

## ***Using Old Cognitive Maps to Discern the Future:***

### ***Understanding the Future of the US Corn and Soybean Market Structure***

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#### ***Introduction***

The purpose of this research is to explore biotechnology's role in tomorrow's market structure and to examine key forces affecting that evolution<sup>2</sup>. A qualitative approach is employed to examine the importance of certain market components, their relationship with the current agricultural environment, and their expected effects in the future.

#### ***Forces Which Suggest Market Structure Change***

The literature on the changing structure of US agriculture is extensive and growing. Academics such as Boehlje (1999), Sonka(1999), Tweeten (1997), and Kalaitzandonakes and Hayenga (1999) have all researched and written on the changes that have been observed.

The transition that we are observing was being discussed some time ago. Tweeten's perspective follows a policy standpoint; explaining that traditionally, US corn and soybean production has been characterized by family farms that have been beset by shocks from nature, technology and markets (Tweeten, 1997). Furthermore, industrialization and structural change in agriculture can be characterized by the

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<sup>2</sup> This work comes directly from unpublished M.S. thesis results (Cunningham, 2000), and is related to a larger project entitled, "Marketing Implications for Biotechnology," a co-operative agreement between the USDA and University of Illinois.

application of modern manufacturing production, distribution, and coordination methods to the food chain (c.f. Tweeten, 1997); and by a distinctive movement to fewer, larger farms, vertical coordination and other departures from the traditional family farm where the operator and family provided over half the labor, management and equity capital (Tweeten, 1997). Tweeten predicts that, “Twenty-first century agriculture will be technologically advanced, large-scale, capital intensive, environmentally sound, scientifically based, internationally competitive, market driven (but government regulated) and managerially demanding.”

Presently, emphasis in research appears to be in understanding the role of relatively new technologies and market structures. Boehlje, Sonka, and Kalaitzandonakes and Hayenga are again cited amongst an extensive literature in these areas. For example, Boehlje (1999) gives suggestion for research and understanding in the changing atmosphere of agriculture. Sonka (1999) identifies six forces that appear to be affecting structural change in the agricultural sector. These include precision ag technologies, the Internet, societal responsibilities, farmer demographics, global competition, and desire for differentiated farm output. Furthermore, Kalaitzandonakes and Hayenga (1999) investigate structural changes in the seed and biotechnology industries. This paper summarizes the many mergers and acquisitions that have taken place and the reasons for the changes.

This research focuses around two main research questions that seek to understand how biotechnology and other factors will drive the future of agricultural market structure and how the identified factors will change and evolve agricultural market structure. In

order to answer these questions, a semi-structured interview was designed and administered to 30 leaders of the agricultural supply chain.

From semi-structured interviews with 30 leaders of the agricultural supply chain, these questions are answered. A table of the original sampling categories of participants can be found in Appendix A. The sample of subjects comes from a bank of people that were nominated by their peers and colleagues to be knowledgeable about the subject being researched. This was determined by several discussions with groups of experts and academics in the field. Therefore, the sample is not random, but rather purposeful in nature. For specific details on the research strategy used for this work, please see Chapter 3 of Cunningham (2000).

The specific interview questions can be found in Appendix B. There were six main questions, three for each time period examined. Four prompted questions were designed to elicit ideas on the Internet, regionalization, the changing demographics of farms and farmers and measurement technology. The interviews were transcribed verbatim and analyzed by the computer-based qualitative analysis tool QSR NUDIST Vivo. This paper is a summary of the interview results and the themes developed for future research. For tabular results and other details of the interview responses, please see Chapter 4 of Cunningham (2000).

This research does not attempt to theoretically explain how these forces work or predict the future of market structure as the previously mentioned scholars have done. The purpose is rather to take from their examples an understanding of how the forces work and how they might affect the future.

## ***Summary of Results***

Two market structures are examined in the research. The first, shorter-run scenario is focused three to four years into the future and is centered on a 20-30% market share for non-GMO corn and soybeans. The respondents were told that a premium is paid for segregation. Of the 30 respondents, 43% of the respondents said the structure was realistic; 47% thought it was not realistic; and 10% said this was the current market structure. The main reasons given for not thinking that the scenario was realistic were that they didn't see the premium occurring; they couldn't see the premium sustaining the market; and they couldn't see consumers paying more for what was once a generic product.

The main issues surrounding what would have to occur in order for a market structure such as this to occur are:

- 1) There would have to be a continued increase in consumer concern surrounding GMO's.
- 2) Similarly, there would have to be an increase in consumer demand for non-GMO products.
- 3) There must be a decrease in the level of risk associated with providing a pure and segregated product at all levels of the supply chain.
- 4) Issues with segregation and identity preservation must be resolved.
- 5) There would have to be an increase in the concern for the loss of international trade with the EU and Japan.
- 6) Governmental regulations and requirements will need to be better understood to certify the products.
- 7) There would need to be a market structure change to accommodate the differentiated product and premium.

Respondents were asked how their decisions and behaviors would change in response to a market structure where 20-30% of corn and soybeans were marketed as non-GMO. Of the 30 respondents, 60% said that their behaviors and decisions would change; 40% said that they would not change; and 30% said that they were already prepared or preparing for this scenario<sup>3</sup>. The major behavior and decision changes that were discussed were as follows:

- 1) Respondents said that in this sort of structure, there would be a need to establish a better infrastructure throughout the supply chain.
- 2) As there would be an opportunity for new markets, management decisions would change to facilitate these opportunities.
- 3) In order to provide segregation, new services, new products or other institute other functions necessary to this market, respondents said that they would need to increase investments in some aspect of their business.

The second, longer-run market structure is focused eight to twelve years in the future and concentrates on a market structure where 40-50% of the market is sold as differentiated output traits. The respondents are told that the premium now lies in the value added nature of the product. Of the 30 respondents, 80% thought that the scenario is realistic; 20% thought that the scenario is not realistic.

The responses about what would have to occur for the scenario to take place were similar to those given in the first scenario. They are as follows:

- 1) In order for the market to be heavily concentrated with differentiated output traits, there must be consumer demand for the products. Additionally, the consumer must realize some value in the product and have few or more expensive substitutes. Many respondents thought

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<sup>3</sup> Those people who responded they were prepared or already preparing are a subset of the respondents who said that their behaviors and decisions would not change.

that the traits would be part of a niche market that comes along with lifestyle or preference changes.

- 2) There must be an available supply of technology to grow the differentiated output traits. Biotechnology developers must have the incentive to supply products that are worthwhile and useful for a long period of time.
- 3) There will be a continued trend of market structure change. Respondents talked about consolidation, which has led to a high level of alliance both horizontally and vertically along the supply chain.
- 4) There must be a method of “insurance” against loss to the environment, misproduction, or commingling of high-value differentiated output products.
- 5) Issues of difficulty of segregation and purity must be resolved.
- 6) International trade concerns surrounding biotechnology and “American science” must be resolved.

Respondents were asked how their decisions and behaviors would change in response to a market structure where 40-50% of corn and soybeans were marketed as differentiated output traits. Of the 30 respondents, 67% (2/3) said that their behaviors and decisions would change; 33% (1/3) said that they would not change; and 20% said that they were already prepared or preparing for this scenario<sup>4</sup>. The behavior and decisions changes were once again much like those that were discussed in the first scenario. The major behavior and decision changes that were discussed were as follows:

- 1) Respondents said that this market would force them to form new relationship with other members of the supply chain. Many saw their firm consolidating or forming alliances with other members of the supply chain.
- 2) As there would be an opportunity for new markets, management decisions would change to facilitate these opportunities.

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<sup>4</sup> Those people who responded they were prepared or already preparing are a subset of the respondents who said that their behaviors and decisions would not change.

- 3) In order to provide segregation, new services, new products or other institute other functions necessary to this market, respondents said that they would need to increase investments in some aspect of their business.
- 4) Respondents said that in this sort of structure, there would be a need to establish a better infrastructure throughout the supply chain.

After the initial questions concerning the two market structures were answered, one or more of four prompted questions were asked depending on whether or not the topic had been covered in the previous discussion. The prompting questions were designed to discuss the four previously identified market factors of: the Internet, regionalization, measurement technology and the changing demographics of farmers and farms.

Of the 30 respondents, 60% had to be prompted to talk about the Internet; 40% did not have to be prompted. All respondents thought that the Internet would play an important role in the future of agricultural market structure. Some respondents said that in order for the Internet to be more useful in the future the speed and availability of connections would have to improve. More than 2/3 of the respondents thought that the Internet would bring greater marketing efficiency to the agricultural supply chain. The respondents identified seven roles for E-Commerce and the Internet. They are as follows:

- 1) Origination Verification
- 2) Supply Contracting (Producer & Input Supply Dealer)
- 3) Production Contracting (Producer & Grain Handler, Processor or Miller)
- 4) Producer Information and Decision Making Assistance

- 5) Regulatory Information
- 6) Host of Spot Price Markets
- 7) Facilitator of International and Domestic Trade

The second prompted question concerned regionalization and whether or not it will play a role in the future of commodity markets. Of the 30 respondents, 46% were prompted to talk about regionalization; 54% were not prompted. Only 7% of the respondents did not think that regionalization would be important; 93% did think it would be important. There were only three common reasons given for the role of regionalization in the future. The most common reason for regionalization was for environmental benefits. Many said that they could regionalization happening for the benefit of some events of corn or soybeans growing better in certain conditions relative to others. The second is the creation of transportation efficiencies. Several respondents related the transportation efficiencies to the Tyson Foods model of regional poultry production. Similarly, respondents said that regionalization would create efficiencies in monitoring trait production. If production is centralized in one region, it is easier for the end-user or grain handler to monitor what inputs and practices are being used to produce the crop.

The third prompted question concerned measurement technology. The question asked what new measurement technologies will need to be able to do and where it needs to be located. Of the 30 respondents, 73% had to be prompted to talk about measurement technology; 28% did not have to be prompted. All of the respondents said that measurement technology would be important. Some respondents commented that before these technologies could be developed, tolerance levels for genetic material or thresholds

for quality content must be agreed upon. Respondents did not talk specifically about what measurement technologies need to be able to do, but rather how they need to be able to measure. Four characteristics were identified:

- 1) The technology must be cheap or cost efficient.
- 2) The technology must be quick to obtain results.
- 3) The technology must be accurate.
- 4) And, the technology must be reproducible.

When asked where the technology needs to be located in the supply chain, respondents generally said that it should be at every level. Many respondents said that testing measures should be implemented even at the farm level. Some said that the first location in the supply chain should be the first handler.

The last prompted question concerns the changing demographics of farms and farmers. Of the 30 respondents, 90% had to be prompted to talk about demographics; 10% did not have to be prompted. Twenty percent of the respondents did not think that changing demographics would have an effect on marketing systems. Of the 24 respondents who discussed the changing age of farmers, 67% thought that it would influence marketing systems; 33% thought that it would not. Those who thought that the changing age of farmers would be important discussed concerns about technology adoption and the need to have a “manager-like” mind-set. Of the 21 respondents who discussed changing farm size, all of them thought that it would affect market systems. Many respondents said that larger farms will translate into a more competitive market, and in general, a move away from the family farm. Respondents also talked about the changing size of farms affecting the way business is done. Specifically, respondents said

that farmers are often creating alliances with members of the supply chain in order to create beneficial relationships.

Overall, the number of respondents who thought the shorter-run scenario was realistic was slightly less than half, but all of those who said yes to the shorter-run scenario also said yes to the longer-run scenario. Approximately half of those respondents who did not think the shorter-run scenario was realistic also did not think that the longer-run scenario was realistic. Of the three respondents who thought that the shorter-run was the present market situation, two thought that the longer-run scenario was realistic; one thought it was not.

### ***Themes of the Results***

There were three common themes to the results that developed from this study of future agricultural market structure. The first, and most common theme was that of present consumer concern and demand for non-transgenic products. It is apparent that agricultural leaders believe that the future of biotechnology lies in the actions and reactions of the end-consumer to government regulation, food safety beliefs and the environment. Every respondent interviewed discussed the consumer at some point during his or her interview.

The second common theme was that the future structural change in agriculture would potentially entail a significant infrastructure change. There will be a need for more storage and facilities to segregate identity preserved and specialty products. A highly coordinated transportation and identification system will be needed to transfer the product and information that makes the product more valuable. Furthermore, the ultimate role of the farmer will be more like that of a manager in a competitive environment where

there is a need to differentiate oneself from others; more so than has been observed in the past.

The final common theme of the research was that relationships along the agricultural supply chain are changing quite rapidly. Respondents mentioned several different types of relationships changing. The most visible of these changes is the horizontal and vertical consolidation, as well as alliances among agricultural firms. These include biotechnology research and development firms, chemical and input suppliers, seed companies, food processors, Internet service providers and other supply chain participants. Firms are cooperating to provide specialized products and services that may have been available before but are being supplied more efficiently. Other changing relationships are those between the farmer and supply chain participants. Several respondents discussed farmer—input supplier and farmer—grain handler relationships changing because of the Internet and the options available in contracting and specialization.

### ***Conclusion***

The purpose of this research is to understand the role of biotechnology and other market forces in the future of agricultural market structure. Two main research questions are answered in this research:

- 1) How will biotechnology and other factors drive the future of agricultural market structure?
- 2) How will the factors that we have identified change and evolve to effect agricultural market structure?

A qualitative approach to analyzing 30 semi-structured interviews was employed to convert tacit information to explicit ideas from agricultural supply chain decision makers. This paper reviewed the results of these interviews, as well as discussed the common themes extracted from the results.

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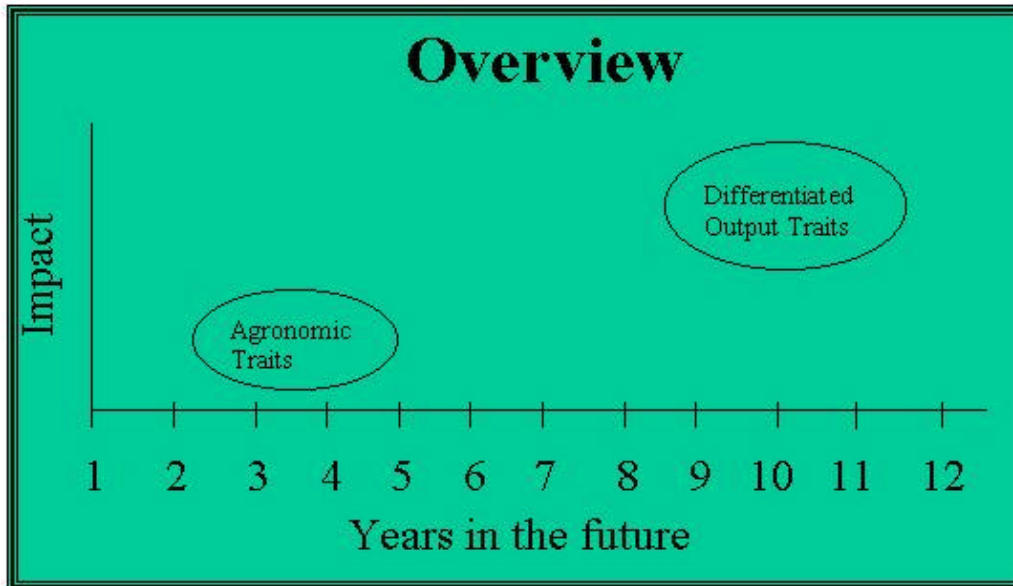
**APPENDIX A**

Sampling Categories for Interview Subjects

Input Supply	Production	Handler	Processor
Service/ Finance Providers		Testing Providers	
Research & Consulting			
Policy Development & Analysis			

## APPENDIX B

### Interview Structure

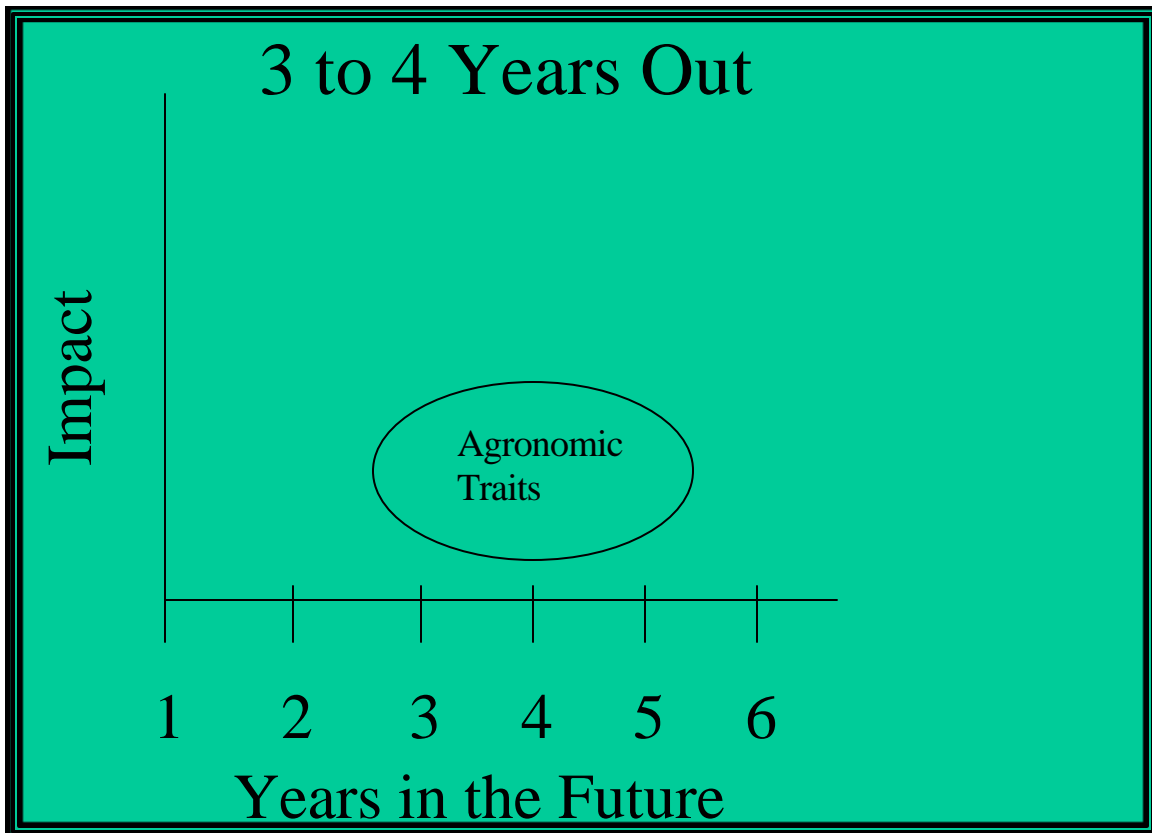


The US corn and soybean markets have seen the potential for dramatic structural change over the past few years. One of the issues that has fueled interest in market structure is biotechnology. The purpose of this interview is to get your ideas on how this dynamic market structure may further change in the future.

Above, we have drawn a diagram to help visualize the two points in time that we will focus on today. We will present you with two scenarios of the future and ask you to discuss them. In our project, we aren't trying to predict the future, but rather better understand the important forces that can affect tomorrow's marketing systems. We will do this by combining your ideas with those of other leaders participating in this effort.

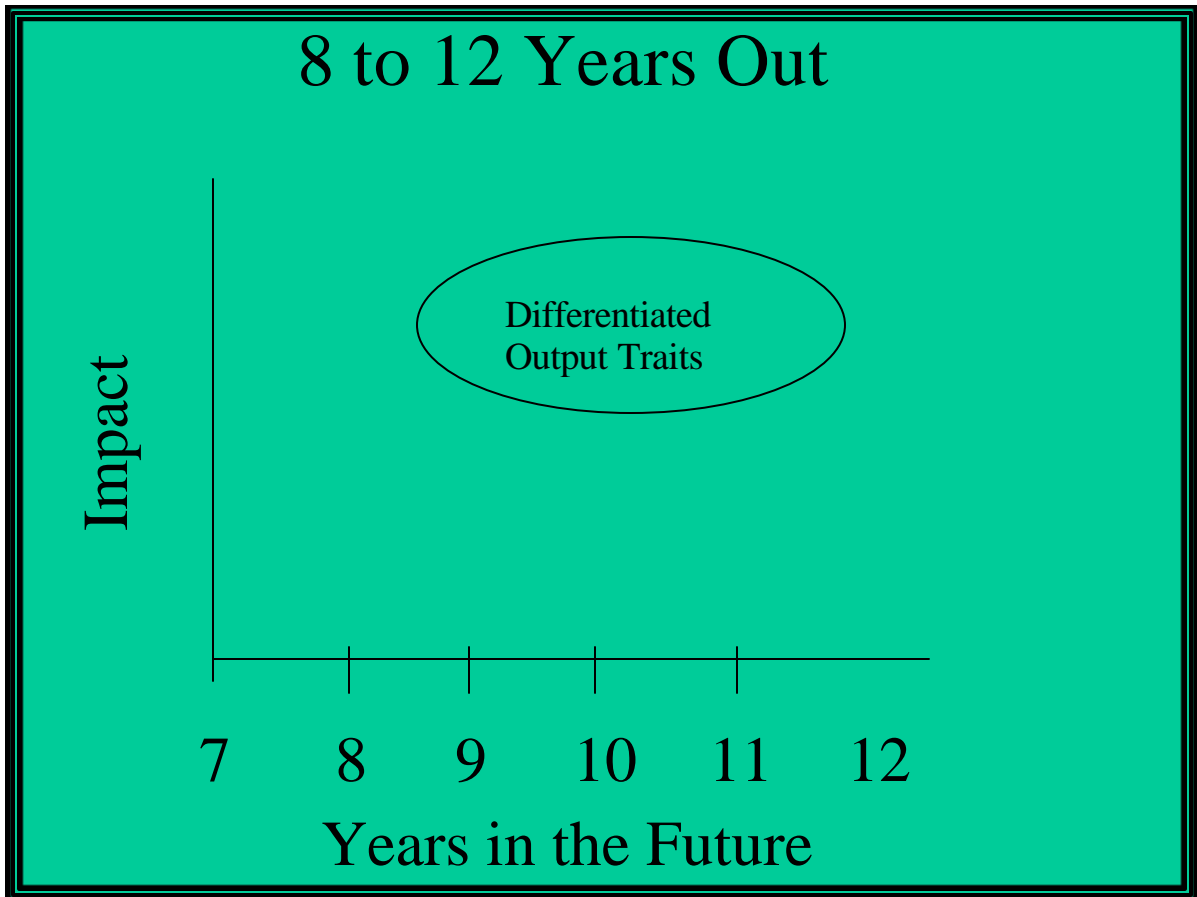
**3 to 4 years out:** Biotechnology only affects agronomic traits. These agronomic traits have no real value to the end consumer, but consumer concerns have created the need for segregation of non-transgenic products, accompanied by a premium.

**8 to 12 years out:** We are now able to produce corn and soybeans with differentiated output traits. The consumer concerns regarding GMO's have either gone away over time or technologies are being used that are generally accepted by consumers. The premium now lies in the added value in the product.



Assume that in three to four years, US corn and soybean producers face a market where 20-30% of corn and soybeans are marketed as non-transgenic products. A premium is being paid to compensate for segregation and other necessary coordination measures.

- Do you think that this is realistic?
  - If yes, why?
  - If no, why not?
- Please talk about important issues and events that could cause this to happen.
- If this were reality, how would behaviors and decisions change in your organization?



Now, looking further into the future, perhaps 8 to 12 years from now, we find the corn and soybean markets have a significant segment (40-50%) with differentiated output traits. These output traits have some realized value to the end consumer: whether it is the processor, miller, or food consumer.

- Do you think that this is realistic?
  - If yes, why?
  - If no, why not?
- Please talk about important issues and events that caused this happen.
- If this were reality, how would behaviors and decisions change in your organization?