nutrients, there are three distinct markets and industries: nitrogen (N), phosphate (P) and potash (K). While there are common demand drivers for these nutrients such as grain prices, there are different supply drivers. Each primary nutrient requires different natural resources as well as different mining and processing technologies. These natural resources are located in different parts of the world. In the case of nitrogen, regions with low cost natural gas such as the Mideast, Russia and the Caribbean Basin are key producers and exporters. In the case of phosphate, regions with rich deposits of phosphate rock and access to low cost sulphur and ammonia are the main producers. These regions include Morocco and a few other North African countries; the United States; China; Russia; Israel and Jordan. In the case of potash, only 12 countries mine this mineral; Canada, Russia/Belarus, Germany, Israel and Jordan are the largest producers.

Despite fewer producers today compared to a couple of decades ago, these are large global markets and prices of crop nutrients in the middle of Illinois are impacted by fundamental developments from around the world. For example, nitrogen and phosphate trade account for about 40% of global use (Table 1). Potash

trade—excluding the large movement from Canada to the USA—accounts for approximately 70% of global potash use. These percentages compare to 13% for the major grains. Even though these large global markets are served by fewer companies today, industry concentration, as measured by the Herfindahl-Herschman Index (HHI), is low for each nutrient (Table 2). Following the procedures described by the U.S. Department of Justice and the Federal Trade Commission, HHI is the sum of the squared market shares by firm with a market categorized as “unconcentrated” if the HHI is less than 1500, “moderately concentrated” for an HHI between 1500 and 2500, and “highly concentrated” if the HHI exceeds 2500.

**Table 1**

**Table 1. World Fertilizer and Grain Trade  
(Million Tonnes)**

	<b>World Use</b>	<b>Total Exports</b>	<b>Exports as a Percent of Use</b>
Coarse Grain	1,047.8	116.4	11%
Wheat	626.5	124.7	20%
Rice	425.6	30.3	7%
Total Grain	2,099.9	271.4	13%
Nitrogen (N)	98.4	39.2	40%
Phosphate (P <sub>2</sub> O <sub>5</sub> )	37.1	14.8	40%
Potash (K <sub>2</sub> O)	25.5	18.9	74%
Total Nutrients	161.0	73.0	45%

Source: USDA, IFA, Fertecon, Mosaic  
Five Year Averages 2005/06 - 2009/10

Note: Nitrogen includes urea, ammonia, ammonium nitrate, ammonium sulphate and calcium ammonium nitrate. Phosphate includes phosphoric acid, DAP, MAP, TSP, SSP. Phosphate rock is not included. Potash includes MOP, SOP and potash exports do not include Canadian shipments to the United States.

**Table 2**

**Classification of Plant Nutrient Industry  
Concentration**

<b>Plant nutrient industry segment</b>	<b>Herfindahl-Herschman Index (HHI)</b>
N	<400: unconcentrated
P	<400: unconcentrated
K	1,050: unconcentrated

Firms throughout the entire supply chain compete on the basis of price and cost efficiency. A good example is the proliferation of unit train movements of fertilizer to ‘big barn’ retail warehouses primarily in the Midwest.

Today, nearly all of the phosphate shipped by Mosaic—the world's leading producer and marketer of concentrated phosphate and potash—via rail from central Florida to domestic customers moves in 65 to 80 car unit trains with 'turns' as low as 12 days. That was not the case 10 years ago. More and more retailers are investing in large warehouses (15,000+ tons) capable of unloading unit trains in order to capture significant freight savings and compete with the dealer down the road or, more likely, in the next county.

The farm machinery and equipment manufacturing industry (North American Industry Classification System (NAICS) code 333111) is obviously a key input industry in the plant and plant product chain and faces many of the same forces described in this article for other input industries. While there have been mergers and acquisitions within this industry, they have not been as substantive or pervasive as in the plant nutrient and the seed/biotech/crop protection segments. Concentration is moderate and has decreased very slightly as seen in the HHI for the 50 largest companies which totaled 1,707 in the 1997 Economic Census of the United States and 1,657 in the 2002 census. This slight decrease in HHI is contradicted by an increase in the market share of the four largest companies, as measured by the value of shipments, which increased from 53% in 1997 to 58% in 2002; market share for the eight largest increased from 60% to 65%.

Acquisition by and purchase of competitors is a highly cyclical activity that is exacerbated by fluctuating currency exchange rates and international financing factors. With the U.S. dollar near all-time lows for its broad-weighted exchange rate, the value of U.S. agribusiness assets—including all companies in the input supply industry—has been very attractive to foreign firms that have access to capital in non-dollar markets. Consequently, the acquisition of U.S. agribusinesses by foreign companies has increased dramatically recently. This increasing globalization of input segments increases the volatility of rivalry by introducing competing firms from other geographic areas.

Another important point is that there is a big difference between industry consolidation and the loss of a segment's competitive advantage. The U.S. nitrogen and phosphate industries are good examples. The U.S. nitrogen industry is about 60% of the size it was 15 years ago. The U.S. industry simply could not compete with foreign producers when domestic natural gas prices began to increase relative to values in other regions early last decade. Strong global demand growth coupled with lower relative natural gas prices resulting from the development of large shale gas reserves domestically has stabilized and may even breathe new life into the U.S. nitrogen industry. Nevertheless, the United States now imports roughly one-half of its nitrogen needs.

In the case of phosphate, some firms depleted their rock reserves and went out of business and others did not invest in new mine development because returns were so low during the first half of the last decade. The largest U.S. phosphate producer, IMC Global, merged with the Crop Nutrition business of Cargill to form Mosaic in 2004. U.S. phosphate rock production today is about one-half of its peak a dozen years ago. The competitive advantage of U.S. phosphate producers has eroded over time due to the higher costs of developing, extracting and processing lower quality secondary and tertiary reserves, as well as complying with more restrictive environmental regulations. Needless to say, the United States plays a much smaller role in the global phosphate market today than it did a decade ago.

### **Threat of New Entrants**

Potential entrants into the plant input sector are both domestic and international, with the latter being a larger threat. The entry of a new local competitor is a small risk in most plant input sectors. In the rapidly changing dynamics of plant inputs, foreign competitors can be enabled by governmental financing without regard to short-term or even intermediate profitability of the entrant. The entrance of Chinese glyphosate producers is a very clear example. All of the new producers emerged as a result of capacity added to existing Chinese petrochemical facilities. Each of these new producers saw a chance to increase local employment and export opportunities. It seems unlikely that they engaged in a market analysis that took into consideration a long-term profit potential. Increasingly, growing economies such as China and India see agricultural production as a strategic need that should be supported by direct government investment and assistance as needed, versus indirect support by the United States and the European Union. The ability for this new capacity to disrupt international trade and prices will be very difficult to assess for strategic planning purposes in more mature markets.

Expiration of patents, such as Monsanto's Round-up, create the potential for new producers in the plant input sector. The sector has followed the lead of the pharmaceutical industry by looking for patentable improvements to its existing technologies. This, plus the higher cost of certification of generics under the

current administration, has helped to provide some additional intellectual property barriers. Given the increasing technological content and environmental scrutiny, this will be an increasingly important tactic to extend existing barriers.

The importance of barriers to entry varies with segments of the input industry. In the case of plant nutrients, there are increasing barriers to entry. Nitrogen requires cheap hydrocarbon feedstock and an investment of a billion dollars; phosphate relies on high quality phosphate rock, access to low cost sulphur and ammonia, and an investment of \$1.5 to 2.0 billion; and potash needs mineral deposits found in a few locations, an investment of \$2.0 to 3.0 billion, plus 5-7 years to develop. The recent hostile takeover attempt of Potash Corp., the world's largest potash producer based in Saskatoon, Saskatchewan, by BHP Billiton, the world's largest iron ore mining company based in Melbourne, Australia, highlighted the attractiveness of the potash industry but also illustrated the difficulty of entry. The \$40 billion bid by BHP was deemed grossly inadequate by Potash Corp. but no white knight emerged to up the ante, indicating either the offer was adequate or there are not many knights whose kings can come up with \$40 billion to invest in a potash company. In the end, the Canadian government, based on the criteria from the Investment Canada Act, concluded the proposed deal would provide no net benefit to Canada, and BHP withdrew their bid.

### **Bargaining Power of Suppliers**

For many suppliers of commodity inputs such as steel and energy for the plant input sector, the agricultural market's profits are relatively opaque and their total consumption of the suppliers' output small. This makes the agricultural input sector a price taker, but it also helps them maintain margins. For example, steel suppliers set the steel price primarily based on global construction and automotive demand; consequently, agricultural implement manufacturers have little power over the steel price they pay. But because they represent a small portion of the sellers' markets, they are unlikely to be scrutinized heavily by steel sellers in an effort to wring special margin advantage. While this is not to say that steel sellers will not bargain hard with agricultural implement manufacturers, the majority of the steel seller's focus will be on larger consumer driven manufacturers and contractors.

Similarly with energy prices, even large producers of plant inputs are a small part of an energy company's market. So the energy producer has considerable power over the plant input supplier but the energy price is set by the consumer market, not the plant input supply market.

The power of human capital, as a supplier of labor, varies regionally, not necessarily due to the power of the individual worker but due to the demand for labor, especially specific skills, from other companies. For example, Mosaic faces considerable competition for skilled labor from other mineral industries as well as the tar sands developments in Western Canada. Thus, labor costs are high in this area and affect the size and type of capacity expansions.

### **Bargaining Power of Buyers**

Even though farm size has increased and the number of farms has decreased, there are still many farmers. So they have minimal power in dealing with their input suppliers. Plus, farmers sometimes decrease their own bargaining power by maintaining preferred suppliers and relationships, and being unwilling to consider competitors' products, because they are risk averse. In addition, many suppliers work to decrease compatibility with other suppliers and thus increase switching costs for farmers.

Farmers may see borrowed money as a commodity, but many do not shop their business to other lenders or even do a serious consideration of other lenders. This is seen anecdotally in the United States, and was found in a survey of German farmers (Musshof, Hirschauer, and Wassmuss, 2009). Farmers could make themselves more "bankable" which would increase the number of lenders who would bid on their business. Farmers, who maintain their financial records in an easy to supply and verify format and take the time to fill out the information required for a serious counterbid, can reduce spreads and fees and remove covenants—thus making lenders more competitive in their market area.

Plant nutrient distributors are consolidating and gaining bargaining power with input suppliers. Agrium is growing a large retail distribution business. More buying groups are emerging. Large distributors are building more import terminals and developing expertise to source product globally. These larger distributors are forcing their input suppliers to be more competitive in their pricing. However, since these distributors sell to

many farmers, they are able to keep a larger share of the supply chain profit for themselves.

### **Threat of Substitutes**

While a plant cannot substitute one nutrient for another, changes in seed technology have had and will continue to have significant implications for plant nutrition. That is, the efficacy of alternative nutrient forms and delivery methods may create products that can substitute for each other even though the basic nutrients do not. The development of genetically engineered pest resistant varieties is another example of products that create substitutes for current pest treatments and alternative seed choices. These new substitutes have resulted in a substantive convergence of two previously fairly independent value chains, seed and crop protection, and a large transfer of value from crop protection companies to seed/biotech companies. Those input producers who can create these products or partner with seed producers will have an advantage in marketing and, if successful, gain market share.

Patent expiration does not create a substitute product directly. But generic products are substitutes for the original product and create competition for the original producers, as discussed earlier in the example of Monsanto's Round-up.

### **Technology**

Changes in seed technology that will increase plant populations to 60,000 per acre will have significant implications for plant nutrition. There simply will be more 'mouths' to feed per acre. Providing plants the right amount of the primary nutrients—nitrogen, phosphorus, and potassium—as well as secondary nutrients, such as sulphur, and micro nutrients such as zinc, at the right time becomes more critical and a bigger challenge. Retail distributors likely will play a greater role in managing plant nutrition with this more complicated technology. In addition to advances in application technologies, new plant nutrient products may emerge, such as Mosaic's MicroEssentials® line of products which contain nitrogen, phosphate, sulphur and different micronutrients depending on the crop. The increased use of GPS enabled equipment allows farmers to increase seeding density, increase the accuracy of nutrient and chemical placement, and decrease fuel use per acre. These new technologies will have different impacts on different inputs and geographical areas. In some cases, they will increase demand for nutrients. In others, they might increase the crop canopy to eliminate the need for weed spraying. Again, those input suppliers and distributors who respond with these new products and services will have a competitive advantage in the future.

The increasing rate of technological change and its significant interactions among inputs puts a premium on technological adoption as a primary farm management skill. Those suppliers who can educate the buyers on these interactions to take advantage of combined effects will gain significant market share. Suppliers can also benefit from the fact that their knowledge has increasing returns to scale, since informing one operator does not restrain another operator's usage of the same knowledge. The information dissemination will be facilitated by increasing applications of information technology (I/T) infrastructure. This large investment in I/T resources will be another "economies of scale" issue for input suppliers. Once the I/T system is in place, the owners of the system have a huge incentive to drive as much volume through the system as possible.

### **Other Drivers of Change**

The growing role of national, state, and local governments and their regulations are important drivers of economies of scale. As governments make it more difficult to comply with environmental issues, those suppliers who can overcome the barriers to entry will find advantage. Smaller companies will most likely look to be acquired by larger companies that have the regulatory expertise to comply. However, their inability or difficulty to comply easily diminishes their value as a stand-alone enterprise, and buyers will use this to bid down the values of those smaller companies.

In other instances, governmental regulations may be met, but other groups use the courts to change the rules or even take away permission to use resources. As an example, environmental groups sued the U.S. Army Corp of Engineers which had issued Mosaic a permit to mine a large track of their own phosphate deposits in central Florida. A Federal District judge granted the groups a preliminary injunction causing Mosaic's largest and most efficient mine to sit idle until the legal issues are resolved through the judicial process. The permitting process has taken seven years, thousands of man-hours, hundreds of thousand pages of documents, and the commitment of significant reserves set aside for resource protection. The use

of the courts has caused the permitting process to be more costly in terms of time, resources and concessions. Again, larger companies have the advantage and capacity to follow the permitting process to completion where smaller operations are less likely to have this capacity.

In many instances, drivers of change are coming to the input suppliers due to pressure farther down the chain, closer to the consumer. For example, concerns over the environment are causing consumers to ask, and even pressure, processors and manufacturers to change their processes and sources of raw inputs. Thus, processors put pressure on farmers to change, and the farmers, in turn, ask their suppliers for specific characteristics in inputs in order to meet demands by the farmers' buyers.

### **Closing Comments**

In summary, the increasing importance of the triple bottom line— economic, environment, and social— multiplied by the internationalization of the value chain and the increasing demand for food, fuel, and fiber as the population grows will put performance demands on all aspects of the value chain, including on input suppliers. These interactions increase the need for companies to manage and mitigate the increased risks of the global economy. Those suppliers who can respond to these new dynamics will be the suppliers of the future.

### **For More Information**

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