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Session 3:  
Evolving Agricultural Supply Chains

# Evolving Agricultural Supply Chains

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Major changes are occurring in US and global agriculture which ultimately will be changing production and trade patterns, as well as impacting management of global supply chains, and ultimately logistics. The purpose of this paper is to describe some of these changes and their impacts on global supply chains.

Topics that are discussed include:

- Macro drivers to changes in agricultural marketing and the implications for global investments;
- Supply chain management in agriculture with an elaboration on some of the major principals, and the implications for market participants;
- Facilitating mechanisms of efficiency gains in supply-chain management and examples are provided on mechanisms to improve efficiency of supply chains;
- Implications for investment and strategy, particularly as it relates to infrastructure and management

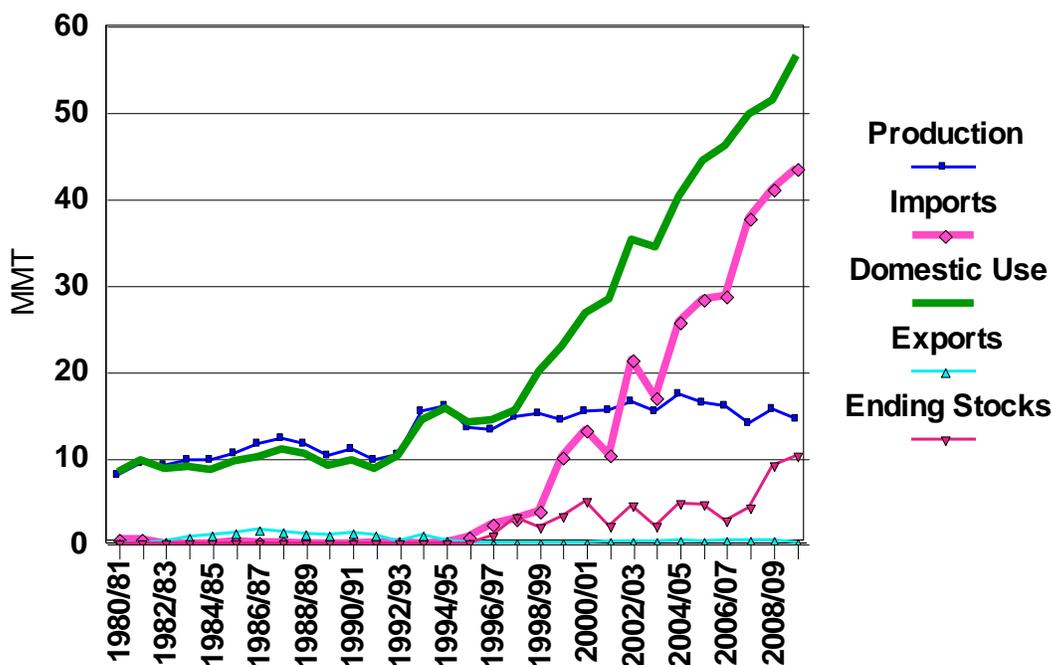
## **Macro drivers to changes in agricultural marketing**

While there are a multitude of factors impacting global agricultural marketing, there are a number that stand out in importance. These include biofuels---which in the United States now takes about 35% of corn area to provide feedstock to the ethanol industry. Second, is volatility---simply agricultural markets are now much more risky (by a factor of about 2 on price volatility compared to the 1980s). As a result, there has been a major dichotomy in terms of agricultural firms making or losing huge amounts of money as a result of effective vs. non-effective risk management strategies. Virtually all food and agriculture firms are in the process of reviewing and/or developing their risk policies. Third, industry managers have become much more sophisticated in terms of their demands for managing supply chains and risks. While 20 years ago, it was primarily US market participants that attended to these issues. Now, buyers from throughout the world are focusing and very ably trying to demand more efficient solutions to supply chains and risk management.

In addition to these there are two sets of issues that are elaborated on in greater detail. These include radically changing global supply and demand characteristics and the growth of agbiotechnology which is a game changer.

**Global supply and demand:** Globally, there are some very important changes occurring in demands and supply. It is important that growth rates in consumption for most agricultural grains and oilseeds are growing at a faster rate than growth in productivity. Our research suggests that typically, growth rates in demand are ranging in the 2 to 3 percent per year range, depending on crop and country.<sup>1</sup> Demand growth is changing radically and is being driven primarily by growth in income, population, urbanization and resulting changes in diet composition, which are largely irreversible. Most dramatic of course is the growth in demands in China, as well as other countries. In fact, one of the most dramatic changes in world consumption is the growth of soybean imports to China (Figure 1).

**Figure 1: China Soybean Supply and Demand.**



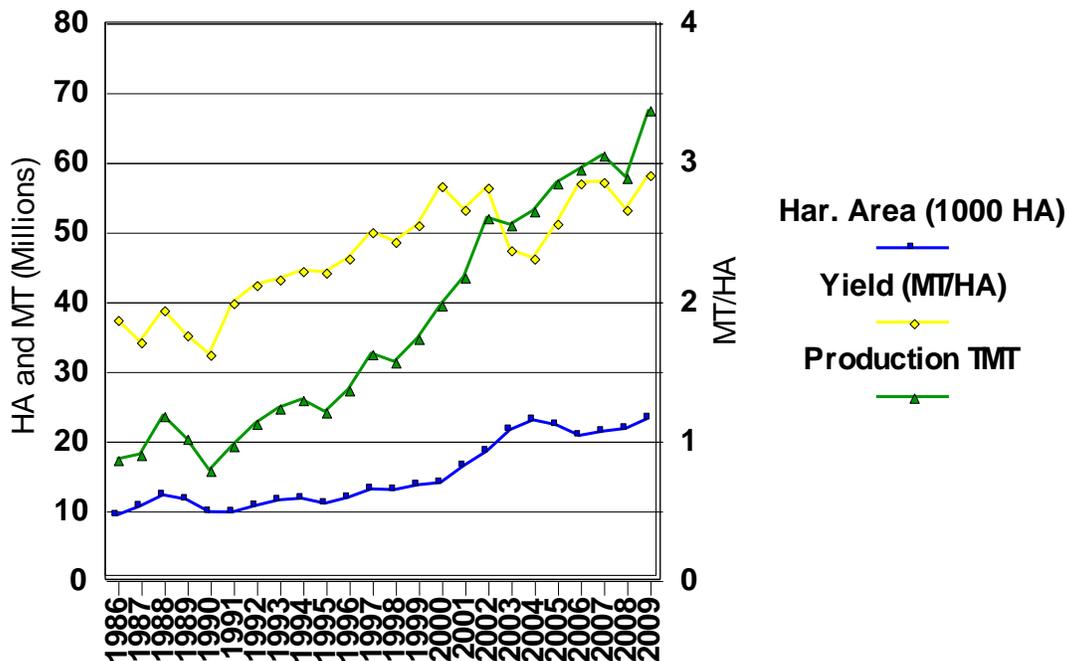
In contrast, productivity in agriculture is less than this, and in the area of 0.8 to 1.3 percent depending on the crop and region. The impact of this dichotomy is that prices have to be high

<sup>1</sup> See William Wilson, Won W. Koo, Richard D. Taylor, and Bruce L. Dahl. 2008. "Impacts of Ethanol Expansion on Cropping patterns and Grain Flows." *Review of Agricultural Economics*, 30(4): 642-663 Winter 2008; Eric DeVuyst, William W Wilson, and Bruce Dahl. "Grain Shipments on the Mississippi River: Longer-Term Forecasting and Risks." *Logistics and Transportation Review*, Accepted Oct 22, Transportation Research Part E. Reference TRE 446; and Wilson, B. Dahl, S. Taylor. "Impacts of Lock Capacity Expansion on Delay Costs For Grain Shipped on the Mississippi River." *Journal of transport economics and policy*, JTEP 2229.

enough, long enough in order to 1) induce new technology into agriculture; 2) induce new lands into production and/or 3) ration demands. Ultimately, each of these will probably be important over time.

There are two regions in the world in which production has notably increased, the Former Soviet Union (FSU) and Brazil. The changes in FSU agriculture are important for a number of reasons.<sup>2</sup> First, after many years of being an importer, FSU emerged as an important exporter in the past few years. See Figures 2-3. In fact, in recent years, the volume of exports from this region is approaching that of Canada. Second, their focus is mostly on small grains, wheat and barley, which are markets which had already been experiencing only modest growth. Third, they have international logistical advantages in a number of regions relative to North America (e.g., North Africa, European Union (EU), etc.), but in addition to these markets, they have been exporting and trying to develop expanded exports in traditional North American markets. These include Asia,<sup>3</sup> Latin and South America, amongst others. Fourth, they have the ability to sell at relatively low prices for a number of reasons. Taken together, these changes are long-lived and will persist in the coming decades. In fact, as they improve the varying aspects of their logistical system and agricultural production, they will improve their ability to penetrate markets.

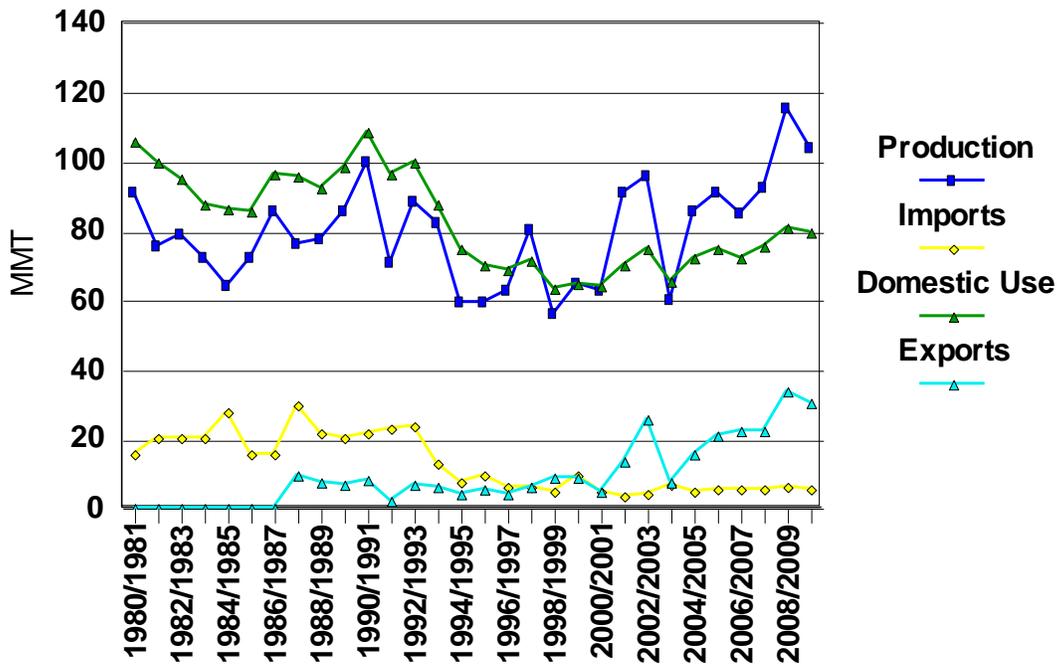
**Figure 2: Brazil Soybean Supply and Demand.**



<sup>2</sup> See Kolesnikova and Dreibus, “Russia Fights for World Dominance—in Wheat: It may supplant the U.S. as the world’s top exporter in less than 10 years,” *Business Week Magazine*, June 7, 2010.

<sup>3</sup> See Ruitenber, “Japan Considers Buying Wheat From Ukraine, Russia,” *Reuters* June 18 (Bloomberg).

Figure 3: FSU Wheat Supply and Demand.



On a global basis there are numerous demands for investment in global marketing infrastructure. In fact, one of the primary advantages to the United States is its logistical system. These other countries are all in varying stages of improving their systems as well, which will go a long way toward reducing their logistical costs, congestion costs, and improving availability.<sup>4</sup>

In the case of Russia, the primary needs are for interior infrastructure (new elevators), railways, wagons and on-farm storage facilities. It is estimated that Russia roughly needs \$20-25 billion for infrastructure costs and production improvements. This includes \$6-10 billion for on farm, and \$350 million for port infrastructure, railway stations reconstruction, wagons, inland country elevators, etc. For the Ukraine<sup>5</sup> it has been estimated to need \$20-25 billion investment in production and infrastructure. Further, they noted that even though major firms have already invested, “the market is still wide open for smaller companies...”

Brazil is the other country that has expanded its production of both soybeans and corn. This growth accelerated after 2004 when there were major changes in laws governing production and research of genetically-modified (GM) crops. Initially, this was a change for a one year duration only, but, eventually the one year restriction was lifted. Since then, their productivity growth rates have escalated and the amount of land in production has grown.

<sup>4</sup> The values below are based on personal communications with individuals knowledgeable on these developments in these respective counties, 2010.

<sup>5</sup> See *Financial Times* June 2 “Investment Climate will Determine Yield”

Demands for logistical infrastructure in Brazil are well known. Brazil has evolved with rapidly changing agriculture, no traditional institutional mechanism to facilitate investment in logistics infrastructure, changing geography of agriculture, excessive logistical delays and demurrage. As early as about 6 years ago, there was an elaborate plan to address a multitude of problems. The estimated cost of this was \$7 billion. Of course, much of this had been stalled for varying reasons. Nevertheless, there has been some progress. This includes the North-South Railway; Tucuruí Lock, Paving of the BR-163, and the expansion of ALL railway from Mato Grosso to Santos.

More recently, the president allocated funds, and the new president will have to execute the program further. This is commonly referred to as the Growing Accelerating Program under which large investments in infrastructure will be executed. Amongst others, this includes ports \$2.5 billion through 2014, waterways (including dredging) \$1.77 billion in the next 4 years and farm roads \$1 billion. Further, the most important investment needs going forward include port investments to expand the capacities at Itaquí, Santarém and Vila do Conde (mainly). Investment will also be needed for inland terminals: railway and waterway terminals will also demand private investments, and transport including rail and barges.

As a result of these investments, Mato Grosso (mostly) will gain strong logistic advantages, helping to develop the region (adding more storage capacity, enhancing second cropping, etc.). In practice however, there will be difficulties due to regulations, environmental issues/permits and bureaucracy which may delay or even halt those funds. By the end of this year the election of a new president will have to re-assess these priorities.

In summary, as noted by an expert in Brazilian grain marketing,

*“Brazil development may not be sustained because we are on the eve of a logistical burnout, simple most of the paved roads, harbors and terminals were made in early seventies.”*

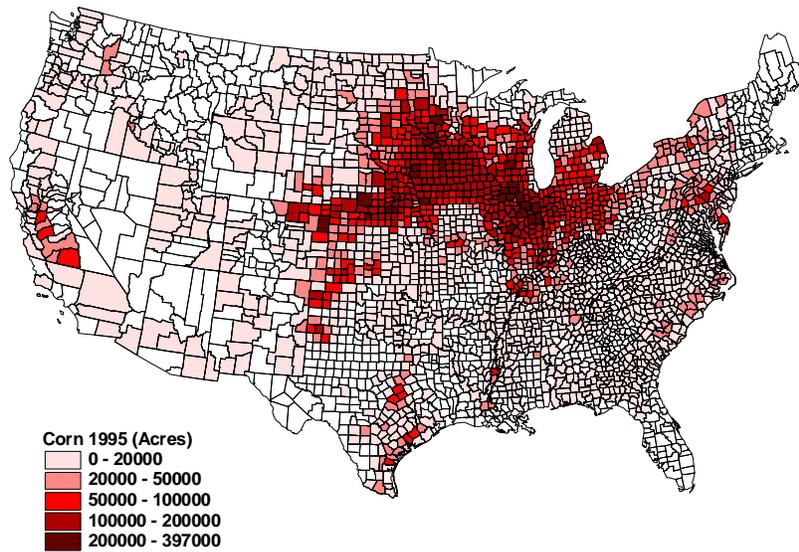
**Biotechnology:** Agricultural biotechnology is having a major impact on agriculture production, marketing and trade, and this is expected to continue in the coming decade. Agbiotechnology has the impact of changing the growth rates in productivity, and, as a result, changes the spatial geography of production, both within the US as well as among countries, in addition to development of numerous differentiated traits. Proposed changes and acceleration in crop technology development (inclusive of conventional breeding, molecular markers and genetically modification) would result in more rapid growth in productivity. Generally, this may result in a doubling of productivity by 2030, which translates to a cumulative growth rate of about 3-3.4 percent per year.

There have been substantial changes in production patterns within the United States, in part as a result of agbiotechnology. Most important has been the shift in production more northerly, and westerly versus historical patterns (Figures 4-8). Generally, throughout some parts of the United States, there have been more cropping alternatives which have impacted traditional crops.

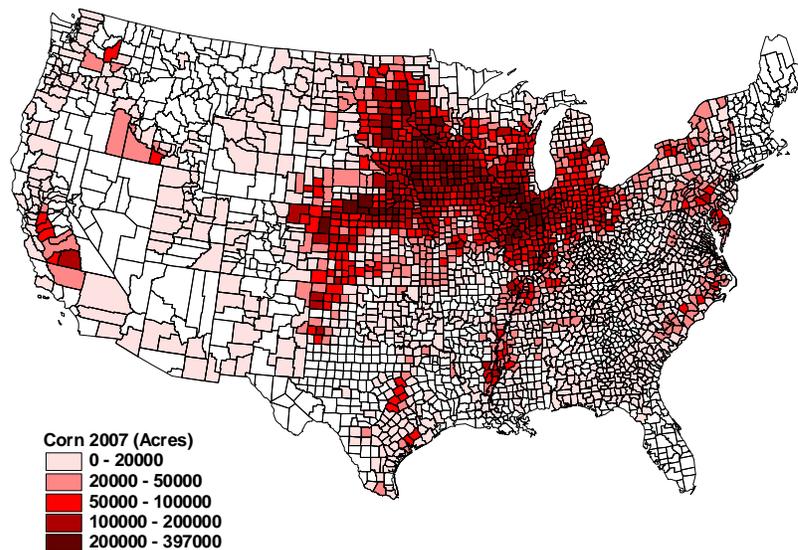
Of particular interest is wheat which has lost 30-40 percent of its area planted during the past couple of decades (Figure 9). In part, this has been lost to crops produced with agbiotechnology.

Finally, with advances in breeding technology, companies are developing and planning to commercialize numerous differentiated traits in the coming decades. For each corn and soybeans, there is expected to be up to 20 new traits under development. Some of these are competing traits, some are a result of partnership initiatives, etc.

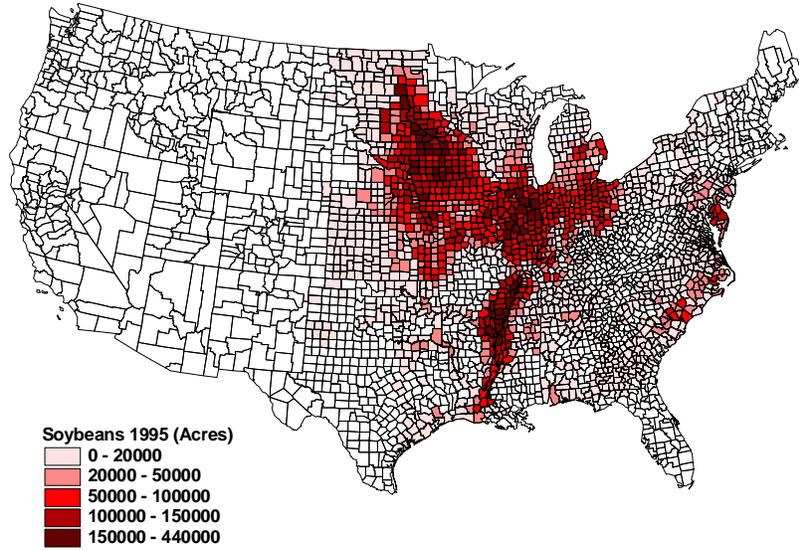
**Figure 4: Corn Planted Area in 1995.**



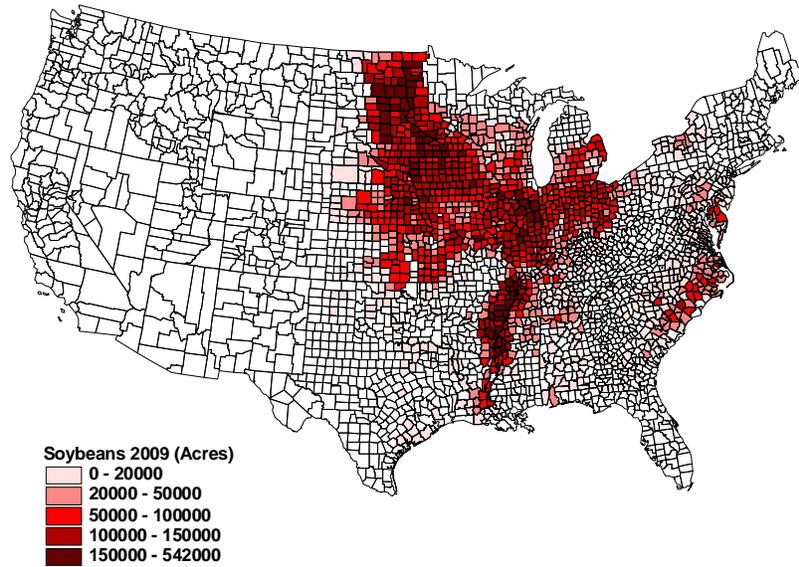
**Figure 5: Corn Planted Area in 2007.**



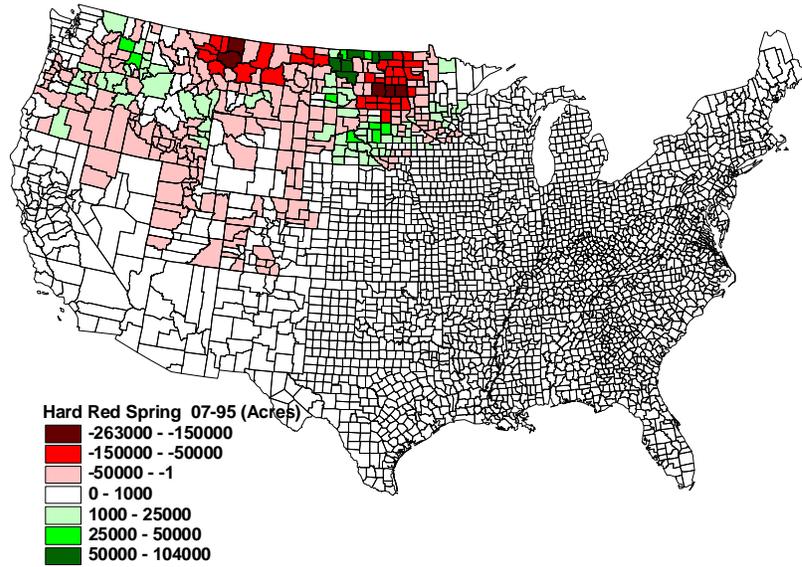
**Figure 6: Soybean Planted Area in 1995.**



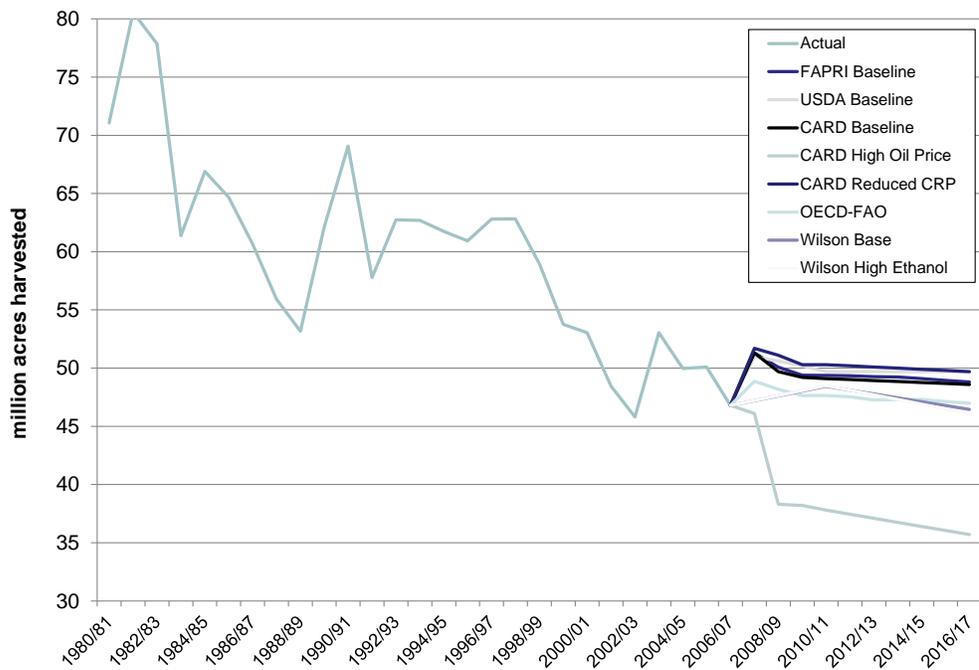
**Figure 7: Soybean Planted Area in 2009.**



**Figure 8: Change in Hard Red Spring Wheat Planted Area 2007-1995.**



**Figure 9: U.S. Harvested Wheat Acres, 1980-2006 and Projections for 2007-2016.**



### **Management Response to Supply-Chain Risk: *Improve Efficiency and Diversify***

There are a multitude of mechanisms that are important in supply-chain management in agriculture. These include varying forms of hedging and cross-hedging, use of contracting mechanisms, geographic diversification and use of buffer stocks. Each are described briefly.

Hedging has been the traditional means of managing risks in the supply chain. This is certainly the hallmark of marketing strategies in agriculture. However, looking forward, hedging mechanisms in agriculture while essential, will pose challenges in further refining supply-chain management risk. There are a several reasons for this. One is that trading futures is really limited to a few large silver-bullet type commodities (e.g., corn, soybeans and wheat). There are many other commodities within agriculture that have exposure to risk that are not covered by futures, in addition to the multitude of emerging specialty crops or crops with special traits, by-products and services. None of these have direct hedging applications, but yet are a very important component of agricultural marketing. Second, for varying reasons the optimal hedge ratios for most commodities have decreased in recent years, ultimately meaning that hedgers are being exposed to greater risk than previously. Third, volatility in futures and basis has escalated drastically in recent years. In our calculations, as a result of the escalation in volatility, there is now about twice as much risk (as measured by volatility of prices; not net returns to production) compared to what existed in the 1980s. Hence, the demands on risk management and risk management alternatives are now very great.

An alternative to complement the use of hedging is direct contracting. While still minor by some standards, there has been an escalation in contracting and we would expect that to continue. The primary motive for this is that direct contracting has the impact of reducing more risk than can conventionally be achieved through direct hedging. Indeed, with the growth of specialty crops and crops with special traits, and battle for acres, the demands for contacting have escalated. However, these are compounded by alternative pricing mechanisms, act-of-God clauses, post-harvest price adjustments, among others,<sup>6</sup> which is inevitable given the interfirm and intercommodity competition that has emerged in recent years. For numerous reasons, direct contracting is escalating as a means to supply-chain management.

A third strategy for supply-chain management is geographic diversification. Indeed, this is a relevant strategy for firms operating in some of the minor commodities that for varying reasons are being squeezed out of traditional production regions. These include malting barley (northern tier, west and Canada), durum wheat (northern tier, Canada and desert durum), and sunflower, amongst others. In each case, because of the high degree of risk in procuring commodities from a single region, it is in most firms' best interests to diversify geographically. In fact, there is a

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<sup>6</sup> See Wilson and Dahl William W. Wilson and Bruce Dahl. 2009. "Grain Contracting Strategies to Induce Delivery and Performance in Volatile Markets." *Journal of Agricultural and Applied Economics*, 41- 2(August 2009):363–376; and greater detail in William W Wilson and Bruce Dahl, 2009. Grain Contracting Strategies: The Case of Durum Wheat, Agribusiness and Applied Economics Report No. 648, August 2009.

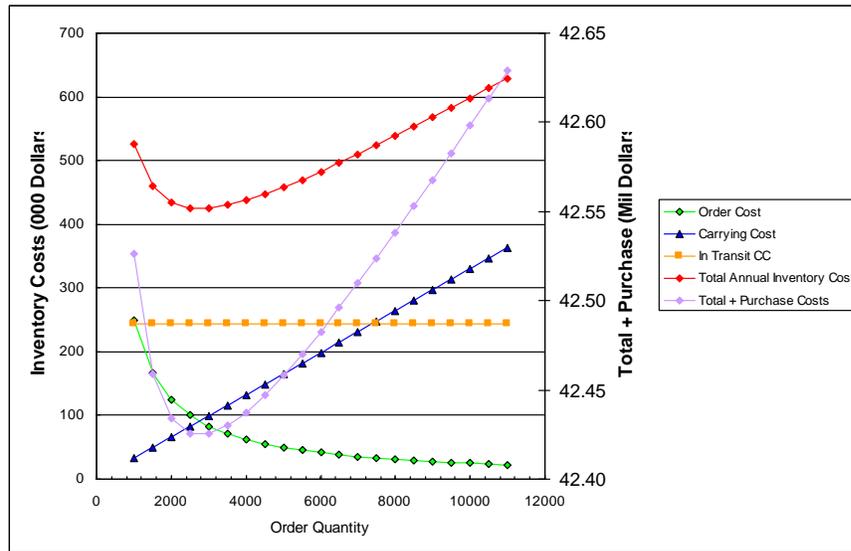
distinct risk/return tradeoff in these decisions in that diversifying typically results in reduced risks, but, greater costs.

A fourth strategy is inventory holding, or buffer-stocks, which are form of temporal diversification. Indeed, one of the principals of supply chain management is that in those commodities with varying forms of risk, the appropriate strategy is to increase the level of inventories. The purpose of this is to manage risks related to quantity, quality, price risk, as well as logistical risks including risks in modal arrivals, transit times, etc. (see below). Inventory holding is a very appropriate strategy for supply chain in agriculture, despite that it frequently is challenged financially by those promoting just-in-time type strategies. It is particularly appropriate for the commodities that are non-hedgable, and those that have excessive basis risks. A typical buffer-stock strategy would involve stock accumulation when prices are low and, drawing down stocks when prices are high. While costs are important, in many cases stock-holding would be less than the cost associated with market volatility.

While these are complicated and typically not used extensively in practice, they are important in managing agricultural supply-chains. Our approach to recommendations on these is that each is an important element of strategy. The role of strategic risk management requires assessment and use of each of above for portions of purchases. As a result, the important strategic questions are how much should be allocated to each strategy and how should these change over time?

The conventional model used to analyze supply chain strategies is commonly referred to as the economic order quantity (EOQ) model (Figure 10). It allows a quantitative assessment of all the elements of procurement costs, and an assessment of the tradeoffs between costs and inventories. The goal of the EOQ is to balance different costs in supply-chain decisions. Ultimately, the model seeks to minimize total costs and the optimal solution determines purchases, timing of purchases, and inventories. One of the results promoted by just-in-time (JIT) manufacturers is a recommendation of near-nil inventories. However, this is not true in agriculture supply-chain management due in part to the multitude of risks in this industry.

**Figure 10: Conventional SGM Models.**



Indeed, quantitative solutions to the EOQ problem results in it being appropriate to hold inventories in many cases. In agriculture, this is mostly due to the impacts of anticipated price changes, price risk, and risks related to quantity and quality. All of these result in solutions requiring more elaborate strategies regarding purchases, relations with suppliers, diversification and buffer-stocks. This form of temporal diversification—intercrop year is common in many industries and provides partial risk protection against is just the opposite of JIT.

Finally, as an important observation in agricultural marketing, supply-chain management (SCM) can be viewed as elements of a firm’s vertical strategy. During the late 1980’s until current, many firms in agriculture pursued varying forms of vertical integration (grain exporters), and in some cases vertical disintegration (e.g., Sarah Lee). The general trend was for originators to become more vertically integrated and processors less.

While debates over vertical strategies will ensue, ultimately, these require very sophisticated quantitative analysis and formulation of combinations of strategies. We are now going to be observing a very interesting evolution on this issue. Anheuser-Busch has traditionally been one of the more strategically vertically coordinated agricultural firms in the United States.<sup>7</sup> The acquisition of Anheuser-Busch by InBev represents a drastic departure from these vertical supply-chain management strategies. InBev paid a premium for Anheuser-Busch, in part, since it is a premium product (i.e. commands a premium in the market), which was due to a multitude of

<sup>7</sup> Specifically, without being exhaustive, the goal was to promote their beer was made with the *best available ingredients*, and, fresh/dated. To achieve these goals, they had tight specifications on ag ingredients, and facilities, variety specific, vomitoxin, chemical use, storage, and used a consistent blend of ingredients across breweries by variety composition, and year of production. While not completely vertically integrated (through ownership), they did their own breeding, varieties, elevators, malt houses, and leases rail cars; they would be considered using tapered vertical integration in most functions, had extensive contracts with growers, were highly geographically diversified, and temporally diversified through the use of inventories.

vertical controls and marketing. However, these two firms have radically different approaches to vertical management. InBev strategically outsources as much as possible, uses incentive contracts and base management bonuses (very substantial by industry standards) on cost savings. In practice they would anticipate adjusting product quality if crop quality problems occur (as opposed to retaining the same ingredient specification/composition). If prices increase, their view is that it would be easy to raise prices as competitors would have to as well, assuming competitors are not covered through contracts of inventories (i.e., assuming competitors are not behaving strategically).

This will be a big experiment to monitor. However, other major firms are going through similar, though opposite, changes in strategies. As examples, both Pepsi and Coke had pursued strategies of vertical disintegration. In 2009, each of these firms sought to re-establish vertical integration as a strategy by acquiring bottlers/distributors. And, the *Wall Street Journal* (Nov 30 2009) argued for more re-verticalization (Oracle, and others). This was a major change in strategy and attributable to changes in volatile commodity prices and financial pressures at suppliers. Specifically, they indicated,

*The historical view of vertical integration was that “you had complete control of the supply chain and that you could manage it the best,” Today's approach is more nuanced. Companies are buying key parts of their supply chains, but most don't want end-to-end control. ....” If you're buying fully from a market, you are relying on that market's supply chain,”*

### **Facilitating Mechanisms of Efficiency Gains in Supply-Chain Management**

The global logistics industry is going through similar changes. In many countries that are emerging exporters, the primary scope of their changes is to expand infrastructure (as described above). In other countries, notably the United States and to a much lesser extent Canada, there has been growth in more sophisticated shipping mechanisms to improve logistical efficiency with existing or marginally increasing capacity. Indeed, these mechanisms are being evaluated for adoption in the emerging countries as well. The implications of this is that the elements (described below) that improve logistical efficiency provide the United States with a logistical advantage with existing capacity; but, over time, other countries may improve upon their own logistical efficiency.

The United States has experienced quite a drastic change in mechanisms that govern logistics during the past couple of decades, ultimately resulting in reduced shipping costs to growers and greater reliability of service. In the case of rail, the most important changes include transitions or adoptions as listed below:

- Box-car to covered hopper cars; to jumbo covered hopper car shipments;
- Multi-car shipments: 1, 26, 52, cars, etc.

- Development of forward guaranteed shipments by rail: tradable, penalties for non-performance, or late; forward, etc.
- Demurrage: Increase in demurrage to encourage better utilization of equipment
- Shuttle trains: 110+ cars with incentives

For one major grain hauling railroad, 50-60 percent of volume is in shuttles (and DET's), and some of the export markets are nearly exclusively shuttle train shipments.

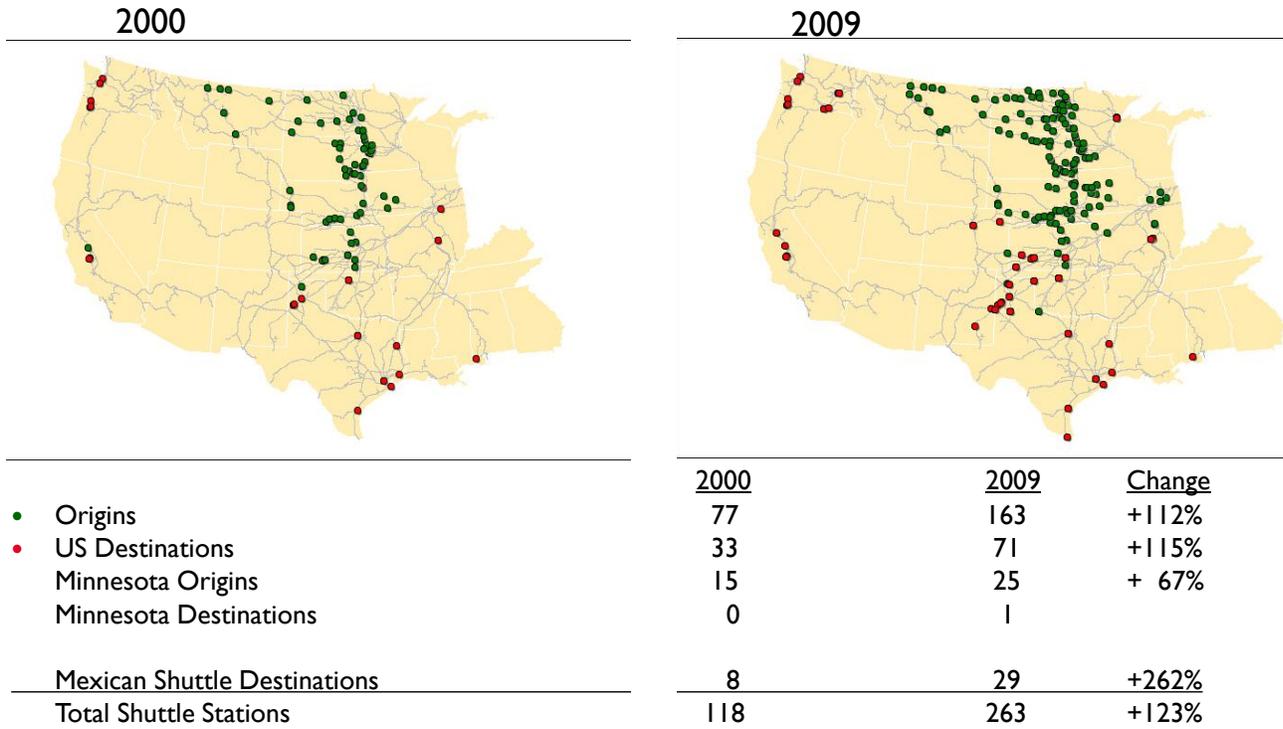
While the above could be viewed as a continuum of changes, the development, adoption and implementation of shuttle shipping is perhaps the greatest change.<sup>8</sup> That mechanism requires shipping of 110 cars from one origin to one destination and then provides for continuing like movements throughout the year, or through multiple years. Incentive payments are made to shippers that load in 15 hours or less and unload similarly, and that provide following originations of like volumes.

The cumulative impacts of these changes are that rail costs are reduced and savings shared with shippers. This, incidentally, has provided an immense advantage to rail relative to barge shipping. As a result there has been major investment in rail shipping capacity and infrastructure (\$10+ million and track space). (Figure 11) For most shuttle elevators, turn-over is now 10 to 12+ times per year. The mechanism also has resulted in improved information transparency (See railroad www pages). Primary market results are available and an efficient set of secondary markets/transactions in shuttle commitments has evolved. Ultimately, this has resulted in an industry that is now simultaneously trading commodities and rail freight. In addition, by utilizing equipment more effectively, it has resulted in an effective expansion in capacity (Figure 12). Finally, this has allowed the railroads to evolving toward more “scheduled” shipments.

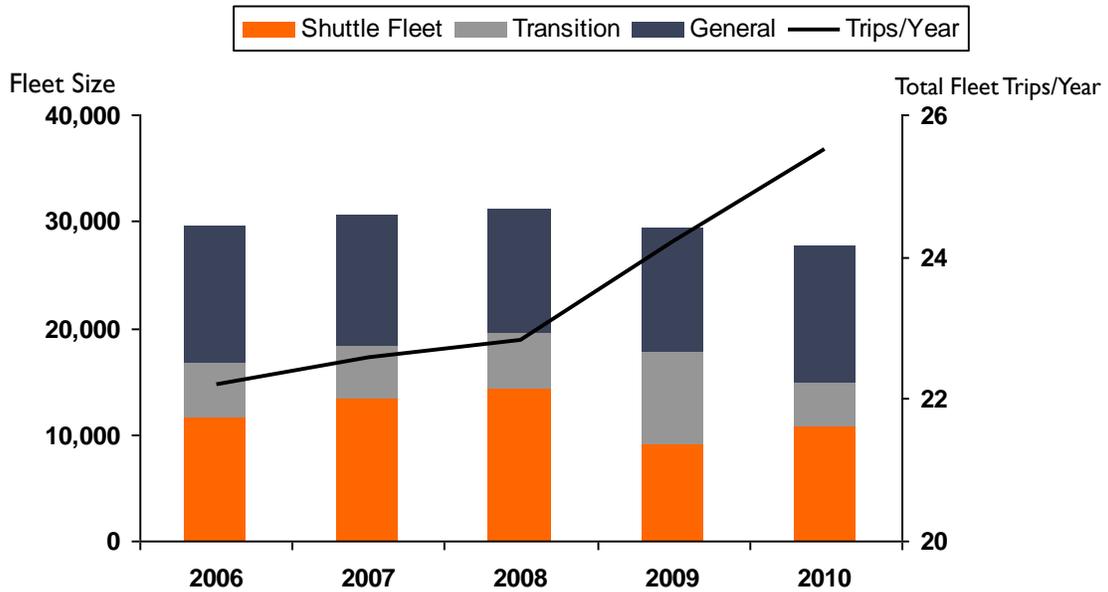
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<sup>8</sup> These issues are covered in: Wilson, W., S. Priewe, and B. Dahl. “Forward Shipping Options for Grain by Rail: A Strategic Risk Analysis” *Journal of Agricultural and Resource Economics*. July 1998, 23:526-544; Wilson, William W., Donald C. E. Carlson, and Bruce L. Dahl. “Logistics and Supply Chain Strategies in Grain Exporting.” *Agribusiness: An International Journal* 20(4):Autumn 2004; and Wilson, W., and Bruce L. Dahl. “Railcar Auctions for Grain Shipments: A Strategic Analysis.” *Journal of Agricultural & Food Industrial Organization* Vol. 3, No. 2 (Article 3):1-27, 2005

**Figure 11: BNSF Shuttle Franchises, 2000 and 2009.**



**Figure 12: Rail Transportation Capacity and Trips/Year.**



## **Summary Points: Implications**

These are very exciting times for agriculture and investment opportunities in global logistics in particular.

From a macro-perspective, it is important that demand growth is exceeding productivity growth (1-4 percent per year). This is being driven by population growth, income, urbanization and changing diets; and, new uses including biofuels. Regions of particular importance with stronger growth include: China, Asia and North Africa. Using conventional technology, productivity growth is about 0.8 to 1.4 percent. With new and proposed advances in breeding (inclusive of molecular breeding and genetic modification), productivity could increase to prospectively 3 to 3.4 percent per year. With these growth rates, most of the increased production (to meet demands) will come from productivity growth and shifts in the geography of production.

There will be some important geographical shifts in production. In general, this will result in the United States increasing soybeans and corn and shifting away from small grains. South America will increase soybeans and corn. The FSU will become more domineering in small grains and non-biotech crops. Biotechnology will be a game changer and induce changes in productivity growth rates, and spatial geography of production.

From a global logistics perspective, major investment in infrastructure is needed in both the FSU and Brazil. While plans are in place for this to occur, it will still be subject to political processes, competitor interactions, and take an elongated period to be realized.

The United States has an important advantage in agriculture due to its existing logistical infrastructure. This is in addition to more efficient management/use of infrastructure through innovative pricing mechanisms. Within the United States there have been increased shipments, notably by rail, in part due to the adoption of shuttle train shipping. In addition, a new export facility is under construction at Longview? These are in addition to more innovative management mechanisms to induce efficiency – having the impact of greater throughput with existing capacity.

The implications of these changes for the agricultural industry are that over time there will be greater competitive pressures for shipments from non-US origins. In the United States, there will be pressures for more forward-looking transactions, including greater detail on shipping mechanisms, requirements and assurances. This requires mechanisms to reduce/manage risks for buyers and sellers for longer periods than previously required. In the future, there will be investment lags/gains (in all countries) to accommodate changing geography of spatial trade in agriculture. There will also inevitably be greater emphasis on managerial control of supply-chains. There will be challenges with escalation of emerging highly differentiated GM traits (i.e. in soybeans and corn), and wheat (10 years). Finally, there will be greater needs to create mechanisms to improve efficiency of supply-chains and to achieve greater volume with existing capacity.

## Industry Panelist

## Transcript

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*Patrick Kleumpke  
Executive Vice President  
CHS, Inc.*

Thank you. You know I just have to take a moment to get my presentation calibrated on the fact that, although we were very honored we were extended the invitation to come to such a “distinguished group,” I have been asked throughout yesterday afternoon and evening, just who is CHS. Although we do not have a power-point presentation that allows us to very subtly advertise our company, such as some of my colleagues are able to do, I do want you to know that CHS has some of the following attributes I quite honestly believe and hope are going to lend further enhancement to this gathering today.

CHS is a farmer-owned organization. We are based in St. Paul, Minnesota. But we have two primary business operations and that is where we get the connotation of C and HS. C is for Cenex, and it is the farmer-owned organization that developed their business model around refining crude oil. They were emulating the strength of supply-chain logistics and distribution throughout the upper Midwest of the United States.

Harvest States was the farmer-owned coop that did the very same thing: replicated their business model around grain marketing, again logistics and distribution in the United States. These two organizations came together in 1998 and today, although we are truly a commodity-driven entity, we have a global platform that spans across the primary production regions of the world to which I am going to address in my presentation.

We are an organization that runs about \$26 to \$28 billion in annual revenue, excluding any of our joint ventures that are off-balance sheet. You heard about one – Ventura Foods. We also have another joint venture with Cargill in the wheat flour milling business.

At the end of the day it is a farmer organization that is taking the business model and truly emulating it in a global nature. Today we have marketing offices in Calgary, Tokyo, Shanghai, and Hong Kong. We are opening one in Singapore. We are in Buenos Aires. We are in Mexico City, São Paulo, Kiev, Geneva, and in Barcelona, Spain. I don’t say that to enhance. I only say that because I think I now have a better appreciation of why Jason Henderson was rather persistent when he called and said, “I would like CHS to talk about evolving agricultural supply chains and what is going to happen in the middle with these crop input suppliers. Whether they are distributors, wholesalers, or dealers, where do you see that all going?”

Then the light bulb finally came on and I said, “I think we can do that.”

So, with that, I have some remarks I would like to go through for you this morning. Again, our responsibility is to talk about the evolving agricultural supply chains.

To better understand and position today’s debate concerning that question, which is how market or government policy forces are going to influence the crop input industry that serves production agriculture, we have to narrow the focus. I would like to draw your attention to some of the following criteria I believe are good benchmarks for us to better understand how we are going to answer it.

First, I would like to divide production agriculture to include the primary global production regions of the world. I am going to give you some examples. A big, distinctive region of the world we watch and participate in is from the western Canadian prairies to the U.S. delta. That is one distinctive region we have to address when answering this question.

Another is from the state of Mato Grosso in Brazil to the state of Buenos Aires in Argentina, another big production area of the world. We have the respective coasts of Australia that play a very important role and are the third region we participate in.

The fourth is the Black Sea region of southwest Russia, Ukraine, and Romania.

Second, I would like to define production agriculture to include cereals, feed grains, oil seeds, rice, cotton, sugar cane, fruits, and vegetables. These truly are the crops a production farmer identifies with on a global basis.

And third, I would like to define production agriculture to include the farming units of 1,000 hectares, which are approximately 2,500 acres or more. As I travel the globe for our company – and I don’t say this with a degree of arrogance on a farmer – but they will truly tell you, if you are not at that minimum, you’re not really serious about being a farmer.

For anyone involved in the agricultural input supply business, whether you are a manufacturer, a wholesaler, a retailer, or a franchise dealer, it is truly all about knowing and accessing the crop acre, with the farm operator making the ultimate decisions. He or she truly is the gatekeeper.

Here are some emerging characteristics I wrote down to best describe this global farm operator we are trying to get our arms around today going forward. Looking at a number of different sources, I pulled up a number of random ones. At CHS we believe they account for more than 70 percent of all crops produced and represents less than 15 percent of all farm entities globally.

They are more focused on net return per acre, than on yield per acre. It is a business; this is not a way of life. They allocate capital to fixed assets and efficiency enhancements that have priorities based on highest returns over stated periods of time. They manage working capital, so that liquidity is their priority. They separate technical expertise from product placement and

control access to an ever-increasing degree. For all of us who think bundling works, that is not necessarily the case for this group.

They seek out knowledge and expertise beyond the farm gate and they are willing to pay for it. Risk mitigation is as important as price discovery to these farm operators when deciding on a supply channel.

For this farm operator sector, crop inputs such as fertilizer, certain chemicals, capital, and fuel are viewed as commodities. While new-generation seed powers units such as combines or tractors, as well as advisory services, they are technology traits and they have proprietary rights. Commoditized inputs therefore are an expense that needs to be controlled, while technology inputs are an asset that needs to be fully utilized.

To this farm operator, controlling expenses means using only what you need, when you need it, and purchasing from competing vendors, while deploying assets means leveraging attributes that improve productivity and efficiency. And you really have to know what you are bringing to the marketplace. Am I a commodity or am I an attribute?

These common denominators that I have just reviewed have come about in more recent years. It wasn't that many years ago where there was an acknowledged and significant comparative production advantage among those different regions of the world. We have often heard Western European or American farmers with a degree of swagger who thought they would always have the comparative advantage when compared with their global farmer competitors. An example of this point: Western European countries, such as Germany and France, have some of the highest yield value production land known. Government policies and marketing programs have enabled those farm operators over the previous years to enjoy yields per acre that in turn rewarded the multistep input supply business.

Next, the production area of North America – also known for their established and reliable food supply – enabled and embraced the multistep supply channel that served their needs to again maximize yields per acre. These two regions were built on the premise of family farms, a way of life, and increasing yields.

On the other side of the spectrum, in the more recent decades, we have the new lands of the Black Sea region and the Mato Grosso of Brazil being more fully developed. These new lands in the form of previous state farms that were unable to produce for their country – not that long ago – or suitable land never before cropped have redefined the business model of delivering crop inputs to the tilled acre.

In these regions, farm programs or government policy that provide a safety net literally do not exist. Here farm operators who tend to be of significant size have had to rely on self-perseverance and create their own supply channels for access to crop inputs. Couple this with the continued consolidation of farmland into fewer and larger units throughout North America and Australia and you start to see the common theme for certain distribution channels to serve this global farm operator.

One that is starting to emerge is that of a business model that procures the crop produced, while providing a market price at planting time for the crop when harvested along with a commoditized crop input, such as financing or fertilizer, enhances the business transaction and assures delivery at harvest with appropriate lien instruments.

Going forward, global agricultural production will continue to shrink this comparative advantage that currently exists among different regions of the world, meaning the bottom performers are making increasingly greater gains than the top performers. As this comparative advantage shrinks, the crop input business sector will continue to redefine its role in value.

Some common trends already starting to be adopted across multiple regions for both technology products with proprietary rights as well as commodity view products are as follows: For the crop-seed sector that serves this farm operator, farm operators of the size and scope we are discussing are the targeted customer for direct sales from manufacturers. Seed manufacturers have created a more streamlined channel between the seed source and field placement for this targeted producer that often excludes a wholesaler or retailer. Price discovery is limited and negotiated by the manufacturer. Viewed as an asset, herbicide-tolerant seed is highly prized in the United States but has limited markets globally until such time the demand side realizes the true economic value of GMOs. At CHS, we believe GMO is going to continue to be adopted across the wider global platform. Because seed is purchased just once per year for many producers, we view this as another trait or attribute.

We say retailers and wholesalers are often challenged to maintain volume and are relegated to handling second and third-generation seed varieties that account for a declining percent of the overall seed sales.

For the machinery sector that serves this farm operator, irrespective of color, this sector has a well-defined approach to global farm operators. Dealer networks, although franchised, are highly controlled by the manufacturer, so that parts and service are limited and internalized. Margins are maintained, transactions are infrequent, and price discovery is negotiated by the manufacturer.

For the advisory services sector, global farm operators are the primary users. They are looking for risk mitigation and price discovery. They formerly were used to market crop output but now are used for commodity crop inputs as well. They also have established long-term relationships and they truly are viewed as an asset by farm operators.

For the credit finance sector, lenders are demanding crop sales align with exposure of crop input expenses. Today, more farm operators are borrowing from nontraditional sources, such as dealers, manufacturers of inputs, as well as from the crop buyer. Farm operators are starting to embrace structured finance, meaning they bring discipline to their balance sheet and they partake in how they are going to structure financing and not necessarily just the lender or provider.

The price of capital is very transparent and is fixed multiple times throughout the year, depending on need. For the patent chemical sector, as patents expire pricing is becoming more generic. Tremendous marketing and sales expertise is chasing diminishing branded demand.

Rebates are becoming a residual pricing mechanism. Think of the pharmaceutical industry. Many industry wholesaler-retailers live off of rebates. Without rebates, profitability is minimized. Farm operators are starting to appreciate price discovery and purchase from multiple suppliers. Renewed interest in 2,4-D-type herbicides, meaning pre-Glyphosate herbicides that can handle these “Wall Street Journal superweeds,” subject to C-traits, are being developed and will reinvigorate certain premium pricing.

For the fertilizer sector that services this global farm operator, it is becoming globally marketed like grain and has high price transparency. Volatile price swings with limited hedging mechanisms have limited the participation of some wholesalers and retailers in recent years. Farm operators price products numerous times a year and from multiple suppliers.

Nitrogen, phosphate, and potash are generic. But certain introductions of this variable rate application and Micro Essentials from Mosaic are but examples creating new, but limited trends that allow for certain margin enhancements. Stand-alone fertilizer wholesale-retailers are consolidating. Therefore, in the North American market, the outlook for the crop input industry is as follows:

For the stand-alone input retailer, they are seeking alignment commitment with manufacturers in the industry channel with limited success. Offering risk mitigation tools for them is a challenge. Service requirements to this larger farm operator make it difficult for many to be successful in marketing to them. Going forward, significant numbers of retailers will elect not to invest to keep pace with current industry benchmarks.

For the multiproduct output-input retailer, they have significant investments in fixed assets in rolling stock and they truly want to emphasize full service. They are more active in offering financing or crop inputs to purchase harvested crop. In other words, they are trying to package it as a risk-mitigation tool. They tend to have large working capital requirements. And many single-location retailers may have limited growth potential going forward.

For the wholesalers and distributors in the crop input market, they are migrating to a broker status. They often compete on price only. As a new business model or player enters the market, many will consolidate or exit, creating fewer entities overall. The overall view of distributors and wholesalers is that eliminating costs can only take you so far.

For the manufacturers that have targeted this global farm operator, they are always concerned about control and influence of the channel. After the latest round of consolidation in the fertilizer manufacturing sector, manufacturers of crop inputs are in a strong global position. Manufacturers will continue to invest in global sourcing and tighter logistics. They can also influence price and knowledge with multiple product alternatives and markets.

In conclusion, this global farm operator represents a huge and growing market. We have witnessed manufacturing consolidation across a number of crop input sectors. As manufacturers have defined and strengthened their presence with a global access network, so too will global farm operators continue to find and strengthen their presence.

Wholesalers, retailers, and dealers that decide to participate in this sector of the market will be challenged to define their role and strength. For their success, we believe they will need three primary attributes for a successful business model.

They will have to develop risk mitigation tools across a broader spectrum of inputs. They will have to provide commodity inputs at a time and location when needed, not just at their local existence today or not just with one crop input. And, third, we believe to be successful you have to build the footprint that reaches global farm operators in multiple regions of the world if you are truly going to be success at executing this business model.

## Industry Panelist

## Transcript

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*William Lapp  
President and Founder  
Advanced Economic Solutions*

Thank you for that kind introduction and good morning to everyone. I want to first congratulate the staff, Jason, Alan, and everybody working with them for a tremendous meeting here in bringing all these people together and organizing this so well. It's a privilege and an honor to have the opportunity to address the group today and provide a little bit of insight.

I want to elaborate a little bit on Advanced Economic Solutions. We have one primary competitor, Remedial Economic Solutions, who we typically dominate. They don't stand much of a chance. Advanced Economic Solutions works with restaurants, food manufacturers, a bit up the chain with some feed manufacturers, grain-trading entities, and also with financial firms, which is a new challenge. I'm hoping I can gain more insights during the course of this meeting in how to work with Wall Street types, but it is a different bailiwick.

I'll apologize in advance, before I make my comments, if I happen to be the first to cast any aspersions on the biofuels industry. I know it is considered in some camps to be blasphemous, but I have provided testimony to talk a little bit about what the other side in the balance of using a large share of crops for biofuels might be.

Dr. Wilson gave a great outline on some of evolving trends in the supply chain and some of the growth areas. And Patrick did as well. I think they covered it nicely. I have a bit different part of the food chain that I'm talking about and I want to talk about food manufacturers and restaurants and some of the challenges they're facing today.

It is a highly competitive industry. Growth is limited typically by income and population. It is an industry that has faced tremendous volatility in input costs in recent years. The evolution of larger grocery chains, such as Wal-Mart, has made it challenging for food manufacturers. The quantum leap in commodity prices we saw in 2007 and 2008 – we haven't returned to old levels yet – has been a big challenge in trying to pass those costs through the system to the consumer, which inevitably they will do, and has been problematic for earnings in many cases. I would be remiss if I didn't talk about the challenge of higher input costs created to some extent by policies that promote biofuels as well, of course.

One of things I wanted to talk about today is some of the changes in contracts that food companies are engaging in now. The typical food manufacturer or restaurant wants longer terms.

A similar trend in the ability to extend terms is already in place in Europe. This is helping reduce working capital requirements and lower inventories.

It seems to me in listening for the past two days the theme here is one of risk management. One of the evolutions in the supply chain – and I think I saw it first hand in the cattle-packing industry – is where you play “hot potato” with the risk in the market and it ends up in the hand of the entity or firm that is most capable of managing that risk.

We’ve been taught in economics and in our business world that being the low-cost producer is a priority, but it is also – and maybe these aren’t contradictory – to have a handle on who can manage that risk the best. There are weather risks, changes in demand, and government policies. We have talked about all these already and it is no different. That is one observation coming away from this meeting.

Dr. Wilson talked about some vertical integration in the industry. For restaurants of some of the national restaurant chains, one of the things I’m observing is whether in a vertical integration there is a vertical coordination and maybe that is the same thing. When a restaurant can allow their suppliers to do a lot of work for them, it sometimes involves a lower cost of production, a cost savings, labor is shifted to suppliers, and that levels out labor requirements. And food safety becomes more and more of an issue. So as we pass additional policies that are meant to protect our consumers with good intent, you see some evolution in the chain where there is perhaps vertical coordination as well.

We saw several charts in the past couple of days that showed the sizable leap in commodity prices, similar to what we experienced in the early 1970s. I’ve talked at length with some of my clients and others about this one-time quantum leap we saw in the past couple years similar to what we saw in the 1970s and some macroeconomic drivers – crude oil going up, changes in the value of the dollar, going away from the gold standard, and Bretton Woods.

We’re moving to a different environment. In the next couple years, we have not gone through the whole cycle of shifting this. In my view, we are still in the process of determining who will grow what crop in what location for what purpose. So there are a lot of gyrations, much as we saw in the early 1970s with spikes in prices, as we made those determinations. It was miraculous in 2007 that we saw corn acres in the United States go from 78 million to 90 million acres and we hit on the head exactly how many acres we would need and we’d have the right yield, so there wasn’t further trauma in the markets in terms of price volatility.

There are more costs to be pushed through the system. Livestock producers are seeing some of that. Realize this year, as the economy rebounds, we are seeing sharp increases in cattle and hog prices. Those are translating into higher beef and pork prices that I don’t think consumers have fully realized yet. Then, in the dairy sector, because feed costs are higher we’ve seen a higher milk price realized and we are probably not finished with the volatility in that market.

One thing I wanted to mention was some of the market influences in the drivers we’ve seen. Having spent many years, first at Quaker Oats and then at ConAgra Foods and now on my own,

following some of the same typical fundamentals you can hear about on the news wires on a daily basis – deliverable stocks in Toledo, the weekly crop condition report, the cattle-on-feed report, and the myriad of government data that come out – are the key barometers we've been allowed to focus on in terms of price determination. Just in the past couple years, for a variety of reasons, many more external factors are driving the prices than once were.

On a daily basis, and I did a small study on this, daily moves in commodities such as corn, soybeans, soybean oil, and wheat had correlations of 60, 70, and 80 percent with changes in the value of the dollar or the price of crude oil. So you're seeing these external factors having a much more dominant role. We can talk about index funds and external money coming into this market, a thirst for commodities, an overriding change in the environment, but this is here to stay at least for the time being. This is persisting and likely to persist into the future.

We are also seeing a closer tie to the change in the value of corn to what happens to crude oil, because of the large amount we're using for ethanol. When crude oil prices rise, it creates a floor for the price of ethanol, because ethanol producers are able to make money at a certain level. You see it also in terms of the price of soybean oil being tied to the price of heating oil, which is essentially diesel fuel.

Over the past 24 months, there has been over a 90 percent correlation between the price of heating oil and soybean oil. So it doesn't matter if the stocks are large or small, if the pressure is making money, if Argentina has a weather problem, or if China is buying, what you have to focus on is, are crude oil prices or heating oil prices going up or down today?

So there is a lot of influence from the energy markets as well. I am certainly not saying that is a bad thing, but it is a new reality in the world that is helping increase and decrease margins on a daily basis for livestock producers and food manufacturers in revenues obviously for grain farmers.

As I mentioned, crop shifts are going to continue. There are some crop shifts that have been going on for a long, long time. And Dr. Wilson showed a map where corn acreage was moving into the Northwest. That shift is probably going to continue.

The Red River Valley is an extremely important part of the world for food manufacturers and restaurants. There are a lot of crops grown there that are extremely important that are directly consumed. As we see corn and soybeans become more dominant in that area, you're seeing other crops move to other parts of the world. This is not a new phenomenon.

Dr. Wilson mentioned spring wheat being an important crop in Cass County and I am going to guess, at some point in time, that was the largest oats county in the country as well. It is continuing to make a metamorphosis. We've shifted oats to other parts of the world. Because we have tractors, we don't need as many oats in the United States, because the type of horse power has changed.

We've seen in more recent years durum wheat production and other specialty crops shifting out of the United States and more into Canada. So there are a number of factors that are driving this. Certainly they are not bad, GMO provides incentive to grow those crops where yields are increasing 3+ percent per year and it's going to discourage other crops. They have an economic disadvantage. They will shift to another part of the world, so sourcing those will be a different challenge.

There are other factors that influence that – crop insurance provides some incentives to grow some crops over other crops. The Farm Bill has different subsidy regimes and ethanol usage promotes more corn, just quite bluntly. These are things that, as we go forward, are going to continue to evolve. And it's not a bad thing.

One thing that strikes me I have not heard much discussion or dialogue on, and Rep. Peterson from Minnesota is going to face this challenge in particular as chair of the House Ag Committee, is that there is a tremendous push within the White House Administration now (well, for a lot of things obviously) but the one that most directly impacts is the idea of fruits and vegetables being a more important part of our diet.

We have a Farm Bill that is sizable in terms of the dollar outlays that does not direct much attention toward fruits and vegetables. As we go through the process of the next Farm Bill, I think that is a point of contention we haven't studied closely enough for what might actually end up happening.

The final point I'll make is that, in terms of food manufacturing, restaurants, and the end close to the consumer part of the value chain, there has been talk of offshore sourcing being a trend or a model where we draw in commodities. That goes along with my previous comments about shifting crops from other parts of the world. In some cases, it is cheaper to do so, but it is also certainly in many cases riskier. The rule of law is dominant in the United States, but it is dominant in all other parts of the world. So the idea of being a low-cost producer – if I could be the low-cost producers of TV dinners, but it involved sourcing in places where there was less certainty – there has been and will continue to be some trepidation. So management of that risk becomes as much of an important goal as being low-cost producers in many cases.

## General Discussion

# Evolving Agricultural Supply Chains

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*Chad Wilkerson, Moderator*

*Vice President and Oklahoma City Branch Executive*

*Federal Reserve Bank of Kansas City*

**Mr. Salmen:** David Salmen with South Dakota Wheat Growers Cooperative. As a company, we're involved in building two shuttle loaders this year. At what point do you see the BN and Pacific Northwest as reaching capacity?

**Dr. Wilson:** I have that number. I don't have it just in front of me.

The most constrained part of the U.S. system was the West Coast, with the new investments going on at the West Coast, notably Bunge's investment but other expansion as well. They will expand that capacity fairly substantially. I measure things in terms of the risk of shortage of capacity or the probability of shortages. I remember prior to that investment, the probability of shortage of capacity there was about 0.3 percent.

**Question from Audience:** In your discussion, I noticed you did not mention river transportation, river systems.

**Dr. Wilson:** I had to cut off what I was going to elaborate too much upon. We have demands for improving logistics on the river system. There are plans in place through the Army Corps of Engineers to expand. They are expanding on that. I don't know exactly the current status of that, but I presume it is moving forward in terms of infrastructure spending.

**Question from Audience:** Have you done any work with containerization? What do you see in the future for containerization?

**Dr. Wilson:** Yes, I have. I am doing a huge project right now for the Army Corps of Engineers on our port areas, particularly the demands for expanding ports and dredging ports to accommodate increased containerization of all commodities, not just agriculture.

In our thinking on the model for this, we have a few pretty big game changers here. One is the expansion of the Panama Canal, which will increase the size of ships – in the case of containers, from about 4,400 TEUs to upwards of 13,000 TEUs through the new expanded canal.

That is going to force bigger ships in all modes of all commodities, but particularly container ships. What will happen is people will build more big ships. It is going to reduce the cost of container shipping.

The bottom line is we are a net importer of full containers. Our growth rate in containers is 10 to 11 percent per year. Even this year, as we come out of the recession, we are going to be growing about 12 percent per year. A lot of those containers prospectively return empty or filled with something of minimal value. So the golden opportunity for agriculture is finding those crops and commodities that can be efficiently utilizing that technology. This is already approved, as you know. DDGs and soybeans are taking full advantage of that, especially in my part of the country. There is more potential, as companies and railroads study more carefully how to tie together programs to those net deficit empty returning containers. So I think there is a lot of optimism for this. And there should be, because the major change in international logistics in the general commerce is containerization.

**Mr. Wilkerson:** Dr. Wilson, you mentioned buffer stocks as a potential risk-mitigating source. How prevalent is that becoming and what are some of the risks associated with that?

**Mr. Wilson:** It is prevalent in those products in agriculture that don't have direct, hedgable instruments. The reality is, for just about all agricultural products, there is more volatility than there used to be. The natural solution is to hedge it in the futures market. But there are a lot of things in agriculture that don't have futures markets and they have fairly poor cross-hedges, as well. So one way to reduce that exposure to risk is to carry some form of buffer stocks.

Bill mentioned the number of restaurants that want to have a longer view toward risk management. We have the corporatization of the food industries. Basically what has transpired is they don't want to absorb risk beyond two months forward. They want to find ways to cover that risk for maybe more than one year forward. Then you say, "Well, if I can't hedge it, but I have to manage these risks somehow, one prospective solution is buffer stock strategy."

To be honest, it is pretty common in things like malted barley, durum wheat, and other commodities I am not knowledgeable about.

**Mr. Stevenson:** Hello. My name is Brian Stevenson and I, like Mr. Lapp, am a consultant. Many of the clients which I have are involved in either the food manufacturing business or even up to and including the retail business.

The thing that has become obvious to me and what I hear from my clients, in the end commodities become products. Then products become brands. But the only way they become brands is through differentiation. What I find interesting is the discussion of moving this huge commodity source we have in the United States, and around the world as well, but yet what I hear from retailers and what I hear from food manufacturers is the true desire and the need for differentiation, which many times implies what would now be called a specialty product. Anything that is not U.S. #2 yellow corn is a specialty product or U.S. #2 soybeans is a specialty product.

The question I would have is, how is the supply chain ready today or may it be ready in the near future to manage these specialty products that are necessary to support these great brands of the likes of Sara Lee, Hostess -- these people? How are we going to manage this?

**Mr. Lapp:** One thing that comes to mind is it will be done in the least-cost fashion. If the transportation mode won't be multicar 52s, 110s, whatever it is, it will be more single cars and trucking obviously to meet those. There is a lot more potential for a vertical coordination. I see this in some end users of flour and they are promoting their product based on the higher quality of flour they have or are coordinating that all the way back to the producer. That is a fairly small share of the total market, but that is how that is achieved. When you do that, like Dr. Wilson was mentioning, you are prone to carry substantial inventories, which are costly, and the ability to be low cost is secondary to having a unique product you can brand and promote and have consumers identify with.

**Mr. Kluempke:** I would go on to say I think the logistics of distribution mentality in agriculture has reached the degree of sophistication, that we address those, in fact we are on the search for more. In other words, whether it is in Ventura Foods or whether it is in Horizon Milling, which are two of our joint ventures, or whether it is in our grain marketing, where we are loading containers of GMO-identified crops, I suppose five or more years ago the industry would have said, "Well, nobody really wants to pay for it."

I would tell you today those companies that have gone after that market have gone after it with a higher degree of success and have been rewarded for it. I would go on to say that over on the food manufacturing or on what I'll call the processed food delivery side, there are not necessarily that many entities that truly have viewed it as a big differentiator. It is surprising but a clear reflection there are still a number of food purveyors in this country who are in the retail side of the business who still have more of a commodity mentality where they are trying to push price down. That is still a fact we all have to reckon with.

**Mr. Wilson:** I will just respond. I've been in this business for a long time. I could tell a couple stories and give you a punch line. The punch line is our marketing system is very competitive and the competitor pressures will allow for ... see what's happened. It has to be buyers who really have to stick their necks out and say, "This is what I want. This is exactly what I want. This is how much more I'm willing to pay for it."

And put out a signal early enough – long term – that marketers can adjust their process.

Early in my career I did a project for a company in South America that bought 6,000 tons a year of white corn. I built a big model and said, "Ah! You should be buying at least a portion from North America."

So we interviewed all the grain companies. It was 1982 and we said, "We want to buy a significant amount of white corn."

They said, "We don't sell #1 white corn. We sell #3 yellow corn."

That was the response. And the company ultimately bought an elevator and started procuring their own white corn. Now, as it turns out, white corn has become a Cinderella-differentiated product in North America. That speaks well to the industry. To this day, they have

annual buying meetings and today the grain companies stand outside their door with seed bag samples of white corn to sell. It is a true story.

But in other commodities, malted barley, the whole industry today is based on variety-specific marketing – variety-specific because of taste profiles. That doesn't happen instantaneously. It is because the buyer has studied it and said, "This is what I want, this is the composition of what I want, and I have to get the signal out ahead of time."

Early, not many years ago, a major brewer involved put out contracts in March and discovered, in order to influence the production decision, they had to put out contracts in November and more recently put them out in August, so they can influence how much fertilizer was applied.

The point I am making is, The market system will respond, but it requires the buyers of the world to decide "what do I want, how much do I want, how much more I am willing to pay for it," and get those signals out through their suppliers very early in the market cycle.

**Mr. Wilkerson:** I'd like to ask one more question about vertical integration. We had examples of some companies moving more toward that. InBev is a big example of a company not moving toward it. Could you talk a little bit more about other examples? What are the general trends? Bill also talked about the restaurants.

**Mr. Wilson:** I will just comment and Pat can think about, because he knows about it. What I see, I am just telling you that in the academic world there is the picture-perfect world of how you decide the optimal vertical strategy. People in agriculture and nonagriculture have been experimenting. Where do we want to be on this?

We're having some very big experiments going on right now in terms of how we want to be vertically controlled. I think what will probably happen is there will be some features that will be highly vertically integrated. Certainly the grain-export business today, if you are not vertically integrated in grain exports I doubt you could survive at all. You need assets throughout the system.

In the durum milling business, in particular, that industry between flour milling and semolina and pasta has known become virtual vertical integration, certainly in the case of malted barley. In agriculture, because the stakes are so huge, everyone is going to study it, but they are going to choose toward trying to control certain functions within the vertical market channel, rather than complete and vertical integration. That would be my view.

**Mr. Kluempke:** And I would concur with that.