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*International Food and Agribusiness Management Review*  
*Volume 11, Issue 3, 2008*

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*International Food and Agribusiness Management Review*  
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## **A Letter from Executive Editor, Peter Goldsmith**

Dear Readers of the IFAMR,

I hope you enjoy the 2008 Symposium Special Edition of the *International Food and Agribusiness Management Review*. There are six research manuscripts, all Best Paper finalists from IAMA's 18th Annual World Symposium held in Monterey, California in June.

Please take special note of the article by Yuliya Bolotova, Christopher S. McIntosh, Kalamani Muthusamy, Paul E. Patterson, titled; "The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry" won the Best Paper Award.

The article "Market Orientation, Innovation and Entrepreneurship: An Empirical Examination of the Illinois," by Eric T. Micheels and Hamish Gow won the Communication Award, and four other articles are featured that were finalists in the Best Paper Award competition.

Also highlighted in this issue are two *Executive Interviews* with David Lobell and Carole Brookins, who discuss the impacts of climate change on agribusiness from two different perspectives. These interviews are available in podcasts which can be seen on our website by following this link:

[http://dev.ifama.org/dispatch.asp?page=executive\\_interviews\\_2008](http://dev.ifama.org/dispatch.asp?page=executive_interviews_2008).

Marcos Fava Neves, Professor of Strategy and Food Chains, School of Economics and Business, University of São Paulo and President, INOVA HOLDING, shares some keen insights on the food vs. fuel debate in the *Industry Speaks* section.

Finally there is a wonderful new *Case Study* from Francesco Braga and Gregory Baker on "Parma Agrifood Research Management Knowledge Network: PARMa KN" that is bound to be a valuable contribution to the classroom. Enjoy the issue.

Let me take a moment and tell you the many exciting things going on at the IFAMR. We were able to simultaneously complete full formal reviews of symposium manuscripts so the best papers could be published quickly in our Symposium Issue. Authors received the benefits of presenting at the conference, a fast and comprehensive review, and quickly see their work print. Plan on submitting full manuscripts to the Symposium in 2009 to take advantage of this wonderful service.

Obtaining an impact factor for our journal is one of our most important goals at IFAMR. With the help of Managing Editor, Gregory Baker from the University of Santa Clara and Administrative Editor, Kathryn White we have begun registering the journal with EconLit, Google Search, The Social Science Index, and Ag Econ Search. These registrations will not only allow the publishing industry to track our journal and its impact, it will help push our authors and their articles to the forefront as knowledge leaders in the food and agribusiness arena.

The Publications Policy Committee of IAMA, led by Dennis Conley from the University of Nebraska-Lincoln, have just made some important changes in our submissions policy. There is no longer a submission fee required to submit your paper for peer review (it was \$100) and authors no longer need to be a member of IAMA to submit. IAMA is a wonderful organization bringing together scholars and executives, so I am sure many authors will want to join.

Finally, the IFAMR is working hard to increase the international dimension of the articles, editorial staff, and reviewers. Two new Managing Editors have recently joined the Editorial Staff, Joao Martines-Filho, Universidade de São Paulo, Brazil and Nicola Shadbolt from Massey University, New Zealand. They join current Managing Editors, Murray McGregor Curtin University of Technology, Australia; Greg Baker, University Santa Clara, USA; Herman van Schalkwyk, University of the Free State, South Africa; and Jacques Trienekens from Wageningen University, The Netherlands.

Great changes are underway, so if you have an interest in getting more involved with the IFAMR please contact me.

Sincerely,



**Peter Goldsmith**

Executive Director, National Soybean Research Laboratory  
Executive Editor, The International Food and Agribusiness Management Review  
<http://www.ifama.org>



International Food and Agribusiness Management Review  
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## ***Symposium Special Edition***

### **2008 Annual World Symposium**

Monterey, California, USA – June 14 – 15, 2008

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## **Executive Summaries**

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### **RESEARCH**

#### **The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry** *Yuliya Bolotova, Christopher S. McIntosh, Kalamani Muthusamy, Paul E. Patterson*

High potato price volatility, decreasing demand for fresh potatoes and potato prices below the cost of production led to a decision of a number of Idaho potato growers to organize United Fresh Potato Growers of Idaho, a marketing cooperative. The United was founded in November 2004, representing 85% of fresh potato growers in Idaho. The goal of the cooperative is to stabilize the supply of fresh potatoes in Idaho to provide a fair level of returns to potato growers. The key program implemented by the United is the potato supply management program which targets both production and marketing of fresh potatoes in Idaho.

We evaluate the effectiveness of the programs and strategies implemented by the United. We analyze differences in the patterns of price behavior between two periods, before the cooperative was organized (pre-coop period) and during the period when the cooperative is in the market (coop period). Prices are indicators of the economic performance of market players like the United. If the United enforced its programs effectively then fresh potato prices would reflect these effects. We expect fresh potato prices to be higher and less volatile in the period when the United is in the market relative to the pre-coop period.

To conduct the analysis, we use monthly Idaho and US fresh potato prices reported by the USDA National Agricultural Statistics Service and weekly Idaho Russet Burbank potato prices reported by the USDA Agricultural Marketing Service. We employ descriptive statistics and time-series econometric techniques (ARCH and GARCH models) to analyze differences in the price level and volatility between the pre-coop and coop periods.

We find that Idaho monthly fresh potato prices were 70% higher and the US monthly fresh potato prices were 31% higher in the coop period relative to the pre-coop period. In addition, Idaho monthly fresh potato prices were less volatile during the coop period relative to the pre-coop period. Furthermore, before the cooperative was organized, Idaho had had the most volatile potato prices as compared to other

major potato growing regions in the country. During the period when the United was in the market, Idaho had the least volatile prices.

The identified fresh potato price increase is not totally due to the actions of the United. Increasing potato production costs are likely to contribute to this price increase. We found that the potato production cost increases between the coop and pre-coop periods fell in the range of 10% to 16%. Consequently, approximately 54% to 60% in the monthly Idaho fresh potato price increase is due to other than potato production cost market factors, and the impact of the United is likely to be the most significant factor explaining the observed price increase.

Based on empirical evidence presented in the paper, we conclude that programs and strategies of the United Fresh Potato Growers of Idaho directed toward stabilization of potato supply in Idaho have been effective thus far. The programs implemented by the United led to higher prices and a reduced price risk for Idaho fresh potato growers. As indicated by the US monthly fresh potato prices, all potato growers received higher prices since 2005.

## **Market Orientation, Innovation and Entrepreneurship: An Empirical Examination of the Illinois Beef Industry** *Eric T. Micheels and Hamish Gow*

Several studies have found that there is a significant positive effect in the relationship between market orientation and firm performance (Narver & Slater, 1990; Slater & Narver, 2000). Market orientation is defined as the process of acquiring knowledge about customers expressed as well as latent needs and then diffusing this knowledge throughout the company and channel partners (Jaworski & Kohli, 1993).

In this study we empirically examine the effect of a producer's level of market orientation on their subjective performance within the US beef industry. The beef industry was chosen as it offers different production alternatives and various marketing arrangements coupled with an assortment of expressed and latent consumer identified product and market needs including leanness, traceability, animal identification, and certification. We believe that firms with a higher market orientation will be better able to meet customers' needs relating to preferences and therefore perform better.

Using a mail survey, we asked 1569 beef producers in Illinois to answer questions relating to their market orientation, entrepreneurship, innovativeness, cost focus and organizational learning. These scales had all been previously validated and drawn from prior studies in the literature. However, as scales mainly targeted at managers of large industrial firms, the specific verbiage was modified to fit a production agriculture framework. Employing factor analysis, the data and scales were then cleaned to remove questions which were empirically shown to not be important in this setting. Following scale purification, we used a structural equation model to test our hypotheses.



Our results show performance to be significantly influenced by a firm's market orientation as well as their level of entrepreneurship and innovation. These results are consistent with findings in previous studies. However, unlike Narver and Slater (1990), this study was able to show a market orientation to have a positive impact on performance in what is generally thought of as a commodity sector. These results indicate that there still is value to be created and performance implications for doing so even in a commodity business.

At the farm level, this paper demonstrates that achieving a balance between cost control and market awareness could be the key to maintaining a competitive advantage as well as improving performance measures for the farm business. At the sector level, the positive impact that market orientation is shown to have on performance may lead other producers to strategically follow suit in an attempt to better meet customer needs and thus gain better performance. The NCBA focus on improving tenderness and communication could be somewhat alleviated if more producers shift some of their focus externally to the market as opposed to a largely internal focus.

## **Industry-Academic Partnerships - The View from the Corner Office**

*Gregory A. Baker, Allen F. Wysocki, Lisa O. House*

The primary objective of this paper is to explore industry-academic partnerships from the industry perspective. This paper follows a previously published paper on industry-academic partnerships that approached the topic from the academic perspective. We discuss the benefits, difficulties, and costs of several types of industry-academic partnerships as well as successful management practices utilized by industry managers and executives who have participated in such collaborations. Finally, we develop a set of guidelines for managing each of the various types of partnerships.

We found that the industry managers and executives that we surveyed had experience with many types of partnering with universities. Although our survey was not conducted by means of a random sample, the results were consistent with our prior expectations. The most common types of industry-academic cooperation were in-class visits (guest speaking), internships, site visits (field trips), student research, and serving on an industry advisory board. Working with a faculty member on research, mentoring students, and hiring faculty members as consultants was less common.

The benefits, costs, and difficulties associated with each type of partnership were, in most cases, specific to the type of partnership. However, we can draw several general conclusions. First, the experience of industry managers in working with universities proved to be almost exclusively positive. Second, the benefits to partnering with academics often related to gaining access to top students and providing a way to "give back" to the university. These benefits also served as factors in motivating industry members to collaborate. Third, many of the

drawbacks identified by industry related to the time required to effectively collaborate with their university partner.

We conclude that industry-academic partnerships are generally fruitful and that both industry and faculty members should continue to explore ways to work together. In particular, members of both the academy and industry may want to explore pursuing those types of partnerships that are less commonly used.

### **Spatial Marketing Patterns for Corn under the Condition of Increasing Ethanol Production in the U.S. *Dennis M. Conley and Adam George***

The economics of energy versus food is leading to major structural changes in the marketing of corn in the U.S. A recent historical perspective shows that when crude oil was priced in the range of \$35 to \$50 per barrel and corn was \$1.80 to \$2.20 per bushel, the financial feasibility for ethanol plants was viable, but required risk capital from sources that believed the investment would be worthwhile. New construction of ethanol plants was happening at a modest pace. In 1999, less than a decade ago, there were 50 ethanol plants producing a little over 1 billion gallons per year. The production of corn in the U.S. was sufficient to meet the needs of the livestock sector, sustain exports at traditional levels, and supply the growing demand coming from ethanol production.

However, a series of events external to agriculture set in motion the conditions for structural change. These included a rapid increase in the price of crude oil from \$40 per barrel to over \$100 caused by hurricanes, geopolitical events, an increased global demand for energy from countries like China and India, and in December 2007, the U.S. raising the renewable fuel standards.

The results of this research show that there could be significant changes in the historical utilization and marketing of corn in the U.S. The change in movement patterns provides one source of visible evidence that a structural change is underway being caused by the surging development of ethanol production. The structural change is not only affecting the production and marketing of corn, but also of soybeans, wheat and even cotton because of the related nature of crop rotation and producers decisions about what crop to plant given market signals. The increased demand for corn is creating a derived demand for increased acres planted to corn that would mostly come at the expense of soybean, wheat and cotton acres. In response, the prices of soybeans, wheat and cotton have substantially increased, by double or more over historical levels, during 2008.

### **Heterogeneity in the Evaluation of Quality Assurance Systems: Taking the International Food Standard (IFS) in the European Agribusiness as an Example *Holger Schulze, Frederike Albersmeier, Jana-Christina Gawron, Achim Spiller, and Ludwig Theuvsen***

Farmers' direct marketing of food is a widely neglected branch of modern agribusiness marketing. It is certainly a niche market but plays a distinctive role for establishing high quality markets in the food business. The importance of direct marketing for high quality farm products has increased during the past few years. However, on-farm outlets are in lively competition with other store formats such as supermarkets and organic stores, which have developed their own assortment of regional and high quality products. In Germany, most supermarkets have entered the organic marketing segment in the last few years, introducing new articles positioned very close to traditional farm produce.

This paper analyzes the impact of customer satisfaction and its driving forces for farmer-to-consumer direct marketing and is based on a customer survey in 33 organic and conventional on-farm stores in Germany. Altogether, 1,537 customers were questioned in several regions in Germany. The results emphasize the role of store atmosphere, customer service and product quality as the main factors which influence customer satisfaction. Consumers who are satisfied with the farm outlet perceive a unique store design characterized by a special interior and an outstanding product presentation. In contrast to the retail industry, farm outlets are not standardized but stamped with the owner's personality. Store atmosphere as well as individual service must reflect the farmer's unique approach. The study demonstrates the importance of customer satisfaction for stable relationships and long-term business success. Customer satisfaction is closely connected to word of mouth communication, which is the main marketing tool for farm outlets.

## **Innovation in Food Products: First-mover Strategy and Entropy Metrics**

*Thomas L. Sporleder, Neal H. Hooker, Christopher J. Shanahan and Stefanie Bröring*

Pioneer firms are first-movers that attempt to gain advantages over rivals from being first. These first-mover advantages may include strong image and reputation, brand loyalty, technological leadership, and being in an advantageous position relative to the 'learning curve' involved in managing a specific product or process innovation. Three advantages typically may accrue to pioneer firms: the preemption of rivals, the imposition of switching costs on buyers, and the benefit that accrues from being seen by customers as a technological leader compared to rival firms. Second-mover or follower firms have the advantage of lower costs through less expensive imitation of first-mover products (or processes) and the resolution of market or technological uncertainties faced by first-movers. In the aggregate, market pioneers deploy innovative products or processes with high initial costs and risks, but yield high potential returns. This also implies that second-movers or followers experience lower costs because imitation is less expensive than innovation.

Food products are in the experience goods category. First-mover firms in experience goods tend to shape consumer tastes and preferences in favor of the pioneering brand. Such preferences often are sustainable for the pioneering product. First-

mover strategy is a common dilemma for managers and has special importance when the product is in the experience goods category. This research develops entropy metrics for tracking new product introductions in the context of first-mover strategy. Entropy is a novel and useful means of examining first-mover strategy and new product development (NPD) in general.

Understanding the complexities of the first-mover strategy and tracking NPD with entropy metrics holds promise for enhancing the analysis of agrifood supply chains and assisting firms in deciphering first-mover strategies of their rivals. Evidence about organic NPD presented here suggests that choosing the right certification scheme as a means to reduce information costs for the consumer (establishing complementary assets) is an important managerial first-mover issue to consider during product launch. The findings suggest that entropy metrics applied to the complex and interrelated levels and categories of food product target markets provides novel and useful information to decision makers. The relative entropy metric has special significance when applied to tracking product introductions that are in the experience goods category.

## **CASE STUDY**

### **Parma Agrifood Research Management Knowledge Network: PARMa KN** *Francesco Braga and Gregory A. Baker*

Funded by the Municipality of Parma, the Parma Agrifood Research Management Knowledge Network is built around a virtual global network of leading professionals from academia, industry, and the public sector. Its mandate is to create value added for firms in food and agribusiness sector by developing cutting-edge research, educational, and service activities. How can this start-up define its niche, grow it and establish its effectiveness? The case deals with a key issue for a traditional food and agribusiness industry: how to secure support for innovation while remaining true to the essential traditional features, including food culture, that are the foundations of the excellence of a typical food. The case may also be used to explore the various issues surrounding the formation of an industry association, including structure, financing, and strategic priorities. It is ideal for use as an application of stakeholder analysis. Finally, it can be used to explore the different needs of companies at different stages of the continuum commodity product ↔ typical product.

## **INDUSTRY SPEAKS**

*An Editorial Commentary*

### **Strategies for Solving the Food Inflation Problem**

*Marcos Fava Neves*

This article addresses some of the partial truths and misinformation in media reporting over the booming food prices debate. Many studies are only linking

biofuels to the inflation cause, while ignoring several other factors such as the growth of the world population, economic development and income distribution. An overview of the causes are discussed and 10 strategies are proposed which policy makers, governments, and organizations can adapt to move the world forward towards long-term sustainability.

## **INDUSTRY INTERVIEWS**

### **Global Climate Change**

*David Lobell, Senior Research Scholar at Stanford University's Program on Food Security and Environment*

Many of the world's poorest regions could face severe crop losses in the next two decades because of climate change, according to Dr. David Lobell, a Senior Research Scholar at Stanford University in the program on Food Security and Environment. The average world temperature is increasing slightly says Lobell and a one-degree Celsius increase over time greatly impacts climatic growing conditions. Unfortunately, agriculture is also the human enterprise most vulnerable to changes in climate. Understanding where these climate threats will be is central to our efforts in fighting hunger and poverty over the coming decades. Dr. Lobell outlines some of the challenges that lie ahead and steps researchers are taking to combat the issues.

This interview was conducted by Doug Jose is a Professor and Extension Farm Management Specialist in the Department of Agricultural Economics at the University of Nebraska- Lincoln and host of the Market Journal, a weekly televised program on agriculture. This interview occurred during the 18th Annual World Forum and Symposium in Monterey, California, June, 2008.

### **Global Climate Change**

*Honorable Carole Brookins, Managing Director of Public Capital Investors*

Carole Brookins is an international consultant known for her work as a policy and trade strategist on issues concerning the global political economy and its effect on the food and agriculture sector. She currently serves on the board of several corporate and non- profit organizations concerned with global food system issues and is currently helping to develop solutions which can offset the effects of global climate change through the reduction and management of carbon emissions—an issue of increasing importance in future food marketing and world trade.

This interview was conducted by Doug Jose is a Professor and Extension Farm Management Specialist in the Department of Agricultural Economics at the University of Nebraska- Lincoln and host of the Market Journal, a weekly televised program on agriculture. This interview occurred during the 18th Annual World Forum and Symposium in Monterey, California, in June, 2008.



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## **The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry**

Yuliya Bolotova <sup>a</sup>, Christopher S. McIntosh <sup>b</sup>, Kalamani Muthusamy <sup>c</sup>  
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### **Abstract**

High potato price volatility, decreasing demand for fresh potatoes and prices below the cost of production led to a decision of a number of Idaho potato growers to organize the United Fresh Potato Growers of Idaho, a marketing cooperative. The programs and strategies of the cooperative target both the production and marketing of fresh potatoes in Idaho. To evaluate the effectiveness of the programs implemented by the cooperative, we examine the level and volatility of fresh potato prices during two periods: before the cooperative was organized and when the cooperative is in the market. We find empirical evidence suggesting that fresh potato prices were higher and less volatile during the period when the cooperative was in the market.

**Keywords:** agricultural markets, cooperative, price volatility, potato industry

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## **Introduction**

Agricultural markets are traditionally characterized by high level of price volatility and the potato industry is no exception. High potato price volatility, decreasing demand for fresh potatoes and low levels of growers' returns that often do not cover the potato production costs led to a decision of a number of Idaho potato growers to organize a cooperative. The United Fresh Potato Growers of Idaho (the United) was officially founded in November 2004 and that time represented 85% of fresh potato growers in Idaho. This is one of many agricultural cooperatives that enjoy the exemptions granted by antitrust laws. The Capper-Volstead Act allows farmers to act collectively in preparing for market and marketing their products.

The overall goal of the United is to stabilize the supply of potatoes in Idaho and to facilitate equitable and stable marketing of its members' production in order to provide a fair level of returns to potato growers. To perform this goal, the potato supply management program targeting both production and marketing of potatoes was developed and enforced starting in spring 2005. The main components of this program are the acreage management, potato flow control and secondary marketing strategies. The acreage management is administered through the bid buy down program and targets the number of potato acres planted. The potato flow control program coordinates potato shipments throughout the marketing year. The secondary marketing programs divert excess supply of already produced potatoes.

Although Idaho is the largest potato producer in the United States with almost a 30% market share in the national fall potato production, the success of the United Fresh Potato Growers of Idaho depends on whether similar strategies are followed by growers in other potato growing regions. Consequently, the efforts were made to organize potato growers nationally. The United Potato Growers of America was founded in March 2005 and a number of potato grower cooperatives with similar objectives were organized in other potato growing regions and in Canada.

The United Fresh Potato Growers of Idaho reported increases in potato growers' returns as a result of implementation of the acreage management program<sup>1</sup>. The impact of the United was also noted at the national level (Lucier and Jerardo 2005a, 2005b). As a result of the acreage bid buy down program implemented in spring 2005, the United reported that 26,000 acres were withdrawn from production that year, which represented 7% of the Idaho potato planted area in 2004. Although this reduction was still below the targeted 10% reduction relative to 2004, fresh potato prices increased during the following marketing year.

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<sup>1</sup> The potato market situations are discussed in the United Fresh Potato Growers of Idaho newsletters.

The United is one of many marketing cooperatives that have been active in various agricultural industries and some of them were more successful than others. A distinct feature of the presented case is the scope of its operation; the group of fresh potato growers cooperatives is about to encompass the whole North American market. If successful in developing effective sets of policies and programs and enforcing them in a proper way, the cooperatives are likely to gain control over the fresh potato supply and, consequently, over the potato price volatility. To accomplish this goal, the cooperatives have to enforce their policies and programs effectively and to monitor the performance of their members. Otherwise, the organizational and discipline enforcement problems would undermine the success and would lead to over production and high price volatility.

The United Fresh Potato Growers of Idaho is a dominant player in the North American potato industry. The success of this cooperative has important implications for fresh potato growers in all potato producing regions in North America. Although there is some evidence on a positive impact of the United's actions on the potato price and supply stability, there has not been any systemized economic analysis done to examine this situation. The results of such analysis would be useful for the potato industry participants in all potato growing regions.

The objective of our paper is to evaluate the effectiveness of programs and strategies of the United Fresh Potato Growers of Idaho. To perform this objective, we analyze Idaho and US level monthly and Idaho weekly shipping point prices for fresh potatoes during two periods: before the cooperative was formed and during the period when the cooperative is in the market. We examine changes in the fresh potato price level and volatility between these two periods, which are hypothesized to be due to implementation of the United's programs and strategies. The effects of potato supply management program, if it is effectively enforced, are reflected in the pattern of price behavior, as prices are indicators of the effectiveness of economic performance of market players like the United.

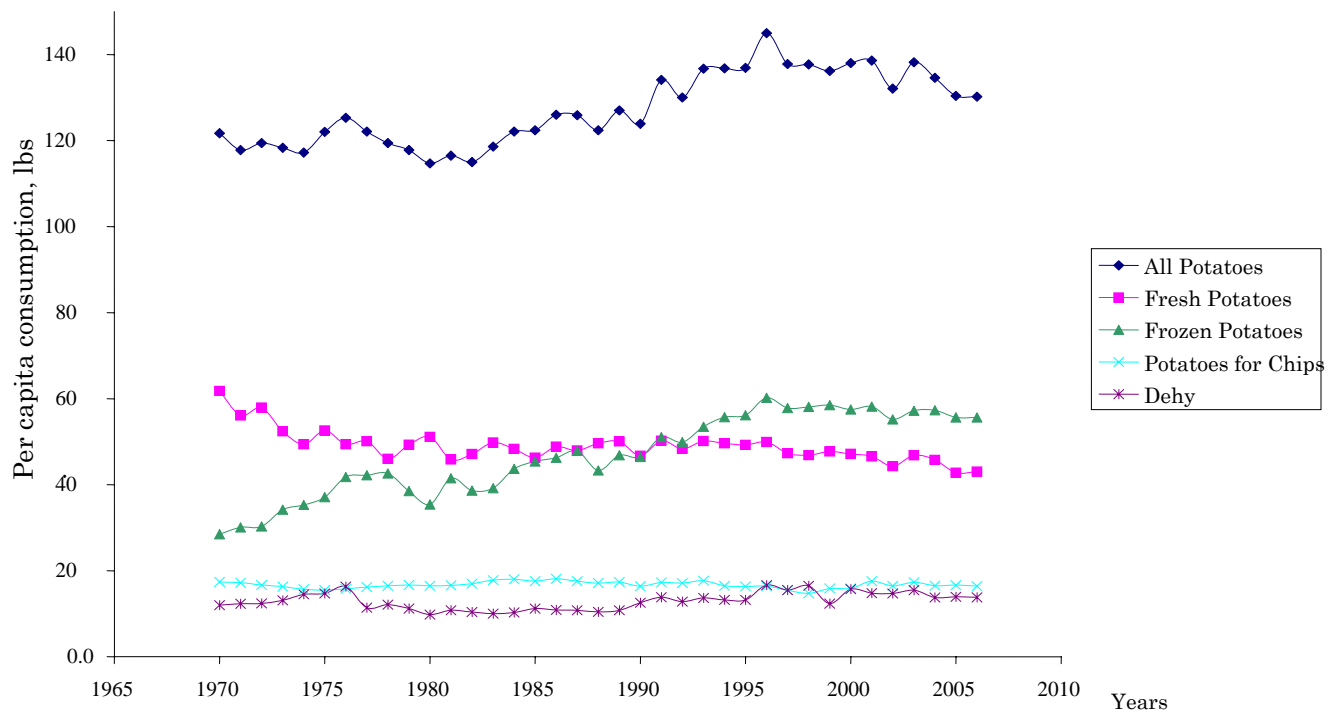
The paper is organized as follows. Section 2 presents the overview of the US potato industry. Section 3 discusses the Idaho potato industry, economic forces leading to formation of the United Fresh Potato Growers of Idaho and the programs implemented by the cooperative. Section 4 develops hypotheses and Section 5 presents data and descriptive statistical analysis. Section 6 discusses empirical models and is followed by Section 7 summarizing the estimation results. Finally, the conclusion of our study is presented.

## **Overview of the US Potato Industry**

Potatoes are one of the most significant products in a diet of the US consumers. Being the most important vegetable in food consumption, during the last twenty years potatoes were ranked as the second important product in the US food



consumption following wheat flour<sup>2</sup>. Potatoes are consumed in fresh and processed forms; processing potatoes are represented by frozen potatoes, dehydrated potatoes and potato chips. Although potato consumption was increasing during the recent decades, there was a change in the consumption pattern of fresh versus processed potatoes. Before 1990, fresh potato consumption exceeded frozen potato consumption; after 1990, there has been a steady increase in consumption of frozen potatoes and a steady decrease in consumption of fresh potatoes (Figure 1). For example, in 1990 fresh potato consumption was only 0.7% higher than frozen potato consumption; in 2006 frozen potato consumption was almost 30% higher than fresh potato consumption<sup>3</sup>.



**Figure 1: Trends in US Potato Consumption, 1970-2006**

*Data source: Economic Research Service.*

<sup>2</sup> Before 1987, potato consumption (in pounds per capita per year) exceeded the wheat flour consumption (in pounds per capita per year). In 2004 the wheat consumption and potato consumption were approximately at the same level (ERS/USDA food availability data system).

<sup>3</sup> Fresh and frozen potatoes represent the largest share in the total potato consumption. In 1990, fresh and frozen potatoes constituted 37.7% and 37.4% of the total potato consumption, respectively. In 2006, these shares were 33.1% and 42.7%. The numbers were calculated by the authors using data reported by ERS/USDA.

In 2005, the United States was the fourth largest producer of potatoes in the world following China, Russia and India (ERS/USDA potato statistics; Table 95). In 2000, the United States was the largest producer of frozen French fries followed by the Netherlands and Canada (Plummer and Makki 2002). Potatoes are the source of revenue for 9,408 potato producing farms in the US<sup>4</sup>. The total value of the US potato production in 2007 was almost \$3 billion, which did not account for the value added through processing.

Potatoes are grown in several states in the United States and there are obvious seasonal patterns in potato production. Depending on the season of production, which is associated with a particular geographic location, potatoes are classified as fall, winter, spring and summer potatoes. Fall potatoes are planted in the spring and are harvested in the fall. In terms of the area planted and value of production, fall potatoes accounted for 86% and 82% in the total potato production in the country in 2007<sup>5</sup>. Because of good storage possibilities, the marketing season for fall potatoes is usually from July (early harvest areas) through June of the following year. The two leading states in production of fall potatoes are Idaho and Washington (Table 1).

**Table 1:** 2007 Structure of the US Fall Potato Industry: 9 Leading States

State	Area planted	Production	Price per unit	Value of production	Market share in value of production	Number of potato farms
	1,000 acres	1,000 cwt*	\$/cwt	\$1,000	%	number (% share in the total)
<i>United States</i>	<i>1,010.6</i>	<i>409,082</i>	<i>6.61</i>	<i>2,704,113</i>	<i>100.00</i>	<i>9,408 (100.0)</i>
Idaho	350.0	131,650	5.80	763,570	28.24	818 (8.7)
Washington	165.0	102,300	6.00	613,800	22.70	408 (4.3)
Wisconsin	64.5	28,160	7.45	209,792	7.76	399 (4.2)
Colorado	59.2	20,981	8.30	174,142	6.44	229 (2.4)
North Dakota	97.0	23,660	6.60	156,156	5.77	216 (2.3)
Oregon	36.5	20,238	7.25	146,726	5.43	278 (3.0)
Minnesota	50.0	20,680	6.40	132,352	4.89	284 (3.0)
Maine	57.1	16,530	7.50	123,975	4.58	444 (4.7)
Michigan	42.5	14,700	8.40	123,480	4.57	395 (4.2)

*Data sources: National Agricultural Statistics Service and 2002 Census of Agriculture.*

All presented in the table economic indicators are for 2007, except for the number of potato farms, which is for 2002.

\* 1 cwt (hundredweight) = 100 pounds.

<sup>4</sup> This number of potato farms is recorded in the 2002 US Census of Agriculture.

<sup>5</sup> The percentages are calculated by the authors using the NASS/USDA statistics for all potatoes and fall potatoes.

The leading states in production of winter, spring and summer potatoes are California, Florida and Texas. Although these potatoes have a considerably smaller share in the total potato production, they help satisfy some specific marketing needs and are usually priced higher than fall potatoes.

In terms of potato utilization, fresh potatoes (table stock) and processing potatoes accounted for 28.4% and 58%, respectively in 2005 (ERS/USDA potato statistics; Table 120). The most significant processing uses are frozen French Fries, chipping potatoes and dehydrated potatoes, which constituted 29.1%, 12% and 10% of the total potato utilization in 2005. Fresh potatoes are usually sold in the open market and processing potatoes are typically sold through contracts; the latter are usually signed prior to the planting season and specify a potato variety, quantity and price tied to a set of quality requirements.

The most popular potato variety is Russet Burbank; in 2006 the share of Russet Burbank in the total area of fall potatoes planted was 46% nationally, followed by Russet Norkotah (13.1%) and Ranger Russet (9.5%) (ERS/USDA potato statistics; Table 67)<sup>6</sup>. Idaho is the leading producer of Russet Burbank; in 2006 this variety was planted on 66% of all potato acres in this state, which represented 48.4% of the fall potato acres planted nationally. Idaho is followed by Washington, North Dakota and Colorado with 12%, 10% and 8% of the national Russet Burbank area planted (ERS/USDA potato statistics; Table 67). A distinct feature of Russet Burbank is its universal uses. This potato variety is sold in the fresh potato market and for processing into French Fries and dehydrated potato products.

Table 1 presents the structure of the US fall potato industry. In 2007, the share of the nine leading states in the total value of fall potato production was 91%. The two leaders are Idaho and Washington with the market shares of 28.2% and 22.7%, respectively. The following seven states have market shares within the range of 4.6% (Michigan) to 7.8% (Wisconsin). Therefore, 51% of value of fall potato production is concentrated in Idaho and Washington. According to the 2002 US Census of Agriculture, there were 818 potato producing farms in Idaho and 408 potato producing farms in Washington in 2002. They represented 8.7% and 4.3% of all potato producing farms in the country, with Idaho being ranked as number two after Pennsylvania in terms of the number of potato producing farms<sup>7</sup>. Therefore, a half of fall potatoes production is concentrated in approximately 13% of all potato producing farms in the country<sup>8</sup>.

If compared to one another in terms of the area planted in 2007, the area of potatoes planted in Idaho was 350 thousand acres, which was more than two times larger

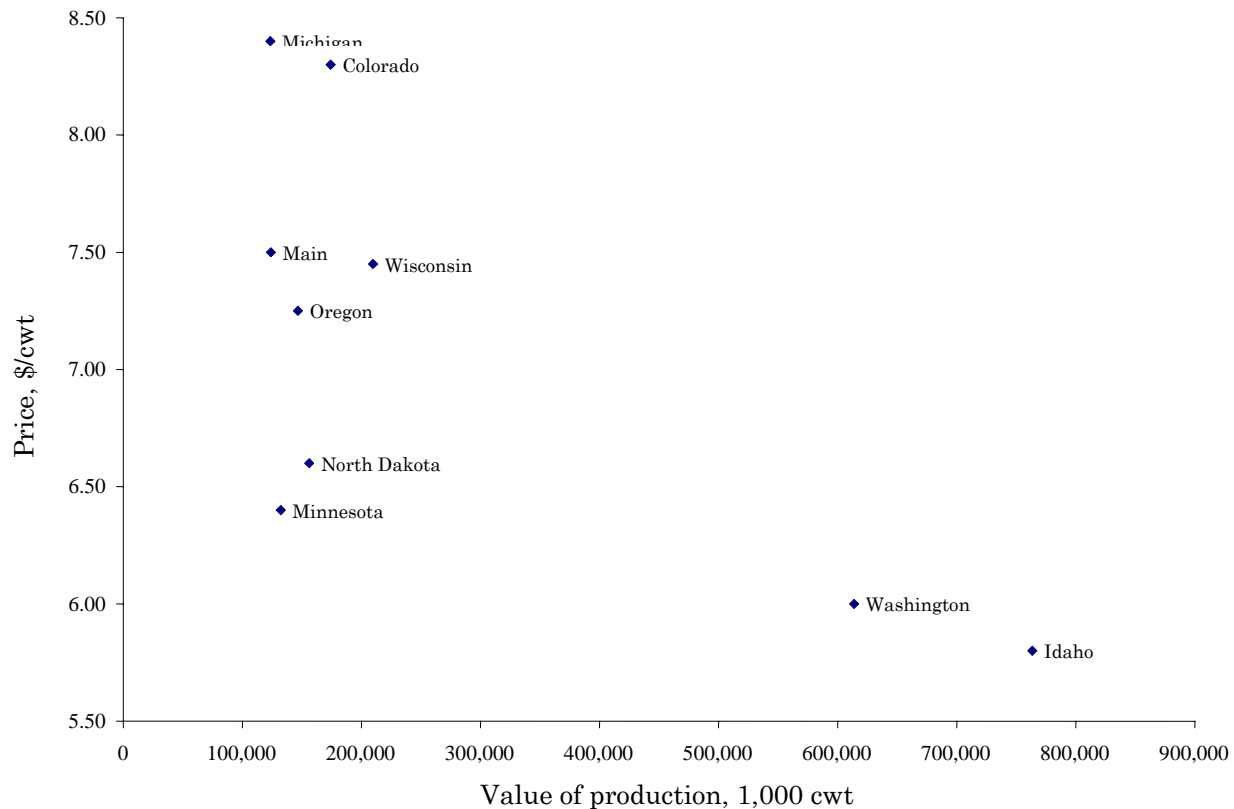
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<sup>6</sup> The percentages are calculated by the authors.

<sup>7</sup> There were 984 potato producing farms in Pennsylvania in 2002 (2002 Census of Agriculture).

<sup>8</sup> The percentages are calculated by the authors using the 2002 Census of Agriculture data.

than the area planted in Washington, 165 thousand acres (Table 1). Due to a 64% higher potato yield in Washington, the value of potato production in Idaho (\$763,570 thousand) was only 24% higher than in Washington (\$613,800 thousand). Although these two states have the largest market shares, potato producers in these states received the lowest prices in 2007, \$5.80 and \$6.00 per hundredweight (cwt)<sup>9</sup>; the average US price was \$6.61 per cwt. The 2007 fall potato price-quantity combinations for the nine leading states are shown on Figure 2. The pattern indicated on the figure suggests that the areas with the lowest level of potato production receive highest prices.



**Figure 2:** 2007 Fall Potato Production and Prices, 9 Leading States

*Data Source: National Agricultural Statistics Service.*

<sup>9</sup> One hundredweight (cwt) is equivalent to 100 pounds.

## Idaho Potato Industry and United Fresh Potato Growers of Idaho

### *Economic Forces Leading to the Formation of the United Fresh Potato Growers of Idaho*

To discuss the economic forces leading to formation of the United Fresh Potato Growers of Idaho, we analyze the level and volatility of potato area planted, potato production and potato prices across the nine states identified earlier. Table 2 presents the average potato area planted, the average potato production and the average potato price for the period before the cooperative was organized (1990-2004) and the period when the cooperative is in the market (2005-2007). Also, Table 2 presents the coefficient of variation for each of the analyzed variables. The United Fresh Potato Growers of Idaho was officially organized in November 2004; the cooperative programs and policies started being enforced in Spring 2005.

**Table 2:** Average Yearly Fall Potato Production and Prices, 1990-2004 vs. 2005-2007, 9 Leading States

State	Area planted		Production		Price per unit	
	1,000 acres		1,000 cwt*		\$/cwt	
	1990-2004**	2005-2007**	1990-2004	2005-2007	1990-2004	2005-2007
Idaho	390 (5.6)	337 (3.7)	132,096 (7.1)	126,284 (5.6)	4.77 (14.6)	5.80 (1.7)
Washington	155 (8.3)	158 (3.7)	87,722 (12.1)	95,893 (6.5)	5.06 (14.2)	5.95 (5.5)
Wisconsin	80 (9.3)	66 (2.7)	29,372 (12.9)	28,470 (2.8)	5.53 (16.0)	7.70 (2.8)
Colorado	72 (6.6)	59 (1.4)	24,899 (8.9)	22,192 (4.8)	4.62 (42.3)	8.30 (4.2)
North Dakota	130 (11.1)	96 (4.2)	25,733 (13.8)	23,213 (10.9)	5.38 (12.3)	6.65 (2.0)
Oregon	52 (13.0)	36 (3.2)	24,727 (14.1)	20,265 (8.6)	5.28 (13.0)	6.52 (10.8)
Minnesota	70 (14.7)	49 (5.4)	18,845 (16.4)	19,570 (8.6)	5.22 (11.3)	6.33 (2.5)
Maine	72 (10.8)	58 (1.2)	18,797 (10.8)	16,655 (7.6)	6.24 (11.8)	7.85 (4.8)
Michigan	44 (13.8)	43 (1.2)	13,162 (17.0)	14,267 (2.8)	6.80 (8.1)	8.22 (3.4)
<b>United States</b>	<b>1,180 (5.3)</b>	<b>991 (2.2)</b>	<b>410,306 (7.4)</b>	<b>396,915 (3.3)</b>	<b>5.27 (12.7)</b>	<b>6.61 (1.1)</b>

*Data source: National Agricultural Statistics Service.*

The entries in the cells are the average values with the coefficient of variations in the parentheses. Coefficient of variation is calculated as the ratio of standard deviation to the mean.

\* 1 cwt (hundredweight) = 100 pounds.

\*\* 15 observations (years) are used to calculate the average values for the period of 1990-2004 and 3 observations (years) are used to calculate the average values for the period of 2005-2007.

Analysis of the level and volatility of the potato production and prices across the nine leading states may explain the adverse economic situation that the Idaho potato growers found themselves in by 2004. During the period of 1990-2004, Idaho had one of the lowest average potato prices with one of the highest price variability (volatility). Among the nine states, only Colorado had lower average potato prices

and a higher level of price volatility<sup>10</sup>. The average potato price during 1990-2004 received by Idaho potato growers was \$4.77 per cwt, while the average US level price was \$5.27 per cwt. Potato growers in seven out of nine states received the average price above \$5 per cwt, and many of these states had lower price volatility than Idaho.

On the other hand, in terms of the number of acres planted and the level of production, Idaho potato production is characterized by the lowest level of volatility. While other eight states are characterized by a higher level of potato production volatility, it may be an evidence of a better reaction of these states to the current market situations, which leads to a higher price level and a lower price volatility. A lower level of potato production volatility in Idaho may be an indicator of a poor reaction of the Idaho potato industry to changes in market environment.

Another factor adversely affecting the economic condition of the Idaho potato industry is the level and volatility of potato production costs. Potato production is concentrated in three distinct growing regions across the Snake River Plain in southern Idaho. Potato production costs per acre vary significantly across the regions and are affected by the production practices used and potato varieties grown. Typically, potato production costs per acre decrease going from west to east across southern Idaho and from south to north in eastern Idaho. Potato production costs per acre in 2007 for Russet Burbank without storage ranged from nearly \$2,900 in southwestern Idaho to under \$2,000 in eastern Idaho (Patterson 2008). Including storage costs adds an additional \$225 to \$300 per acre<sup>11</sup>.

However, it is the cost per hundredweight that best illustrates the problem that Idaho growers encounter. Many Idaho potato producers were not able to recover their costs for a number of years. For example, while the without storage cost was approximately \$4.65 per cwt in 2004, a monthly average fresh potato market price in October was \$3.30 per cwt. With five months of storage, the cost per cwt had risen to approximately \$5.20 per cwt and the average March price had fallen to \$2.70 per cwt. Furthermore, in 2004 the average production cost was higher than the average fresh potato price received by potato producers. While the potato production cost fell in the range of \$4.63 to \$5.23 per cwt, the average fresh potato price was only \$3.89 per cwt (Table 5).

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<sup>10</sup> Colorado is the only state among the nine analyzed states where both fall and summer potato production takes place. Interaction of these two seasonal markets is likely to affect the pattern of the potato price level and volatility in this state relative to other states.

<sup>11</sup> The University of Idaho Department of Agricultural Economics and Rural Sociology conducts yearly surveys of potato producers to collect detailed information on potato production costs. The results of these surveys are summarized in the reports published as part of Agricultural Economics Extension Series in the mentioned Department. In this study we use potato production cost data presented in Patterson (2004, 2008) and Patterson and Smathers (2005, 2006).

In summary, high level of potato price volatility and low grower returns that do not always cover potato production costs coupled with the largest potato production area in the country led to a decision of a number of Idaho potato growers to organize their industry by founding the United Fresh Potato Growers of Idaho, a marketing cooperative.

### *Structure of Idaho Potato Industry*

The Idaho potato industry consists of potato growers, potato shippers and potato processors.

### **Potato Producers**

Analysis of the size distribution of potato farms and the potato marketing value distribution reveal that the large share of potato production is concentrated on the large potato farms (Table 3 and Table 4)<sup>12</sup>. Approximately 70% of all potato acres and potatoes produced are concentrated in 27% of all farms; this group is represented by 218 farms with 2,000 and more acres each (Table 3). The next group of farms, those with 1,000 to 1,999 acres, represents 25% of all potato farms and 19% of all potato acres and potato production. Therefore 86% of all potato acres and all potato production are concentrated in the farms with more than 1,000 acres representing 52% of all potato farms. Consequently, 48% of all potato farms produce 14% of all potatoes on 14% of all potato acres in Idaho.

**Table 3:** Distribution of Idaho Potato Farms by Size

	Number of acres (% share in the total)				
	Total	1-259	260-999	1,000 to 1,999	2,000 or more
Farms	818	113 (13.8)	281 (34.4)	206 (25.2)	218 (26.7)
Acres	364,229	4,659 (1.3)	46,852 (12.9)	70,832 (19.4)	241,886 (66.4)
Cwt* (1,000)	129,597	1,491 (1.2)	16,551 (12.8)	25,100 (19.4)	86,363 (66.6)

*Data source: 2002 Census of Agriculture.*

\* 1 cwt (hundredweight) = 100 pounds.

**Table 4:** Distribution of Idaho Potato Farms by Potato Marketing Value

Item	All farms	\$1,000,000 or more	\$500,000 to \$999,999	\$250,000 to \$499,999	\$100,000 to \$249,999	10,000 to 99,999
Farms	818	325 (39.7)	191 (23.3)	144 (17.6)	92 (11.2)	53 (6.5)
Acres	364,229	290,319 (79.7)	47,848 (13.1)	18,879 (5.2)	5,868 (1.6)	1,297 (0.4)
Cwt* (1,000)	129,597	105,069 (81.1)	16,052 (12.4)	6,335 (4.9)	1,764 (1.4)	375 (0.3)

*Data source: 2002 Census of Agriculture.*

\* 1 cwt (hundredweight) = 100 pounds.

<sup>12</sup> This analysis is based on the latest available Census of Agriculture data (2002).

In terms of the potato marketing value, 325 farms (40%) generate more than \$1 million and these farms' shares in all potato acres and all potato production are about 80%. Approximately 23% of all potato farms are those with potato marketing value of \$500,000 to \$999,999; it is produced on 13% of all potato acres and constitutes 12% of potato production. Therefore, approximately 94% of all potato marketing value is concentrated in 63% of all potato farms and 6% of all potato marketing value is concentrated in 37% of all potato farms.

## **Potato Shippers**

Potato shippers operate potato packing sheds and are represented by independent shippers and potato growers-shippers. Given that potato production is concentrated in large farms, some large potato growers are also potato shippers. While Idaho has had a long history of independent packing sheds, the current trend is toward larger, grower-owned sheds (Patterson et al 2005). Potato packing activities allow potato growers to capture additional benefits by adding value (i.e. packing and shipping) to the grown potatoes. Given the large size of some potato farms, establishing a potato packing business is a profitable strategy for them. There is a trend toward increasing consolidation of packing sheds in response to the consolidation among buyers and the growing importance of large retailers.

Packing sheds play the intermediate role between farmers and consumers. Packing sheds add value by washing, grading and packing potatoes for shipment to large distributors and large retailers who serve consumers. Fresh potato standards have to be satisfied before potatoes leave packing sheds<sup>13</sup>. A crucial distinction is made between size A potato tubers and non-size A tubers. The former are typically greater than 6 ounce, and the latter are less than 6 ounce and greater than 4 ounce. Size A potatoes are packed in 50-pound cartons, while non-size A tubers are placed in consumer packs. The number of tubers in the cartons must fall within specified standards. The number of potatoes per carton is from 40 to 120. The "Grown in Idaho" seal is a highly recognized trademark that potato shippers affix to potato bags and boxes.

There are 33 licensed fresh potato shippers and 4 licensed potato brokers in Idaho (Idaho Potato Commission web-page). There are 48 potato distribution businesses listed as members in the Idaho Grower Shippers Association and there are 48 associated members representing various businesses involved in distribution of potatoes and associated services (storage, packaging, transportation, insurance, marketing, etc) (Idaho Grower Shippers Association web-page).

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<sup>13</sup> United States Standards for Grades of Potatoes (1991) establish the requirements for different grades of potatoes.



## **Potato Processors**

The two largest potato processing sectors represented in Idaho are production of frozen potato products, primarily French Fries, and production of dehydrated potato products, primarily flakes and granules. Processing companies produce frozen and dehydrated potato products for food service use and for retail sales. There are 11 potato processors in Idaho (Idaho Potato Commission web-page); the largest of them with the longest history of involvement primarily in frozen potato product processing in Idaho are J.R. Simplot Company, McCain Foods and ConAgra Foods. The Idaho processing plants of these three companies represent approximately a quarter of the US fry plant capacity (Patterson et al 2005). Basic American Foods and Idaho Fresh Pack Corporation (Idahoan) dominate the dehydration sector.

Processing companies producing frozen potatoes use pre-season contracts to ensure a steady supply of potatoes with specified requirements for quality. Dehydrators typically rely on the fresh potato market off-grades potatoes and also use contracts with growers and potato shippers (packing sheds).

Given that the number of potato processors is small relative to the number of potato producers, and processing companies possess oligopsony market power<sup>14</sup>, growers of processing potatoes are represented by a bargaining association. For many years the Potato Growers of Idaho carried out this role. In recent years, the Southern Idaho Potato Cooperative (SIPCO) has represented interests of processing potato growers by negotiating the terms and conditions of yearly potato contracts with potato processors.

### *The Organizational Structure, Programs and Strategies of the United Fresh Potato Growers of Idaho*<sup>15</sup>

The United Fresh Potato Growers of Idaho (the United) was formed in November 2004 and that time represented 85% of fresh potato growers in Idaho. The goal of the cooperative is to stabilize supply of fresh potatoes in Idaho in order to provide fair returns to potato growers. A key to successful implementation of this goal is participation of other potato producing states. The United Potato Growers of

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<sup>14</sup> Oligopsony is a type of market structure where the number of buyers is small relative to the number of sellers, which allows buyers to have market power over the price of input bought. Therefore, potato processing companies have market power over the price of potatoes that they buy from numerous potato producers. According to the U.S. International Trade Commission, a four-firm concentration ratio among buyers of frozen potatoes is 80% (Richards et al 2001). This means that the four largest potato processors buy approximately 80% of all processing potatoes grown in the country. A rigorous quantitative analysis of a degree of oligopsony power in the processing potato industry is presented in Richards et al (2001).

<sup>15</sup> This section is based on the information presented in various newsletters available on the United Fresh Potato Growers of Idaho web-page.

America was organized in March 2005 and that time represented 70% of fresh Russet potato growers in the country. These events led to formation of potato cooperatives with similar objectives in other potato growing states and in Canada.

The fresh potato market is strongly affected by processing potato and seed potato markets. Cooperation with the process and seed potato growers is crucial for the success of the United. Seed potato growers joined the United Fresh Potato Growers of Idaho as a seed district. In summer 2005, Southern Idaho Potato Cooperative (SIPCO) representing processing potato growers in Idaho joined the United as an independent district. The United/SIPCO share in all produced in Idaho potatoes was 80% that time; the SIPCO members represented 80% of all processing potato production and the United members represented 85% of all fresh and seed potato production in the state. The United and SIPCO have a common marketing agency. United “manages” the SIPCO members’ fresh potato acres and SIPCO “manages” the United members’ processing potato acres.

To perform its objective, the United Fresh Potato Growers of Idaho developed and started enforcing a set of programs and policies that targeted both production and marketing of fresh potatoes (i.e. potato supply management program). The level of potato production is controlled through implementation of two policies. First, before the beginning of a planting season, the potato production is controlled by enforcing the acreage management program, which is implemented through the bid buy down program. Secondly, during the potato growing season, before harvest, the production is monitored over time and accurate yield prediction is performed; this is implemented through a series of field digs. The marketing programs include coordinating potato shipments throughout a marketing year (i.e. potato flow control program), providing marketing information to potato growers and implementing secondary marketing strategies. The latter are intended to remove excess supply of already produced potatoes.

### *Coordination of Potato Production*

The first year acreage management program was implemented in spring 2005 and by June 2005 the number of planted fresh potato acres was reduced by approximately 15% (26,000 acres) relative to 2004 (the base year). The program proceeded in two phases. First, a group of largest potato growers voluntary and with no compensation reduced their planted area by 11,000 acres (15% on average). Secondly, the first ever buy bid down program was implemented. Potato growers were submitting bids on how much they needed to be compensated in order not to plant, and the United Fresh Potato Growers of Idaho accepted the best bids. This helped affordably reduce potato acreage. The first year bid buy down program was financially supported by the United Potato Growers of America. Currently the program is enforced according to the recommended planting guidelines as approved by both the United Fresh Potato Growers of Idaho and United Potato Growers of

America Boards of Directors. These guidelines are also supported by all United Potato Growers of America Cooperatives.

The 2007-2008 United Acreage Reduction Program establishes the following rules<sup>16</sup>. The basic potato acreage assessment is \$50 per base acre. A cooperative member or any grower willing to participate in the program has two options. The first option is to reduce potato planting area by 15% relative to the 2004 year base. This option would be a payment in kind and the grower owes no cash if he reduces the planting area by exactly 15%. The second option is to reduce potato acreage by less than 15% relative to the 2004 year base. In this case, the grower is assessed a pro-rated percentage of \$50 per acre on all his base acres. This money is used to “buy out” acres elsewhere in Idaho. Growers who decide to expand without base are assessed \$100 per acre on all acres (expansion plus base acres).

Base acres are acres that had potatoes planted on them since the 2003-2004 crop year, regardless of whether or not these acres were registered with the United. Acres without base are those that did not have potatoes planted on them since the 2003-2004 crop season. Planting on acres without base is considered a “mindless expansion” as this strategy takes advantage of the improved market conditions facilitated by the programs implemented by the United.

If a grower is willing to expand, the following strategies are possible. First, he can buy or rent acres with base. In this case, the grower has to participate in the United’s programs (i.e. reduce planting by 15% or pay a pro-rated \$50 per acre assessment). Secondly, the grower can plant his full 2004 base by paying \$50 per acre. The collected money will be used to buy acres elsewhere in Idaho. Thirdly, the grower can buy or rent acres without base or accelerate the normal rotation of crops resulting in planting acres without base. This type of behavior is considered to be illegitimate and against the mission of the United because it leads to over production and represents the threat to the success of the United. A disincentive to this type of conduct (i.e. “mindless expansion”) is that in this case the grower has to pay \$100 per acre on all acres (base plus expansion acres).

### *Coordination of Potato Marketing*

The main components of the marketing program of the United are the potato flow control throughout a marketing year and exchange of marketing information. Before the cooperative was organized, uncoordinated potato flow to the fresh potato market often resulted in over supply of potatoes leading to low potato prices and high potato price volatility.

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<sup>16</sup> This summary is based on information presented in the 2007-2008 United Acreage Reduction Program basic definitions and ground rules.

To control the quantity of potatoes supplied to the market throughout a marketing year, the United instituted the potato flow control program in January 2006. Warehouses participating in this program represent more than 75% of the state's potato packing capacity. Warehouses enter information on the capacity, stocks and pack-outs on the web-page of the United on a regular basis. This information along with other information (prices, demand and supply trends, weather, etc.) is discussed during the conference calls twice a week at the state level and once a week at the national level. The results of these discussions are summarized in a price advisory which is posted on the internet. The price advisory information is used as the pricing strategy for the coming week.

Another marketing activity of the United is negotiation of potato contracts with processors. For example, in 2006 crop year, members of the United who entered the contracts with the dehy companies received an additional 25-cent premium to the price received by non-members, which was \$3.00 for Russet Burbank and \$2.75 for Russet Norkotah.

To remove excess supply of already produced potatoes, the United implements secondary marketing programs. An effectively executed secondary marketing strategy at the beginning of 2005 removed approximately 8% of potato stock from the market. A 2004 year potato surplus was diverted to charities, food banks and as dehydrated potatoes used for humanitarian services. One of the successfully used marketing opportunities was winning the USDA procurement contracts.

## **Hypotheses**

The effects of the potato supply management program are reflected in the behavior of fresh potato prices, as prices are indicators of the effectiveness of economic performance of market players like the United. If programs and policies of the United were effective, then the pattern of fresh potato price behavior in the period when the United is in the market is different from the pattern of price behavior in the period before the cooperative was organized.

The effective implementation of the acreage management program targeting the number of potato acres planted is expected to result in higher fresh potato prices. Therefore, our first hypothesis to be tested is that fresh potato prices are higher during the period when the United is in the market relative to the period before the United was organized.

The effective implementation of marketing strategies, in particular, the potato flow control throughout a marketing year, is expected to result in less volatile fresh potato prices. Therefore, our second hypothesis is that fresh potato price volatility is

lower during the period when the United is in the market relative to the period before the United was organized<sup>17</sup>.

## **Data and Descriptive Statistics**

### *Data*

Two different sources of data are used in the analysis. First, we use Idaho monthly fresh potato prices received by potato growers; these prices are for the period of January 2003 – January 2008. Given that Idaho has the largest share in the national potato production, we also use the US monthly fresh potato prices for the same period, that are likely to reflect the effects of the United's programs and policies. These prices are reported by the National Agricultural Statistics Service, and represent prices aggregated across all potato varieties and all potato grades. The prices are reported in \$ per hundredweight (cwt).

Secondly, we use weekly shipping point prices for Russet Burbank reported by the Agricultural Marketing Service. These are the prices received by entities involved in potato shipping (i.e. potato growers-shippers and independent potato shippers). The shipping point under consideration is Upper Valley Twin Falls-Burley, District Idaho, which is the major potato shipping point in Idaho. As mentioned earlier, Russet Burbank is the major potato variety produced in Idaho and it represents almost 50% of all potato acres planted nationally. As there are different prices associated with different grades of potatoes, we decided to analyze the most demanded grade, US No.1<sup>18</sup>. In particular, we focus on size A 70 counts and size A 80 counts. These potatoes are sold in 50 pounds cartons containing 70 potatoes and 80 potatoes, respectively. The US No.1 potato size A 70 count is 9-15 ounces and size A 80 count is 8-13 ounces. These prices are measured in \$ per a 50 pound carton. The shipping point prices are collected for the period of October 2002 to March 2008. The Agricultural Marketing Service reports a low and a high price corresponding to each week; in our analysis we use the average of these two prices.

### *Descriptive Statistics*

The descriptive statistics for the analyzed prices are presented in Table 5 and the price-series are presented on Figure 3 and Figure 4. The price level and price volatility are calculated for a period before the United was organized (the pre-coop

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<sup>17</sup> The most recent industrial organization studies focusing on illegal collusive conduct developed theories and tested a hypothesis suggesting that that price variance during collusion may be lower than during non-collusive periods; some empirical support to this hypothesis was found (Athey et al 2004, Connor 2005, Harrington and Chen 2006, Abrantes-Metz et al 2006, Bolotova et al 2008).

<sup>18</sup> The US Standards for Grades of Potatoes (1991) distinguish the following grades of potatoes: US Extra No.1, US No.1, US Commercial, US No.2 and Unclassified. One of the major differences among these grades is in terms of the diameter and weight of potato tubers.

**Table 5:** Descriptive Statistics –US and Idaho Monthly Fresh Potato Prices and Idaho Weekly Shipping Point Prices

Period	US	ID	Russet Burbank	
		(the minimum and maximum potato production cost* is in the parentheses; \$/cwt**)	70s	80s
	monthly prices (\$/cwt)		weekly prices (\$/50 lbs carton)	
<i>Price level</i>				
Pre-coop period	7.78	3.89 (4.63 - 5.23)	8.86	7.73
Coop period	10.19	6.63 (5.17 – 5.96)	10.11	9.87
<b>Coop Price/Pre-Coop Price</b>	<b>1.31</b>	<b>1.70 (1.10 -1.16)</b>	<b>1.14</b>	<b>1.28</b>
Overall Sample	8.89	5.15	9.44	8.72
<i>Price variance</i>				
Pre-coop period	2.27	1.12	4.97	2.85
Coop period	3.21	0.56	3.53	3.20
<b>Coop Variance/Pre-Coop Variance</b>	<b>1.42</b>	<b>0.50</b>	<b>0.71</b>	<b>1.12</b>
Overall Sample	4.12	2.73	4.67	4.14
<i>Coefficient of variation</i>				
Pre-coop period	0.19	0.27	0.25	0.22
Coop period	0.18	0.11	0.19	0.18
<b>Coop CV/Pre-Coop CV</b>	<b>0.95</b>	<b>0.41</b>	<b>0.76</b>	<b>0.82</b>
Overall Sample	0.23	0.32	0.23	0.23

*Data sources:* National Agricultural Statistics Service and Agricultural Marketing Service.

Coefficient of variation is calculated as the ratio of standard deviation to the mean.

The US and Idaho monthly fresh potato prices: the pre-coop period is January 2003 – September 2005 and the coop period is October 2005 – January 2008. The total number of observations is 61; the pre-coop period is represented by 31 observations and the coop period is represented by 28 observations.

The Idaho Russet Burbank weekly shipping point prices: the pre-coop period is mid-October 2002 – mid-August 2005 and the coop period is October 2005 – mid-March 2008. The total number of observations is 257; the pre-coop period is represented by 138 observations and the coop period is represented by 119 observations.

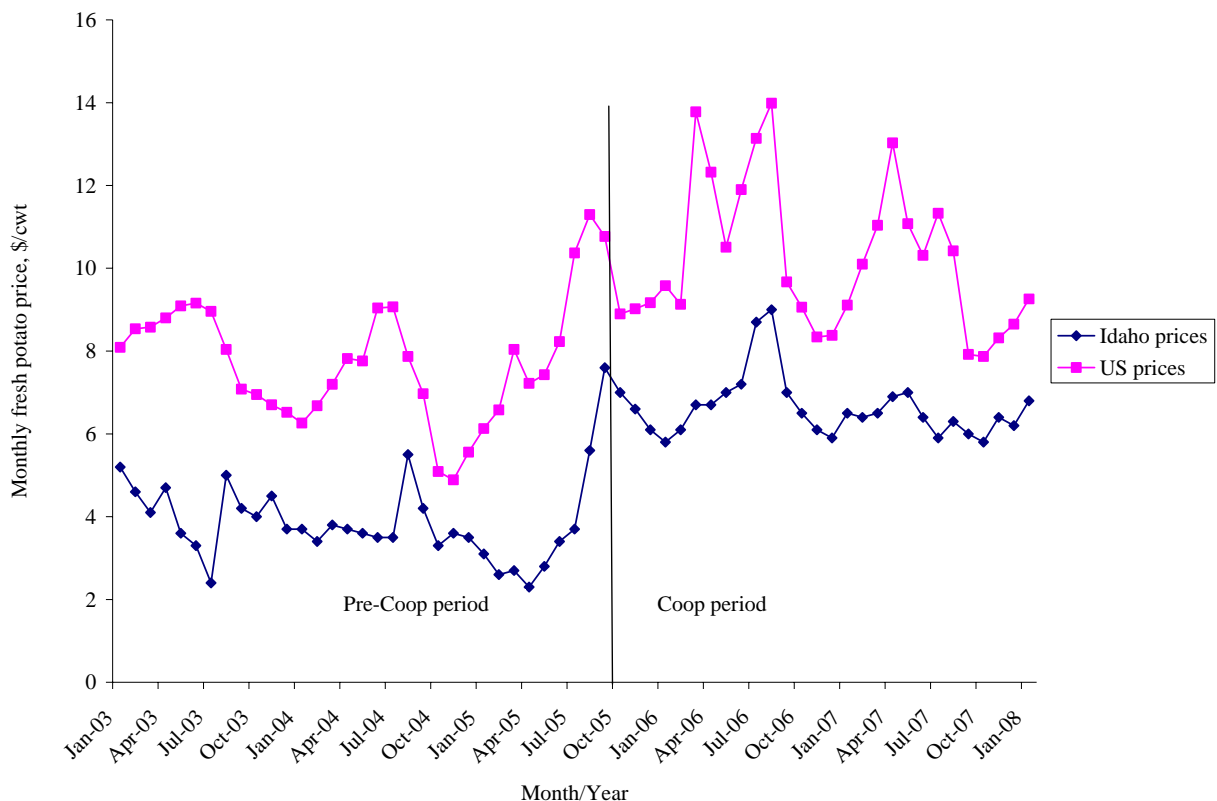
\* Potato production costs are calculated using information presented in Patterson (2004, 2008) and Patterson and Smathers (2005, 2006).

\*\* 1 cwt (hundredweight) = 100 pounds.

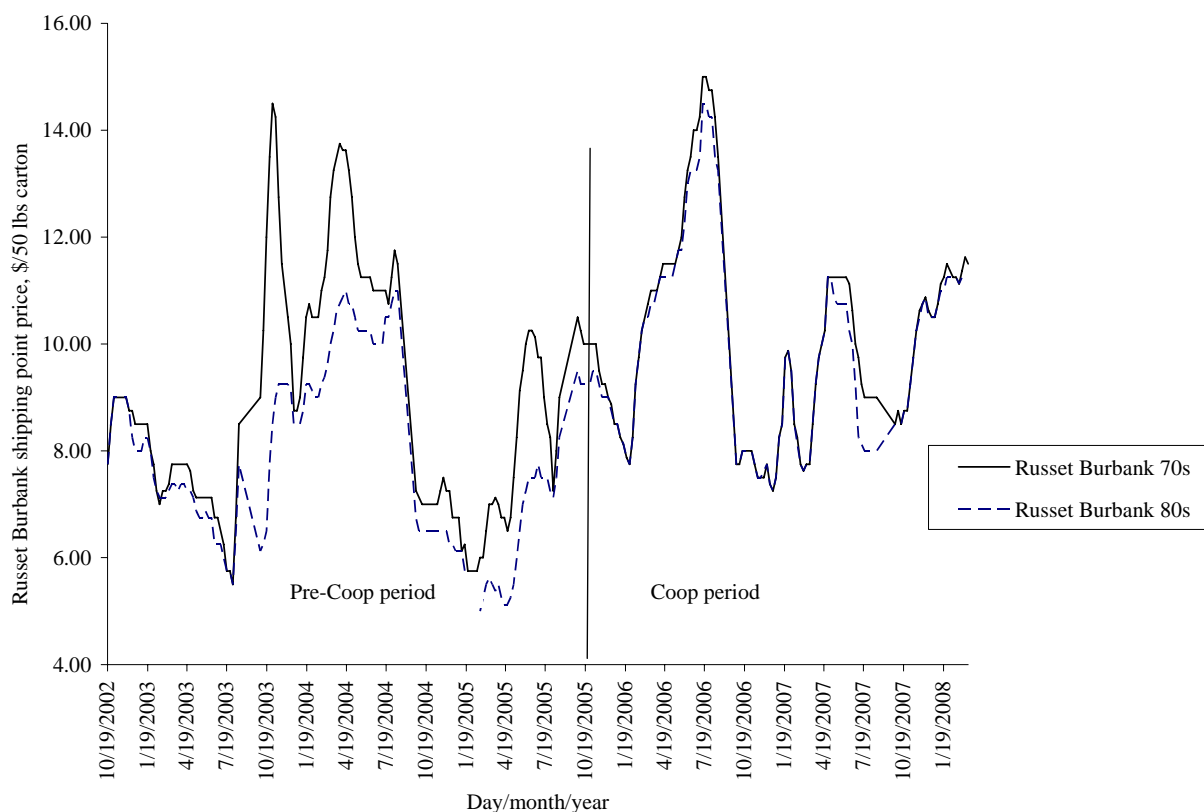
period) and for a period when the United is in the market (the coop period). In the case of the US and Idaho monthly prices, the pre-coop period is January 2003 – September 2005 and the coop period is October 2005 - January 2008. In the case of the weekly shipping point prices, the pre-coop period is mid-October 2002 to mid-August 2005, and the coop period is October 2005 – mid-March 2008. A newmarketing year usually starts in September – October and ends in late August following year. No potato shipping occurs during a few weeks around August – September.

The pre-coop period is chosen such that approximately the same number of observations is available for the pre-coop and coop periods. In the case of the US and Idaho monthly fresh potato prices, the total number of observations is 61; the pre-coop period is represented by 31 observations and the coop period is represented by 28 observations. In the case of Russet Burbank weekly shipping point prices, the total number of observations is 257; the pre-coop period is represented by 138 observations and the coop period is represented by 119 observations.

Although the United was formally organized in November 2004, we consider that fresh potato prices started to reflect the effects of the United's policies and programs in October 2005, when the new marketing season began. This explains our decision on using October 2005 as a date distinguishing the pre-coop and coop periods. Descriptive statistics analysis provides evidence suggesting that the average price during the coop period is higher than the average price during the pre-coop period. The Russet Burbank 70 counts weekly prices increased from \$8.86 per a 50 lbs carton in the pre-coop period to \$10.11 per a 50 lbs carton in the coop period. The Russet Burbank 80 counts weekly prices increased from \$7.73 per a 50 lbs carton in the pre-coop period to \$9.87 in the coop period. The Idaho fresh potato monthly



**Figure 3:** US and Idaho Monthly Fresh Potato Prices, January 2003 – January 2008  
*Data Source: National Agricultural Statistics Service.*



**Figure 4:** Idaho Russet Burbank Weekly Shipping Point Prices, October 2002 – March 2008

*Data Source:* Agricultural Marketing Service.

prices increased from \$3.89 per cwt in the pre-coop period to \$6.63 per cwt in the coop period, and the US fresh potato monthly prices increased from \$7.78 per cwt to \$10.19 per cwt.

The evidence on the price variance change between the pre-coop and coop periods is mixed; it depends on the price-series under consideration and the statistic used to calculate the price variance. We use two statistics to calculate the price variance effect; these are the variance and coefficient of variation. The coefficient of variation is the ratio of standard deviation to the mean; therefore, it takes into account both the mean and variance effects. In the case of all analyzed price series, coefficients of variations are smaller in the coop period relative to the pre-coop period, which suggests that prices are less volatile in the coop period relative to the pre-coop period. As for the variance, Idaho monthly fresh potato prices and Russet Burbank 70 counts weekly shipping point prices exhibit lower variance in the coop period relative to the pre-coop period. In contrast, US monthly fresh potato prices and



Russet Burbank 80 counts weekly shipping point prices exhibit higher variance in the coop period relative to the pre-coop period.

If we compare the US and Idaho monthly fresh potato prices, the magnitude of the price mean and price variance changes is higher for Idaho rather than for the US. While the US monthly fresh potato price increased by 31%, the Idaho fresh potato prices increased by 70%. Furthermore, while the US fresh potato price variance increased by 41%, the Idaho fresh potato price variance decreased by 100%.

The identified changes in the price level and price variance may not be due solely to the impact of the United. Other important market factors were likely to contribute to these changes, and increasing potato production cost represents the most significant factor. To conduct a more precise evaluation of the effect of the United on fresh potato price behavior, we attempt to isolate the effect of changes in the potato production costs by comparing the potato price increases with the potato cost increases during the analyzed periods (Table 5).

In our analysis we use the 2004 potato production cost as a proxy for the pre-coop period potato production cost; this year represents the highest level of potato production costs during the pre-coop period. A proxy for the coop period potato production cost is calculated as the average over the last three years (i.e. 2005-2007). We observe that the potato production cost increases between the pre-coop and coop periods, and the cost increase falls in the range of 10% to 16% (Table 5). Using the Idaho monthly fresh potato prices, we conclude that while the fresh potato prices received by growers increase by 70% on average, potato production costs increase by 10%-16% on average (Table 5). Consequently, approximately 54% to 60% in the Idaho monthly potato price increase is due to other than potato production cost market factors, and the impact of the United is likely to be the most significant factor explaining the identified price increases.

Descriptive statistics corresponding to the yearly data on potato production and prices in the nine leading potato producing states and the US (Table 2) also provide some evidence suggesting that the average level of production was lower and the average level of price was higher in the coop period relative to the pre-coop period. Another important observation is that both the production and price volatility is considerably lower in the coop period relative to the pre-coop period. If we compare the average price volatility during the coop period across the nine analyzed states, Idaho apparently has the lowest potato price volatility, while during the pre-coop period Idaho had one of the highest potato price volatilities.

We should note that the analyzed yearly data are associated with the total potato production, both fresh and processing. However, given that fresh and processing markets are connected, the identified changes in the yearly data are likely to reflect some effects of programs and policies of the United Fresh Potato Growers of Idaho,

United Potato Growers of America and other potato cooperatives with similar objectives.

In summary, there is evidence suggesting that fresh potato prices were higher and less volatile in the coop period relative to the pre-coop period. To conduct a more critical evaluation of the identified changes in the price level and volatility and test the statistical significance of these effects, we use econometric analysis.

## Empirical Models

To quantify the effect of the programs and policies of the United Fresh Potato Growers of Idaho on fresh potato price behavior (price level and price volatility), we use extended versions of the traditional autoregressive conditional heteroscedasticity (ARCH) model and the generalized autoregressive conditional heteroscedasticity (GARCH) model<sup>19</sup>. A distinct feature of these time-series econometric techniques is that they allow for simultaneous estimation of the conditional mean and conditional variance processes over time<sup>20</sup>.

The original ARCH( $m$ ) model is represented by equations [1] and [2] and the original GARCH( $r,m$ ) model is represented by equations [1] and [3]<sup>21</sup>. Equation [1] describes the conditional mean process and equations [2] and [3] describe the conditional variance process in the ARCH and GARCH models, respectively. If these models are applied to analyze prices, then the current price level ( $p_t$ ) is modeled as a function of the past prices (conditional mean equation) and the current price variance ( $h_t$  or  $u_t^2$ ) is modeled as a function of the past price variances (conditional variance equation).

$$[1] \quad p_t = \psi_0 + \psi_1 p_{t-1} + \psi_2 p_{t-2} + \dots + \psi_m p_{t-m} + u_t \quad ^{22}$$

$$[2] \quad u_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 + \dots + \alpha_m u_{t-m}^2 + w_t \quad ^{23}$$

<sup>19</sup> The ARCH model was originally introduced by Engle (1982) and was generalized by Bollerslev (1986).

<sup>20</sup> The models assume that unconditional variances are homoscedastic and conditional variances are heteroscedastic and depend on the variances in previous periods.

<sup>21</sup> A noise process  $u_t$  satisfying the variance equation [2] is described as an autoregressive conditional heteroscedastic process of order  $m$ , denoted as ARCH( $m$ ). Correspondingly, GARCH( $r,m$ ) describes the  $r$ -th and the  $m$ -th orders of the two components of the autoregressive conditional variance processes specified in equation [3].

<sup>22</sup>  $u_t$  is a white noise,  $E(u_t) = 0$ ,  $E(u_t u_s) = \sigma^2$  for  $t = s$  and 0 otherwise.

<sup>23</sup>  $w_t$  is a new white noise process,  $E(w_t) = 0$ ,  $E(w_t w_\tau) = \lambda^2$  for  $t = \tau$  and 0 otherwise. The sufficient stationarity (regularity) condition requires  $\alpha_0 > 0$  and  $\alpha_j \geq 0$  for all  $j \leq m$ .

$$[3] \quad h_t = \xi + \delta_1 h_{t-1} + \delta_2 h_{t-2} + \dots + \delta_r h_{t-r} + \gamma_1 u_{t-1}^2 + \gamma_2 u_{t-2}^2 + \dots + \gamma_m u_{t-m}^2 \quad 24$$

To analyze the effects of policies and programs of the United on the fresh potato price level and volatility, we extend the traditional ARCH and GARCH models to allow for structural shifts due to the cooperative's policies and programs<sup>25</sup>. We introduce a binary variable ( $Coop_t$ ) in both the conditional mean and conditional variance equations<sup>26</sup>. This variable is equal to 1 if a price observation belongs to the coop period and it is equal to 0 if a price observation belongs to the pre-coop period<sup>27</sup>.

The estimated ARCH and GARCH models with a structural shift due to the effects of the United are represented by equations [4] and [5] and equations [4] and [6], respectively. Equation [4] describes the conditional mean process and equation [5] describes the conditional variance process in the extended ARCH(1) model applied to the US and Idaho monthly fresh potato prices. Equation [4] describes the conditional mean process and equation [6] describes the conditional variance process in the extended GARCH(1;2) model applied to the Russet Burbank weekly shipping point prices<sup>28</sup>.

$$[4] \quad p_t = \psi_0 + \psi_1 p_{t-1} + \lambda p_{t-1} Coop_t + \chi Coop_t + u_t$$

$$[5] \quad u_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \eta Coop_t + w_t$$

$$[6] \quad h_t = \xi + \delta_1 h_{t-1} + \gamma_1 u_{t-1}^2 + \gamma_2 u_{t-2}^2 + \mu Coop_t$$

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<sup>24</sup>  $u_t = \sqrt{h_t} v_t$  and  $v_t$  is i.i.d. with a zero mean and a unit variance. The sufficient stationarity

(regularity) condition requires  $\xi > 0$ ,  $\delta_i \geq 0$  for all  $i \leq r$ ,  $\gamma_j \geq 0$  for all  $j \leq m$  and  $\sum_{i=1}^r \delta_i + \sum_{j=1}^m \gamma_j \leq 1$ .

Calculation of the sequence of conditional variances  $\{ h_t \}$  for  $t=1$  to  $t=T$  requires their pre-sample values. They are calculated as a sample average of the squared predicted residuals for each pre-sample observation in the T sequence (Bollerslev 1986; Hamilton 1994).

<sup>25</sup> Bolotova et al (2008) used a similar approach to examine the impact of illegal collusion on price level and volatility in the US citric acid and lysine markets.

<sup>26</sup> We assume that this binary variable acts as an intercept and as a slope shifter in the conditional mean equation.

<sup>27</sup> The discussion of the pre-coop and coop periods is presented in a previous section presenting descriptive statistics analysis.

<sup>28</sup> ARCH and GARCH models are alternative empirical techniques. A number of ARCH(m) and GARCH(r;m) models was applied to each price series and results were compared. The reported results are those for the models with the best fit.

$\psi_0$ ,  $\psi_1$ ,  $\lambda$ ,  $\chi$  are the conditional price mean equation coefficients to be estimated;  $\alpha_0$ ,  $\alpha_1$ ,  $\eta$  are the ARCH model conditional price variance equation coefficients to be estimated, and  $\xi$ ,  $\delta_1$ ,  $\gamma_1, \gamma_2, \mu$  are the GARCH model conditional price variance equation coefficients to be estimated.  $\chi$  is a coefficient measuring the effect of the United on the fresh potato price level.  $\eta$  and  $\mu$  are the coefficients measuring the effect of the United on the fresh potato price variance in the ARCH and GARCH model, respectively.

If the United is effective in enforcing its policies and programs, we would expect the estimated coefficient for the coop binary variable in the conditional price mean equation to be positive. Furthermore, we would expect the estimated coefficient for the coop binary variable in the conditional price variance equation to be negative.

## Estimation Results

The ARCH and GARCH estimation results are presented in Table 6. The ARCH (1) model was used to analyze the US and Idaho monthly fresh potato prices. The GARCH (1;2) model was used to analyze the Russet Burbank weekly shipping point prices. The estimated coefficients have expected magnitude and many of them are statistically significant.

**Table 6:** The ARCH(1) and GARCH(1;2) Models Estimation Results – US and Idaho Monthly Fresh Potato Prices and Idaho Weekly Shipping Point Prices

Variable	US	ID	Russet Burbank	
			70s	80s
	monthly prices (\$/cwt*)	monthly prices (\$/cwt*)	weekly prices (\$/50 lbs carton)	weekly prices (\$/50 lbs carton)
	ARCH(1)	ARCH(1)	GARCH (1;2)	GARCH (1;2)
<i><b>The mean equation: the dependent variable is price level</b></i>				
Lagged price (PL)	0.919 <sup>a</sup> (9.15)	0.543 <sup>a</sup> (3.04)	0.966 <sup>a</sup> (40.85)	0.969 <sup>a</sup> (78.68)
PL*Coop	-0.346 <sup>a</sup> (-1.87)	-0.220 (-0.97)	-0.049 <sup>a</sup> (-2.05)	-0.051 <sup>a</sup> (-4.12)
<b>Coop binary variable (Coop)</b>	<b>3.564<sup>a</sup> (1.98)</b>	<b>2.526<sup>a</sup> (2.24)</b>	<b>0.579<sup>a</sup> (2.68)</b>	<b>0.591<sup>a</sup> (5.67)</b>
Constant	0.750 (0.95)	1.757 <sup>a</sup> (2.60)	0.309 <sup>c</sup> (1.43)	0.288 <sup>a</sup> (2.80)
<i><b>The variance equation: the dependent variable is price variance</b></i>				
Constant	0.648 <sup>a</sup> (3.62)	0.444 <sup>a</sup> (2.95)	0.280 (0.89)	0.018 <sup>a</sup> (3.32)
Squared error, 1st lag	-0.002 (-0.02)	0.760 <sup>a</sup> (2.18)	0.009 (0.38)	-0.011 <sup>a</sup> (-6.70)
Squared error, 2nd lag			-0.015 <sup>b</sup> (-1.47)	-0.002 <sup>a</sup> (-2.07)
Conditional variance, 1st lag			0.280 (0.34)	0.923 <sup>a</sup> (30.69)
<b>Coop binary variable (Coop)</b>	<b>1.443<sup>a</sup> (2.40)</b>	<b>-0.336<sup>a</sup> (-2.19)</b>	<b>0.001 (0.03)</b>	<b>0.011<sup>a</sup> (3.53)</b>
Log-Likelihood function value	-87.63	-59.54	-237.84	-195.71
Number of observations	60	60	256	256

The entries in the cells are the estimated coefficients with the Z-statistics in the parentheses.

<sup>a</sup> The estimated coefficient is statistically significant at a 10 percent level of probability of Type I error using a two-sided Z-test.  $H_0: \beta=0$  and  $H_a: \beta \neq 0$ . The Z-statistic rejection regions are  $(-\infty; -1.64]$  and  $[1.64; \infty)$ .

<sup>b</sup> The estimated coefficient is statistically significant at a 10 percent level of probability of Type I error using a one-sided Z-test. The null hypothesis  $H_0: \beta > 0$  is rejected in favor of the alternative hypothesis  $H_a: \beta \leq 0$ . The Z-statistic rejection region is  $(-\infty; -1.28]$ .

<sup>c</sup> The estimated coefficient is statistically significant at a 10 percent level of probability of Type I error using a one-sided Z-test. The null hypothesis  $H_0: \beta < 0$  is rejected in favor of the alternative hypothesis  $H_a: \beta \geq 0$ . The Z-statistic rejection region is  $[1.28; \infty)$ .

\* 1 cwt (hundredweight) = 100 pounds.

The major interest is on the interpretation of the coefficient for the Coop binary variables in the price mean and price variance equations. These coefficients measure the hypothesized effects of the programs and policies of the United Fresh Potato Growers of Idaho on the fresh potato price level and volatility. The estimated coefficients for the Coop binary variables in all four price equations are positive and statistically significant. The magnitude of this coefficient across the four analyzed price series seems to be affected by the level of data aggregation and by the units of measurement. The magnitude of the coefficient is higher in the case of monthly prices (\$ per cwt) and is lower in the case of weekly shipping point prices (\$ per a 50 lbs carton).

According to the ARCH (1) model applied to the Idaho monthly fresh potato prices, the United policies and programs are likely to contribute to a \$2.53 per cwt increase in price between the pre-coop and coop period. As Idaho has the largest share in the US value of production and similar policies on stabilization of potato supply started being enforced in other states the same year, these actions were likely to contribute to a \$3.56 per cwt increase in the US level fresh potato price between the pre-coop and coop periods. The Russet Burbank weekly shipping point prices under consideration (70 and 80 counts 50 pounds cartons) increased by almost \$0.6 per a 50 pounds carton between the pre-coop and coop period. All these price increases are statistically significant. Therefore, we find empirical support to our hypothesis suggesting that enforcement of the potato supply stabilization program by the United resulted in an increase in the fresh potato prices.

As for the effect of the United's potato supply stabilization program on the fresh potato price volatility, the empirical results are mixed and depend on the price series under consideration. The fresh potato price variance is lower in the coop period relative to the pre-coop period only in the case of Idaho monthly fresh potato prices, and this effect is statistically significant. The US level monthly fresh potato prices exhibit a higher price variance in the coop period relative to the pre-coop period and this effect is statistically significant. These monthly price series variance effects are consistent with the descriptive statistical analysis results.

In the case of the Russet Burbank weekly shipping point prices, 80 counts price series exhibits a higher price variance in the coop period relative to the pre-coop period and this effect is statistically significant. This shift in variance is similar to the descriptive statistical analysis results. The Russet Burbank 70 counts price

series exhibits a higher price variance in the coop period relative to the pre-coop period, but this difference in price variance is not statistically significant. Further, we can interpret this result as a failure to reject the null hypothesis of a non-positive variance shift under a one-sided test of the variance hypothesis. In summary, there is some limited empirical evidence suggesting that the fresh potato price variance is reduced due to implementation of the potato supply management program.

## **Conclusion**

High potato price volatility, decreasing demand for fresh potatoes and potato prices below the cost of production led to a decision of a number of Idaho potato growers to organize United Fresh Potato Growers of Idaho, a marketing cooperative. The United was founded in November 2004, representing 85% of fresh potato growers in Idaho. The goal of the cooperative is to stabilize the supply of potatoes in order to provide a fair level of returns to all potato growers.

We evaluate the effectiveness of the programs and policies of the United. We analyze the patterns of price behavior during two periods, before the cooperative was organized and during the period when the cooperative is in the market. Prices are indicators of the economic performance of market players like the United. If the United enforced its programs effectively, then fresh potato prices would reflect these effects. We use monthly Idaho and US fresh potato prices and weekly Idaho Russet Burbank potato prices to conduct this analysis.

The major program implemented by the United is the potato supply stabilization program which targets both production and marketing of fresh potatoes in Idaho. The fresh potato production is coordinated through the potato acreage management program and the fresh potato marketing is mostly coordinated through the potato flow control program.

If the potato acreage management program targeting the number of potato acres planted was implemented effectively, then we would expect to observe a fresh potato price increase. Currently the cooperative reduces the number of potato acres planted relative to 2004 year. Given that potato industry participants face the inverse demand schedule, a reduction in the number of potato acres would lead to a fresh potato price increase. We find strong empirical support to this hypothesis. Idaho monthly fresh potato prices were 70% higher in the coop period relative to the pre-coop period.

This price increase is not totally due to the actions of the United. Increasing potato production costs are likely to contribute to the identified price increase. Following the most conservative evaluation of potato production costs, we found that the potato production cost increases between the coop and pre-coop periods fell in the

range of 10% to 16%. Consequently, approximately 54% to 60% in the monthly Idaho fresh potato price increase is due to other than potato production cost market factors, and the impact of the United is likely to be the most significant factor explaining the observed price increase.

If the potato flow control program coordinating the flow of potatoes to the market throughout the marketing year is effective, then we would expect it to impact the fresh potato price volatility. In addition, exchange of marketing information and secondary marketing programs would contribute to this effect. In particular, effective implementation of these programs would lead to a lower level of potato price volatility. We find some empirical support to this hypothesis. Idaho monthly fresh potato prices were less volatile during the coop period relative to the pre-coop period. Furthermore, before the cooperative was organized, Idaho had had the most volatile potato prices as compared to other major potato growing regions in the country. During the period when the United was in the market, Idaho had the least volatile prices.

Given that Idaho is a dominant player in the US potato industry and other potato growing regions started following similar strategies, the US level monthly fresh potato prices are likely to reflect the effects of the United and cooperatives with similar objectives. We find that the US monthly fresh potato prices were 31% higher in the coop period relative to the pre-coop period; the national level effect is weaker than the Idaho level effect.

Therefore, based on empirical evidence presented in the paper, we conclude that programs and strategies of the United Fresh Potato Growers of Idaho directed toward stabilization of potato supply in Idaho have been effective thus far. The programs implemented by the United led to higher prices and a reduced price risk for Idaho potato growers. As indicated by the US monthly fresh potato prices, all potato growers received higher prices since 2005, after the acreage management program started being implemented in several potato growing regions in the country.

We do not argue that the identified changes in the fresh potato price level and volatility were totally due to the efforts of the United and similar cooperatives. Other factors, such as potato yield variation, increase in potato production costs and changes in the domestic and foreign demand may have contributed to the observed effects. However, by analyzing a wide array of related economic variables and connecting the patterns of their behavior to the programs and strategies of the United, we believe that the United Fresh Potato Growers of Idaho and potato growers cooperatives with similar objectives were successful in accomplishing their goals and impacted the fresh potato price level and volatility during the period of 2005-2008, which benefited all potato growers.

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## **Market Orientation, Innovation and Entrepreneurship: An Empirical Examination of the Illinois Beef Industry**

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### **Abstract**

This paper explores the importance of a producer's market orientation on their subjective performance within agricultural commodity markets. Using a structural equation model of beef producers, our findings suggest that market oriented firms are highly innovative and achieve superior performance. These findings are consistent with previous research on the market orientation-performance relationship in heterogeneous product markets. The cost focus of a firm was also found to have a significant influence on innovation, but no direct effect on performance. This suggests that beef producers should follow a balanced approach utilizing both an external market and an internal productivity focus to achieve superior returns as opposed to solely focusing on internal productivity as many producers currently do.

**Keywords:** market orientation, beef production, innovation, performance

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## **Introduction**

The concept of a market orientation (MO) and its influence on firm performance has been extensively researched within the marketing literature (Slater and Narver, 1990; Kohli and Jaworski, 1990; Day, 1994). The premise behind this research is firms who are more closely aligned with and better understand their clients and market demands will, in turn, be able to provide products, services and solutions that more closely meet consumers' expressed and latent needs and thereby achieve superior performance measures. Recent studies have shown the MO-performance relationship to be robust across a variety of industries and regional locations, such as small craft firms in Spain (Bigne and Blesa, 2003), large Japanese corporations (Deshpande, Farley and Webster, 1993), and various strategic business units (SBU) of a single forestry firm in the United States (Narver and Slater, 1990). The breadth of this body of research gives credence to the findings of Slater and Narver (1994) who state that in any business environment, highly market oriented firms are better positioned for successful outcomes.

Researchers have defined market orientation as a firm's ability to generate market intelligence and disseminate it throughout the firm and marketing channel, while using this new knowledge to create products which meet the expressed as well as latent needs of consumers (Kohli and Jaworski, 1990). The foundation of a market orientation is customer and channel knowledge. Working backwards along the channel from the consumer market interface, market oriented firms search for possible sources of value creation using market intelligence and then determine if they in fact can meet these needs based on their own core capabilities. Similar to what is seen in other industries, beef producers can acquire market intelligence through various sources and methods, including consumer focus groups, discussions with channel members, participant observations, trade publications, as well as extension personnel. Increased channel communication may provide producers with specific market knowledge, such as preferred loin size, that would allow them to make better production management decisions in terms of genetic selection and culling.

The performance implications of a market orientation have been studied extensively in the literature within numerous contexts. Agricultural markets are the exception as they have been largely overlooked. Agricultural commodity markets, however, provide a unique context in which to study market orientation as they are generally highly competitive, price taking, markets characterized by many small firms with extremely small market share. Within these commodity markets most producers would view an internal focus on improving production efficiency as more important than earning potentially higher prices through improved quality. The lack of research on the market orientation- performance link in agriculture is even more puzzling given that Moore and Hussey (1965) stressed that in the future agricultural firms' must become more market oriented in order to succeed.

The purpose of this paper is to determine the performance implications of a market orientation in the Illinois beef industry. This research fills two important voids in the literature. First, thus far the impact of market orientation in commodity businesses has been shown to be ambiguous. In two papers which have explored this issue, Narver and Slater (1990) found a positive, but non-significant MO-performance relationship in their study of a forest products firm, and Pelham (1997) found no relationship when examining small industrial manufacturing firms. Pelham did however find that a market orientation was an important determinant of performance in segmented markets. Secondly, there is a lack of empirical research examining the level and affect of a market orientation on firm performance in agriculture. While the U.S. beef industry has traditionally been largely commodity based, the increasing growth of niche marketing and production alliances is resulting in parts of the industry becoming more highly segmented and vertically aligned. Furthermore, food retailers indicate that the amount of branded beef offerings has been increasing in recent years (National Meat Case Study, 2007). In this new marketing environment, we argue that increased market knowledge, combined with appropriate firm capabilities, is gaining importance in determining a firm's competitive advantage and thus performance.

## **The Current U.S. Beef Industry**

The U.S. beef industry has historically been characterized as a homogenous and highly fragmented commodity based business composed of numerous buyers and sellers interacting in autonomous spot markets. Within this commodity market structure, pooled equilibrium prices are determined by a broad set of public grades and standards based upon subjective measures of perceived quality and product attributes. As a market information mechanism, pooled lot pricing systems are a highly ineffective mechanism for signaling changes in consumer demand for specific product and service attributes and passing this information back through the channel to producers. This inefficiency in information transfer has been identified as a key driver of the fall in beef demand over the past few decades (Purcell, 2002). Another possible reason for the inefficient transmission of information through the pricing mechanism is the lack of control over price received in terms of the commodity producer's profit equation.

$$(1) \quad \pi = pq - cq$$

Within this equation firm profit is found by subtracting variable costs from revenue where  $p$  is the price received by the producer and  $c$  is the per unit cost of production, and  $q$  is quantity produced. As commodity producers generally perceive prices received as given or something over which they have little control, their strict reliance on improving efficiency as a means to increase profitability at first glance seems warranted.

The strategy literature however identifies two methods that lead to a sustainable competitive advantage; cost leadership and product differentiation (Grant, 2002). By achieving a cost advantage over the competition, firms with lower costs of production are able to earn profits (or reduce losses) even at low market prices. However, this strategy may not bear fruit for many in the beef industry given that fewer than 10% of producers have the necessary cattle numbers to achieve economies of size (Langemeier, McGrann and Parker, 1990; USDA, NASS).

Conversely, product differentiation, where premium prices are earned through distinguishing characteristics of the product offering, may provide small beef producers an opportunity to create sustainable competitive advantage. In that vein, several studies have recently shown that by providing additional value to downstream channel participants can increase the price beef producers receive. Lalman and Smith (2001) found Oklahoma cattlemen earned a price premium for preconditioned cattle when compared to an average price for calves in the area. Similarly, a Montana study found prices for 600-pound calves to be over \$12.00/head higher when the calves were enrolled in an approved age- or source-verified program while premiums for vaccination programs were over \$14.00/head (Vanek et al., 2007).

In addition to the premiums received, participation in such programs may also allow producers access to carcass data following processing. This data could aid in on-farm decision making as it relates to culling decisions and genetic selection, albeit ex post. In the absence of this level of production data, culling and genetic selection decisions are largely based on efficiency measures, whereas it is also important to consider how these decisions impact product quality.

Over the past two decades, as beef demand fell and market share was lost to poultry and pork producers, many beef producers began establishing various forms of integrated marketing alliances to produce specific product offerings to meet consumer demand for certain attributes, such as all natural, organic, or grass-fed beef alternatives. Alliance participation provided producers the benefit of higher prices along with the assurance of a marketing channel through which they could market their value-added cattle. It also often produced a positive externality of access to more fine-grained market and channel information from various stakeholders.

In segmented markets and their aligned marketing channels, the majority of the information is gathered by the channel captain who owns the architectural knowledge. This firm or individual then shares or directs the other component participants with respect to input and output requirements, such as genetic selection or production practices to be followed (Gow, Oliver and Gow, 2002; 2003). This firm-level market orientation is important as it allows for a more efficient

method of information transfer of consumer attribute requirements to producers for use in the production of value-added products.

Given the above examples, we argue that it is important that producers adopt a suitable market orientation irrespective of whether they market through either a commodity or value-added marketing channel. Through increased market awareness, highly market oriented producers can internalize market information, make appropriate strategic and operation adjustments to earn higher prices by providing customers (both immediate and terminal) the specific product attributes they demand.

## **Conceptual Model and Theoretical Foundations**

Recent contributions to the market orientation literature have highlighted the importance of organizational learning in the development of a firm's market orientation (Farrell and Oczkowski, 2002). A commitment to learning is important as superior market knowledge, if continually generated, enables the firm to quickly react to changes in the market (Leonard-Barton, 1992). If higher prices and sustainable excess rents are to be earned for products and services that provide consumers with their desired attributes, it is important that firms learn which attributes provide the most value, and if and how the required attributes may change over time.

An important consideration when establishing a culture which fosters organizational learning is that firms must prevent turning core competencies, in this case market learning, into core rigidities by not focusing on continuous learning using a variety of sources (Leonard-Barton, 1992). Failure to continuously learn results in market embeddedness which is similar to Hamel and Prahalad's (1991) 'tyranny of the served market,' where a firm's narrow focus on current customers can limit the ability to identify changes in the market as a whole.

The establishment and integration of appropriate learning processes within beef firms and marketing channels should lead to better knowledge about consumer attribute demand and increased ability to improve product offerings through new product, process or service introductions or other innovations. These organizational solutions are based off of a knowledge culture which sees both the internal as well as external vantage points of the profit equation. In the beef industry, grass-fed, fully-traceable, or other desired product attributes could be introduced in markets where there is unmet expressed demand or unfulfilled latent demand.

Using a survey of business executives of both large and small firms, Baker and Sinkula (1999a) found that a learning orientation influenced both innovation and firm performance. In a similar study, Baker and Sinkula (1999b) found support for



the direct affects of market orientation and learning on performance, but no significant affect for the mediating relationship of learning on market orientation.

In the beef industry, we feel market sensing capabilities developed and enhanced through market learning will increase a firm's market orientation as well as the firm's ability to innovate and respond to changing consumer demands. A learning orientation could also affect the internal efficiency, or cost focus of the firm. Being efficient is a superior quality in many industries, but is of great importance for firms who participate in commodity markets. In this case, firms participating in a commodity marketing channel could increase their efficiency through their learning orientation.

*Hypothesis 1: A firm's learning orientation will positively affect their market orientation.*

*Hypothesis 2: A firm's learning orientation will positively affect their ability to innovate.*

*Hypothesis 3: A firm's learning orientation will positively affect their cost focus.*

Changing the operating procedures of a firm not only brings the opportunity for improvement, but it also brings risk as some changes may not be successful. Provided the modification is based on accurate market knowledge, however, the change could dramatically improve the returns of the firm. Consideration of the business environment in which the firm operates is also important. In a rapidly changing market, an entrepreneurial move that is unsuccessful could lead to negative returns and the unwillingness to change in the future. Careful consideration of the current capabilities of the firm and proposed changes can minimize this downside risk.

Using a simulation of the U.S. hog industry, Ross and Westgren (2006) show that positive rents can be earned by entrepreneurial producers. Modeling an agricultural industry, they find producers can earn positive rents through innovative processes such as segregated early weaning and contracting.<sup>2</sup> Similarly, Naman and Slevin (1993) argue innovation and entrepreneurship should be beneficial to firms in ever-changing markets, however they find that many firms instead "fall into a Hold or Harvest strategy" (pg 146). This same phenomenon could be present in the Illinois beef industry as successful firms are embedded in the practices that led to the initial success. However, the strategies that have been

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<sup>2</sup> Ross and Westgren define these rents as Schumpeterian in nature (Schumpeter, 1934), as they are new and/or more efficient sources of supply for the production channel. The efficiency gain is due to more hogs per sow and lower transaction costs, respectively.

successful in the past may not be so in the future. Nadler (1994) describes this as the 'success syndrome' and this unwillingness to change in the face of turbulent environments can hamstring a firm's future success through an increased focus on historical routines which may not be appropriate or valuable in a new market.

Based on the inability to determine the successfulness of an entrepreneurial act ex ante, the direct and indirect effects of entrepreneurship on performance could be positive or negative. If the information on which the strategy change is based is from a trusted and accurate source, one would hypothesize the performance affect would be positive. However, firm performance could also be indirectly affected by the entrepreneurial nature of the manager. In their study of manufacturing firms, Matsuno, Mentzer and Ozsomer (2002) found the entrepreneurial penchant of a firm to have a positive and significant affect on the firm's market orientation, but a negative direct affect on firm performance. They also found that a market orientation has a positive direct affect on firm performance. Thus the entrepreneurship level of the firm can be said to have an indirect affect on performance. Similarly, the entrepreneur could choose to focus internally rather than externally, and as such, the entrepreneurial proclivity of the manager could positively affect the cost focus of the firm.

*Hypothesis 4: The entrepreneurial nature of the firm could have a positive or negative effect on the market orientation of the firm.*

*Hypothesis 5: The entrepreneurial nature of the firm could have a positive or negative effect on the cost focus of a firm.*

*Hypothesis 6: The entrepreneurial nature of the firm will have a positive effect on the innovativeness of the firm.*

A firm which is able to learn from their customers and other sources faster than the competition may have a competitive advantage in the marketplace (Slater and Narver, 1995). With this knowledge, firms can provide augmented products to meet customers current, articulated needs and also search for methods to meet the latent, or unarticulated, needs of future consumers. As a firm learns about consumer's latent needs and translates this knowledge into new products to meet these needs, performance measures should improve as these products earn higher prices and/or sales increase. In either commodity or non-commodity marketing channels, higher beef prices can be earned by providing downstream users product attributes which they value.

While not a traditional agricultural market, Slater and Narver (1994) found a significant relationship between market orientation and performance in their research on several SBU's of a forest product firm, even when accounting for competition. Similar results displaying the performance implications were found in

several business environments including large UK firms (Greenley, 1995), small to medium sized enterprises in the UK food sector (Tregear, 2003), UK manufacturing firms (Liu, 1995) as well as in buyer-supplier relationships (Bigne and Blesa, 2003).

Similarly, Day (1994) discusses how market focused firm can leverage their capabilities related to market sensing, customer linking and channel bonding to generate increased market knowledge resulting in increased profitability. While it may not be obvious, channel linking is also important in commodity industries where ownership changes across segments.<sup>3</sup> As such, an upstream firm can focus on meeting the needs of the end-user or simply the next segment of the marketing channel. In the U.S. beef industry, a historical lack of communication between segments limited customer linking capabilities; therefore guidelines for increasing communication were outlined in the 2005 National Beef Quality Audit (NBQA), (NCBA, 2007). While traditional adversarial relationships between segments have diminished the communication needed to improve the product offering, customer linking and the ability to coordinate production with other channel member requirements may help the industry as a whole to meet consumer needs.

The ability to quickly sense market changes and react to them allows market oriented firms' greater flexibility when environmental crises occur. Food safety issues beginning with the initial occurrence of BSE in the U.S. in 2003 along with more recent food scares in other products point to an increased need to develop standards to ensure food safety from a consumer point of view, and to ensure market access from a producer perspective. A market orientation may help in determining how to implement these standards while also maintaining strategic flexibility. In their study of Thai firms during the recent Asian economic crisis, Grewal and Tansuhaj (2001) found strategic flexibility to be of greater importance than market orientation during times of crisis in highly competitive markets, but also suggest that market orientation and flexibility be concurrently developed.

*Hypothesis 7: A market orientation will positively affect the innovativeness of a firm.*

*Hypothesis 8: A market orientation will positively affect firm performance.*

Nelson and Winter (1982) define innovations as simply changes in routines. Innovation can also be thought of as the implementation of new ideas generated through an increased market orientation, greater entrepreneurial capacity, learning capacity and cost focus. Market oriented firms are thought to gather information

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<sup>3</sup> Schroeder and Kovanda (2003) illustrate the production/marketing channel to consist of Seed Stock producers, Cow/Calf producers, Backgrounders, Feedlots, Packers, Retailer/Wholesaler, and finally the end-user. Some producers and alliances choose to operate in more than one segment of this marketing channel.

concerning consumer's current and future needs, but what happens following the gathering and dissemination of this information? Provided a firm has the capacity to innovate, it is likely this market information is transformed into product innovations targeted at meeting consumer needs. These innovations do not need to be frame-breaking, however. Increased communication with downstream partners would be considered an innovation if communication is not typical of the business relationship. While increased communication would begin to achieve a goal of the 2005 NBQA, it could also benefit producers by providing more information to use in decision making at the farm-level.

In our study we conceptualize innovation as the willingness to use new ideas to improve the cattle operation, but leave what exactly that new idea is to the respondent. In this instance, the innovation could be a means of improving efficiency through a technological innovation or by improving the product offering through an externally focused innovation. In their study of a sector of the U.S. government, Hurley and Hult (1998) found innovation to be an important driver of performance. Similar results were found in studies using large Japanese firms, (Deshpande, Farley, and Webster, 1993) U.S. banks, (Han, Kim, and Srivastava, 1998) and New Zealand firms, (Darroch and McNaughton, 2003). In all cases market knowledge was the primary driver of the innovation. Increased market knowledge allows firms to modify routines in a way that provides the consumer with the attributes which they desire.

*Hypothesis 9: The level of innovation of the firm will improve firm performance.*

A market orientation is an inherently external view of the current environment in which the manager and firm operates. Market information is gathered and processed and is used to modify routines, production or marketing practices in order to improve the product offering and, hopefully, earn a price premium for doing so. However, it is still important to maintain a balance between the external and internal focus of the firm. Ignoring efficient production practices in favor of gathering consumer and competitor information is not the answer either. In fact, once an innovation has caught on in the marketplace, the entrepreneurial rent from the innovation is likely to have already disappeared as increased competition has removed the premium price. Therefore, we also model the manager's cost focus as a determinant of firm profitability.

Ritchie (2003) argued increased efficiency is a necessary condition for high net income within the beef industry. Obviously a high gross income is also important and this could be earned by increasing output or prices received. Higher prices could be earned by producing products with desired attributes, but being able to efficiently provide an augmented product may be more important in the long-run. In some sectors of the beef industry efficiency may be more important than a

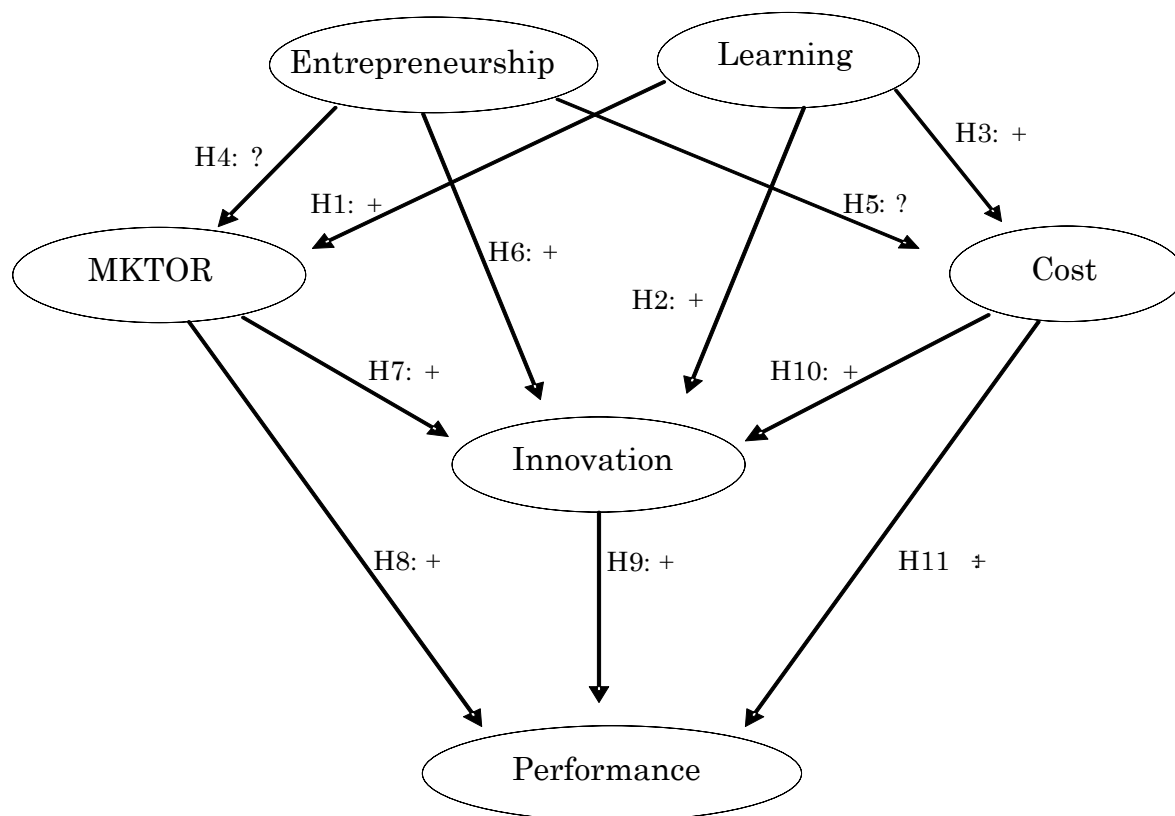
market orientation in the short-run, provided the market is stable and not undergoing rapid change. A producer operating in the commodity beef sector may still feel increasing efficiency is their only method of improving performance. Support for this mind-set is given in Narver and Slater's (1990) study of the commodity SBUs of the forest product firm they studied in their seminal article. They found performance to have a U-shaped relationship to the level of market orientation in the commodity SBUs; that is, on average an SBU with a low level of market orientation outperformed those with a medium level of market orientation.

*Hypothesis 10: The cost focus of the firm will positively affect firm innovativeness.*

*Hypothesis 11: The cost focus of a firm will contribute to higher firm performance.*

## Data and Survey design

To test the propositions developed in the previous section, survey questions and marketing scales were obtained from previous studies. The phrasing of the individual scales was modified slightly in order to accurately measure the same



**Figure 1:** The Conceptual Model with Hypothesized Relationships.

construct in an agricultural setting. To check face validity, questions were examined by University of Illinois extension specialists to determine question clarity and scale relevance. Following modifications, a small sample of Farm Business Farm Management Association (FBFM) farm cooperators were mailed surveys and were asked to read through the questions and provide comments. Following pilot testing of the survey instrument, changes were made to the survey to improve the readability while also hoping to increase the response rate relative to a less user-friendly survey.

The sample population was taken from a mailing list was obtained from the Illinois Beef Association containing names and addresses of 1569 beef producers in the state. An initial wave of the survey was mailed out to half of the survey population in June with a reminder card following 2 weeks later. Four weeks after the initial mailing, a second survey was sent to non-respondents. This resulted in an initial sample size of 170. In the fall, the survey was sent to the second half of the mailing list in an attempt to increase the sample size. In total, 347 usable surveys were returned resulting in a 22.1% response rate.<sup>4</sup>

Respondents were asked to provide answers to survey questions using a 6-point Likert scale. A neutral choice was omitted in order to force respondents to either agree or disagree with the statement in question. Previous studies have shown 6-point scales to be of similar quality to 5-point and 7-point scales (Preston and Colman, 2000). As late respondents have been shown to be similar to non-respondents, the sample was tested for differences as outlined in Armstrong and Overton (1977). No significant differences were found between early and late respondents.

### *Construct Development*

#### **Independent Variables**

We used the scale first developed by Narver and Slater (1990) to measure the market orientation of Illinois beef producers. In this scale, a firm's market orientation is comprised of their customer and competitor focus as well as the coordination of market knowledge within the firm. As with all the measures we used, we modified the verbiage to fit with production agriculture and pre-tested the scales with extension personnel so construct meaning was not lost in translation. We also chose to model market orientation as a higher-order factor, meaning the indicators were influenced by a latent variable, (Customer Focus, Competitor Focus, and Coordination) which was influenced by the firm's overall market orientation.

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<sup>4</sup> In surveys where only a few responses were missing, responses were imputed through a regression procedure in SPSS. This method attenuated the loss of sample size that would occur had listwise deletion been employed.

To measure organizational learning, questions from Farrell and Oczkowski (2002) were used (See Appendix). These items sought to measure the 'learning culture' of the farm business. The entrepreneurial tendency was measured with scales used in Matsuno, Mentzer and Oszmer (2002). The indicators measured the inclination of managers to use innovative marketing strategies to improve performance or whether they chose to 'play it safe' when it comes to forming solutions to management problems. Innovation was measured using a scale tested by Hurley and Hult (1998). Similar to the entrepreneurship scale, the innovation scale measured the penchant for managers to utilize innovative strategies to solve problems on the farm. The final independent variable measures the cost focus of the firm. This was operationalized by using a combination of scales developed by Homburg, Workman and Krohmer (1999) and Kotha and Valdamani (1995). The scale measured the manager's focus on production efficiency and cost reduction as a means of improving performance.

### **Dependent Variable**

The independent latent variables were used to measure subjective performance on beef farms in Illinois. Seven subjective performance indicators were included in this study to measure both the producers' satisfaction with individual and comparative performance. Respondents were asked, using a 6-point Likert scale, to rate their satisfaction with their return on assets, cash flow, production and marketing investments, and overall performance. To assess comparative performance, respondents were asked to rate the overall performance of the farm business, as well as prices received, relative to their competitors. Subjective performance was used as our sample consisted of small, privately held businesses which are generally unwilling to share confidential financial data, even in an anonymous setting. While objective measures of performance would be preferred, Dess and Robinson (1984) showed a strong correlation between subjective and objective measures of performance. Single informants were used in this study, so some bias may be introduced due to 'halo effects,' which occur when indicators measuring dependent constructs are biased by the independent variables. However, this bias could not be eliminated as these firms are generally one-farmer operations.

### *Construct Reliability*

The latent constructs and indicator variables used in this analysis were all taken from previous studies which reported scale reliability measures as well as survey questions. As these scale measures and indicators were all previously tested, a confirmatory factor analysis was conducted to test for consistency with previous studies. Following factor analysis testing for internal consistency, individual items were deleted if they were found to not have significant loadings on the core factor.

As outlined in Worthington and Whittaker (2006), items that did not have factor loadings greater than 0.32 were removed. Item-to-total correlations less than 0.2 were removed in accordance to Streiner and Norman (1995) as they are likely to be measuring a different construct from the other items in the scale. The purified measurement scales along with their means, standard deviations, item-to-total correlations, factor loadings, extracted variances, and coefficient alphas are shown in Table 1. Cronbach alphas are all shown to be greater than 0.70 in accordance with previous research (Nunnally, 1978; Nunnally and Bernstein 1994). Variance

**Table 1:** Reliability Analysis of the Measurement Scales

Scale	Items	Mean	Std Dev	Corrected Item-to- Total Correlation	Factor Loadings	Variance Extracted	Alpha
Customer Focus	Cust1	3.93	1.168	0.647	0.844	0.5950	0.762
	Cust2	3.77	1.102	0.624	0.826		
	Cust4	3.91	1.238	0.381	0.576		
	Cust5	3.73	1.267	0.616	0.809		
Coordination	Coord1	3.38	1.418	0.523	0.730	0.5858	0.757
	Coord2	3.94	1.304	0.524	0.733		
	Coord3	3.87	1.216	0.619	0.814		
	Coord4	4.17	1.184	0.574	0.781		
Competitor Focus	Comp1	3.76	1.378	0.548	0.601	0.5504	0.861
	Comp3	3.74	1.256	0.587	0.669		
	Comp4	4.14	1.240	0.526	0.615		
	Comp5	3.15	1.344	0.670	0.835		
	Comp6	3.00	1.266	0.712	0.807		
	Comp8	3.90	1.250	0.648	0.768		
Learning	Comp9	3.78	1.283	0.725	0.847	0.6308	0.794
	Learn2	4.80	0.904	0.620	0.805		
	Learn3	4.92	0.929	0.703	0.869		
	Learn4	4.91	0.961	0.685	0.851		
	Learn5	4.33	1.045	0.438	0.627		
Entrepreneurship	Ent2R	3.24	1.069	0.500	0.791	0.6144	0.683
	Ent4R	3.21	1.127	0.567	0.836		
	Ent5R	3.71	1.153	0.428	0.720		
Innovation	Innov1	4.52	1.018	0.578	0.803	0.5706	0.740
	Innov2R	4.66	1.173	0.550	0.758		
	Innov3	4.54	0.941	0.595	0.807		
	Innov5R	4.85	1.105	0.430	0.642		
Cost Focus	Cost1	4.98	0.894	0.653	0.847	0.5099	0.726
	Cost2	4.94	0.934	0.581	0.808		
	Cost3R	4.88	1.143	0.389	0.621		
	Cost4	3.98	1.269	0.333	0.516		
	Cost5	4.54	0.989	0.573	0.727		
Performance	Perf2	4.09	1.176	0.689	0.844	0.6975	0.784
	Perf3	4.07	1.104	0.718	0.822		
	Perf4R	3.85	1.353	0.422	0.854		
	Perf5	4.02	1.027	0.620	0.642		
	Perf6	3.73	1.125	0.290	0.943		
	Perf7	3.63	0.996	0.529	0.705		



extracted for each scale is also shown to be above 50% for all latent constructs, which demonstrates the variance due to the scale is larger than the variance due to measurement error (Fornell and Larcker, 1981).

Discriminant validity was also checked to ensure observed variables were measuring only one factor, and thus were not highly correlated with other latent variables. As shown in Table II, diagonal entries (the square root of the extracted variance from each latent variable) are all larger than the off-diagonal entries which show the Pearson correlations between latent variables. As described in Fornell and Larcker (1981), discriminant validity is shown when the square root of variance extracted is greater than any correlation with other latent constructs. The results in Tables 1 and 2 show the measurement model exhibits a high degree of convergent and discriminant validity.

**Table 2: Discriminant Validity<sup>a</sup>**

	Customer Focus	Coordination	Competitor Focus	Learning	Entrepreneurship	Innovation	Cost Focus	Performance
Customer Focus	0.77							
Coordination	.540**	0.77						
Competitor Focus	.542**	.615**	0.74					
Learning	.260**	.336**	.235**	0.79				
Entrepreneurship	.167**	.206**	.139**	.191**	0.78			
Innovation	.278**	.317**	.200**	.483**	.326**	0.76		
Cost Focus	.262**	.345**	.281**	.460**	.132*	.498**	0.71	
Performance	.230**	.228**	.205**	.238**	.182**	.253**	.180**	0.84

<sup>a</sup> Items along the diagonal are the square root of the extracted variance for each latent variable. Off-diagonal entries display correlations.

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

## Results and Discussion

Using the purified scales as variables in the path diagram (Figure 1), we tested the relationships using a structural equation model (SEM) with maximum likelihood estimation. However, when using Likert scale measures, non-normality is often an issue. This poses a problem as multivariate normality is assumed when using SEM procedures. Upon testing for multivariate normality, it was discovered the data failed to meet this assumption, so bootstrapping procedures were employed to provide unbiased estimates. Structural variables were also included in the path diagram to control for firm size (in terms of both acres and herd size), manager experience, and manager education. The number of magazines the manager receives was also included as an explanatory variable on market orientation.

Following an initial test of the model, several control variables were found to not be significant, so they were removed from the final analysis.<sup>5</sup> Specifically, firm size was not found to have any impact on performance. This is an intriguing result, but is not all that amazing. The firms in this study were all relatively small, with a few exceptions, but well within the averages of cattle farms nationwide. According to the 2002 U.S. Census of Agriculture, over 90% of beef farms have herd sizes under 100 cows and calves while accounting for about 50% of beef production (USDA, NASS). This would not seem to allow for economies of size, and our results appear to corroborate this fact. The education of the manager was also found to be not significant, and was also removed from the final analysis.

The results of the SEM and fit statistics are shown in Table 3. The findings generally seem to show the data corroborates the specified hypothesis. Several fit

**Table 3: Results from Path Diagram**

Latent Construct		Influence	Hypothesis	Hypothesis Supported	Estimates	Standardized Estimates	Standard Error	Bootstrap Standard Error	P
MKTOR	<-----	Magazines			0.030**	0.140	0.012	0.013	0.01
MKTOR	<-----	Learning	H1	Yes	0.368***	0.360	0.075	0.081	< .001
Innovation	<-----	Learning	H2	Yes	0.404***	0.381	0.076	0.072	< .001
CostFocus	<-----	Learning	H3	Yes	0.527***	0.453	0.075	0.076	< .001
MKTOR	<-----	Entrepreneurship	H4		0.104**	0.135	0.051	0.050	0.041
Cost Focus	<-----	Entrepreneurship	H5		-0.045	-0.052	0.054	0.059	0.398
Innovation	<-----	Entrepreneurship	H6	Yes	0.195***	0.244	0.047	0.046	< .001
Innovation	<-----	MKTOR	H7	Yes	0.147**	0.142	0.060	0.073	0.015
Overall Performance	<-----	MKTOR	H8	Yes	0.181*	0.128	0.095	0.110	0.056
Overall Performance	<-----	Innovation	H9	Yes	0.224**	0.165	0.102	0.112	0.028
Innovation	<-----	Cost Focus	H10	Yes	0.255***	0.279	0.058	0.066	< .001
Overall Performance	<-----	Cost Focus	H11	No	0.028	0.022	0.087	0.091	0.747
Overall Performance	<-----	Experience			0.005**	0.335	0.002	0.003	0.006
Fit Statistics	$\chi^2$	d.f	$\chi^2$ /d.f.	IFI	TLI	CFI	RMSEA	RMSEA confidence interval	
	1410.335	754	1.87	0.885	0.874	0.884	0.05	.046-.054	

a \*\*\*, \*\*, \* displays significance at the 0.01, 0.05, and 0.10 level, respectively

<sup>5</sup> Specifically, parameters were removed using a Wald-test. When comparing non-nested models, the AIC is a statistic which can determine better fitting models. The model AIC with all control variables was 1807.754, and AIC declined to 1573.202 following respecification, thus a better fitting model.

statistics are reported and they seem to point to a reasonable model fit.<sup>6</sup> The RMSEA and  $\chi^2/df$  demonstrate a good fitting model. However, the other fit measures are not quite to the typical thresholds, thus, these results should be interpreted with some caution. When interpreting the path coefficients, a one unit change in the independent latent variable would elicit a change equal to the path coefficient in the dependent latent variable.

H1-H3 examined the relationship between learning and other latent constructs. The data show building a learning culture is important if one wishes to develop a market orientation or find innovative methods to solve management problems (H1;  $\gamma = 0.368$ , H2;  $\gamma = 0.404$ , respectively). A culture of learning was also shown to have a positive influence on the cost focus of a firm (H3;  $\gamma = 0.527$ ), thus all hypothesis were supported. The question of what these results mean also has to be determined. In an SEM framework, the coefficient  $\gamma = 0.368$  for H1 can be interpreted as the marginal change in the producer's market orientation given a one-unit change in the learning orientation of the firm. Other coefficients can be interpreted similarly.

The importance of entrepreneurship on a firm's market orientation, its innovativeness and its cost focus was examined through H4, H5 and H6. In contrast to organizational learning, the data show no statistically significant influence of entrepreneurship on a cost focus, but indicated a statistically significant influence on the level of market orientation (H4;  $\gamma = 0.104$ ) and innovativeness (H6;  $\gamma = 0.195$ ) of firms. The data also showed firm innovativeness to be an important determinant of firm performance (H9;  $\gamma = 0.224$ ). Through innovation, learning and entrepreneurship have an indirect effect on firm performance.<sup>7</sup> The effect is indirect as the ability to learn or be entrepreneurial is meaningless without the innovations to solve the production or marketing problems managers face.

The cost focus of the firm was found to be influential of the firm's innovativeness (H10;  $\gamma = 0.255$ ), allowing for an indirect affect on firm performance, but a direct effect was not supported by the data. The data also showed the degree of market

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<sup>6</sup>  $\chi^2/DF$  is the value of the  $\chi^2$  statistic divided by the degrees of freedom of the model. Values less than 5 indicate adequate fit. IFI is the incremental fit index is a measure of fit similar to the normed fit index (NFI) however IFI was developed by Bollen to address issues of sample size and parsimony. Values again range from 0 to 1 with values close to 1 indicating good fit. TLI is the Tucker-Lewis Index and is similar to the IFI in that it corrects for model size and complexity. Values range from 0 to 1 with values above 0.90 indicating good fit. CFI is the comparative fit index and is another alternative to the NFI for studies with small samples. Values range from 0 to 1 with values over 0.90 indicating good fit. RMSEA is the root mean squared error of approximation and is a parsimony-adjusted index that corrects for model complexity. Values less than 0.05 indicate good fit and values less than 0.10 indicate mediocre fit. (Byrne, 2001)

<sup>7</sup> Indirect effects can be measured by multiplying path coefficients together. For instance, the indirect effect of learning on performance is  $0.404 \times 0.224 = 0.09$ . Other indirect effects can be interpreted similarly.

orientation to have a significant influence on subjective performance, both directly (H8;  $\gamma = 0.181$ ) and indirectly through innovation (H7;  $\gamma = 0.147$ ).

The question of whether it is more important to be externally focused or internally focused was also answered in this study. The results show that, even in a commodity marketplace, a balance of both external and internal mindsets seems warranted. Firm innovation was also revealed an important determinant of firm performance in our study. Acting as the conduit through with market orientation, organizational learning, entrepreneurship and a cost focus flow, innovation was found to have a significant effect on firm performance. These results indicate that to achieve superior performance, beef producers should strive to achieve a balance between market orientation and cost focus (external and internal focus). This allows for an entrepreneurial mindset and culture of organizational learning which leads to both external market innovations and internal cost efficiency innovations. Producing in this manner allows firms to determine the needs of the market and find efficient methods of supplying those needed attributes rather than efficiently producing a non-differentiated product and selling it at competitive prices in anonymous spot markets.

Furthermore, this model, while one of many that could be supported by the data, seems to indicate a need to reassess the cost of across-the-board independence between production sectors in the beef industry as well as the benefits from seeing the product through the eyes of the consumer. Production decisions made independent of consumer demands are likely to have resulted in unmet opportunities to provide consumers value and extract additional consumer surplus out of the marketplace. Simple strategies such as increasing communication with channel members would likely lead to improved relationships with downstream partners, as well as being the first step in working towards meeting one of the new challenges of the 2005 NBQA; increasing communication between sectors (NCBA, 2007). By making production and marketing decisions based on consumer and channel needs, market oriented producers could possibly realize a greater proportion of the value of their production with minimal additional investment.

Notwithstanding our interesting results, a few limitations need to be addressed. The main limitation of our research pertains to the nature of our sample. While this study is one of the first to empirically examine the MO-performance relationship in the beef industry, caution is needed in generalizing the results. Our findings suggest a market orientation is an important driver of firm performance, which is consistent with other published studies examining the MO-performance relationship. However, would these results hold in other areas of the country? In 2007, Illinois ranked 18<sup>th</sup> in terms of number of beef farms (USDA, NASS), with 19,700 farms, but 38<sup>th</sup> in terms beef farms as a percentage of total farms (27%). Texas, on the other hand, has 149,000 beef farms according to the USDA, accounting for 65% of the total farms in the state. One could assume that if a

market orientation was important in a state where beef is not the most important agricultural industry, it should also be important in states with a larger percentage of beef operations. Future research could focus on a state or region where beef production is a more important part of the agriculture industry.

Second, this type of research would benefit from both objective and subjective performance data to remove the single informant bias typical of studies such as this. Given many states have programs where objective financial datasets are a result of cooperative extension, it would be beneficial to use these cooperators as a sample for further research. However, in this case we may be trading single informant bias for increased self-selection bias as cooperators self-select into these programs and pay a fee for the service provided. Provided it is feasible, a longitudinal study would also be valuable to further determine changes in market orientation over time and how these changes impact firm profits and other performance measures.

## **Theoretical Contributions and Implications**

The purpose of this study was to examine the performance implications of a market orientation in an agricultural commodity industry. Overall, our findings are consistent with other studies which show a market orientation to be a positive influence on firm performance. However, the main contribution this research makes to the literature is it demonstrates the MO-performance relationship holds, even in commodity markets. Typically in a commodity value chain the goal is to be the low-cost producer, as this is perceived as the only means of increasing profitability. Using a dataset consisting of cow-calf producers and feedlot operators, we were able to find evidence which supports the hypothesis that a market orientation may also have performance implications in the beef industry.

Taken together, the results lead to an important discussion: Is a market orientation more important than a cost focus? The answer may be that neither is *more important* than the other, but a sense of balance between an internal and external focus is warranted. This is an important contribution, as many analysts and producers alike argue that there is only limited to no excess returns available to investing in a market orientation. Our results indicate that there are superior returns to be gained in a balanced approach. However, it must be noted that we cannot determine and measure the exact impact of investments due to the use of subjective performance measures. Examining the indirect effects of a cost focus and a market orientation through performance would point to a balanced approach (H7 and H10). The standardized effects point to a cost focus to be almost twice as important as a market orientation on innovation. However, a market orientation was found to have a positive direct effect on performance, while a cost focus was not found to have a significant direct effect. This result stems from the firm's ability, through a market orientation, to differentiate their product offering to meet the

needs of consumers while a cost focus only allows producers to acquire already developed technology, which is available to all competitors, to increase efficiency. For too long, producers operated under the impression that they could do little to influence the prices they received, and recent evidence points to the contrary, even in a commodity market (Lalman and Smith, 2001). Furthermore, the growth of production and marketing alliances would point to the gains to be made through differentiation in the marketplace.

Some managerial implications from this research may be a greater focus on communication with both up- and down-stream channel partners. This communication would foster relationship building that would lead to increased trust in what have historically been adversarial relationships. With increased communication, open innovation may begin to occur within the channel as partners can share information while creating 'win-win' situations between segments of the industry. This information could lead to improved production decisions for the upstream producers as well as an improved product to provide value to downstream processors and end-users. As shown in the importance of organizational learning and market orientation, improved quality and quantity of market information could aid in decision making could lead to improved performance measures at the farm level. Further research could begin to quantify the performance gain from a market orientation, and whether the performance implications are consistent across geographic regions and countries.

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## Appendix – Questionnaire Items<sup>8</sup>

1=Strongly Disagree, 2= Disagree, 3= Somewhat Disagree, 4=Somewhat Agree, 5=Agree, 6=Strongly Agree

### Customer Focus (based on Narver, Slater, and MacLachlan, 2004)

We continuously try to discover additional customer needs which they are not aware of yet.

We incorporate solutions to unstated customer needs in our new products and services.

We rarely brainstorm on how our products and services benefit our customers.\*

We innovate even at the risk of making our previous farming practices obsolete.

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<sup>8</sup> Items marked with a \* were reverse coded when conducting the analysis.

We work closely with lead customers and try to recognize their needs months or even years before the majority of the market may notice them.

**Competitor Focus (based on Narver and Slater, 1990; Porter 1980)**

Employees on our farm share information concerning competitor's activities.

We respond slowly to competitive actions which threaten our survival.\*

We regularly discuss competitor's strengths and weaknesses.

We target customers where we have an opportunity for competitive advantage.

Members of our farm collect information concerning competitor's activities.

We diagnose competitor's goals.

We seldom track the performance of key competitors.\*

We identify the areas where our key competitors have succeeded or failed.

We evaluate the strengths and weaknesses of key competitors.

**Coordination (based on Narver and Slater, 1990)**

We regularly visit our current and prospective customers.

We freely discuss our successful and unsuccessful customer experiences with our partners.

All of our business units (marketing, production, research, finance/accounting) are integrated in serving the needs of our target markets.

People on our farm understand how everyone can contribute to creating customer value.

We rarely share resources with other members of our marketing channel.\*

**Internal Operations/Cost Orientation (based on Homburg Workman, and Krohmer, 1999; Kotha and Vadlamani, 1995)**

Improving the operating efficiency of the business is a top priority.

We have a continuing overriding concern for operating cost reduction.

We hardly ever seek to improve production processes so that we can lower costs.\*

Achievement of economies of scale or scope is an important element of our strategy.

We closely monitor the effectiveness of key production processes.

**Innovation (based on Hurley and Hult, 1998)**

Technical innovation based on research results is readily accepted.

We seldom seek innovative ideas which we can use in our cattle operation.\*

Innovation is readily accepted on our beef operation.

Individuals on our farm are penalized for new ideas that don't work.\*

Innovation in our farm is perceived as too risky and is resisted.\*

**Learning (based on Farrell and Oczkowski, 2002)**

We do not see our ability to learn faster than our competition is the key to our competitive advantage.\*

The basic values of this farm include learning as key to improvement.

Our take is that learning is an investment, not an expense.

Learning on my farm is seen as a key commodity necessary to guarantee survival.  
We are not afraid to challenge assumptions we have made about our customers.  
There is total agreement on our organizational vision on our farm.  
All employees are committed to the goals of this farm.  
Employees view themselves as partners in charting the directions of the farm.  
We rarely question our own biases about the way we interpret customer information.\*  
Personnel on this farm realize that the very way they perceive the marketplace must be continually questioned and adapted.  
Firms in my marketing channel do not have the same goals as we do.\*

**Entrepreneurial Proclivity (based on Matsuno, Mentzner, and Ozsomer 2002)**

When it comes to problem solving, we value creative new solutions more than the solutions of conventional wisdom.  
On our farm, we like to implement plans only if we are very certain they will work.\*  
We value risk-reducing management processes much more highly than innovative methods for profit seeking.  
On this farm, we like to 'play it safe.'\*  
On our farm, we tend to talk more about problems rather than opportunities.\*  
We firmly believe that a change in the market creates a positive opportunity for us.  
On this farm, we encourage the development of innovative marketing strategies, knowing well that some will fail.

**Overall Firm Performance (based on Jaworski and Kohli, 1993)**

The return on farm assets did not meet expectations last year.\*  
We were very satisfied with the overall performance of the farm last year.  
The return on production investments met expectations last year.  
The cash flow situation of the farm was not satisfactory.\*  
The return on marketing investments met expectations last year.  
The prices we receive for our product is higher than that of our competitors.  
The overall performance of the farm last year exceeded that of our major competitors.





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## **Industry-Academic Partnerships The View from the Corner Office**

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### **Abstract**

Industry-academic partnerships are described and discussed from the perspective of industry. Eight types of partnerships are discussed, including internships, mentoring, site visits, faculty-directed research, student research, consulting, in-class visits, and industry advisory boards. The benefits, problems, costs, motivation to participate, and advice for managing industry-academic partnerships are presented.

**Keywords:** industry partnerships, industry collaboration, internship, mentor, field trip, consulting, advisory board

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## Introduction

One of the distinguishing characteristics of most university agribusiness programs is the relationship they have with industry. As an applied discipline, there are many opportunities to interact with industry and many universities have engaged industry managers and executives<sup>1</sup> to enhance their programs and offerings. While agribusiness programs have long fostered relationships with industry, a recent review of food and agribusiness programs concluded that we need to strengthen these linkages if agribusiness programs are to remain relevant (NAMEFC, 2006).

The first paper to broach this subject in a comprehensive manner was written more than a decade ago. Litzenberg and Dunne (1996) wrote about forming partnerships between agribusiness programs and industry. They noted that internships and industry guest speakers were common ways in which agribusiness programs have worked with industry. Furthermore, they indicated that recent innovations in partnering with industry included executives-in-residence, mentorships, collaborative research projects, student-industry research projects, and advisory committees. In the intervening twelve years, many agribusiness programs have formed and matured. As a profession we have accumulated much experience in developing academic-industry partnerships. Many of the programs described by Litzenberg and Dunne (1996) as innovative are now mature and we have years of experience in managing, refining and evaluating them.

In a recent article, Baker et al. (2008) described the various means by which faculty members can partner with industry to conduct research, broaden the experience of their students, and provide opportunities to faculty members and their departments. Like many academic papers addressing academic programs, the perspective of this recent article is that of the faculty member. However, in the case of industry-academic partnerships the view from the corner office is significant and, we might add, quite different from that of the ivory tower. It is our belief that a thorough understanding of the benefits and costs of industry-academic partnerships *for industry managers* will make it easier for managers to undertake and manage partnerships with universities. For this reason, we adopt the perspective of the industry manager in this paper. Additionally, by understanding the industry experience, academic partners will find it easier to recruit and manage these partnerships themselves.

The primary objective of this paper is to explore industry-academic partnerships from the industry perspective. To this end we discuss the benefits, problems, and costs of several types of industry-academic partnerships as well as successful management practices utilized by industry managers and executives who have

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<sup>1</sup> In the remainder of the paper, we use the term managers to include both managers and executives in order to avoid needless repetition of the term managers and executives.

participated in such partnerships. Finally, we develop a set of guidelines for managing each of the various types of partnerships.

This paper will be of interest to both industry managers and academics alike. Industry managers will learn what each type of partnership entails, how they and their companies can benefit, what the costs are, and how they can effectively manage the partnership. Conversely, faculty members will have a better understanding of what it means for an industry manager to embark on a partnership with an academic program. Understanding the industry viewpoint should help faculty members in developing and managing industry-academic partnerships and in recruiting industry partners who may be reluctant to participate.

We conducted research on eight types of industry-academic partnerships: internships, student mentoring, site visits, faculty-directed research, student research, consulting, in-class visits, and industry advisory boards. We did not include executives-in-residence in this research because we did not believe that agribusiness programs have sufficient experience with this type of partnering so that it could be adequately addressed. The primary source of information for this paper was a survey of industry managers, which the authors of this paper sent to their contacts in industry. The survey was administered via the World Wide Web through SurveyMonkey (SurveyMonkey.com). A total of 105 e-mail invitations to participate in the survey were sent out in mid-February. A single reminder to participate in the survey was sent approximately one-week later. A total of sixty-four responses were received for a response rate of 61%. The response rate was very high, although not unexpected, given the relationship between the survey administrators and the respondents.

The following description and discussion of the industry-academic partnerships is based on the results of the survey and the collective experience of the three authors. No claim is made as to the representativeness of the survey. The intent was solely to generate ideas and to more fully understand the industry perspective on managing relationships with university partners. The authors of this paper draw heavily on their many years of teaching, research, and outreach at both public and private universities, as well as their experience in working with and for industry.

## **Student Enrichment Programs**

### *Internships*

Utilizing students as company interns is possibly the most common means of cooperation between industry and academia. Wolf and Qenani-Petrela (2007) point out that integrating internships into the curriculum is increasingly important for agribusiness programs. They note that graduates of undergraduate programs who



have completed an internship “adjust faster on the job, need less on-the-job training and have a more open minded attitude.” They also note that a salary premium is associated with graduates who have completed a foreign internship. Although there is little written about internships at the graduate level, a survey of agribusiness Master’s programs indicated that only a few programs did required the completion of an internship as part of the degree (Boland, and Featherstone, 2007).

Many organizations offer internship programs on an annual or on-going basis. Internships may be conducted as part of a formal internship program coordinated by a school where the intern attends, by the organization employing the intern, or both. Occasionally, students will arrange for an internship on a one-time basis with an organization that has no formal program in their area of interest. The results of our industry survey indicated that internship programs are commonly employed, offer widespread benefits to employers and students alike, and do so at a modest cost to the company offering the internship. Of the sixty-four managers responding to this question, almost half (48 percent) indicated that they had directly participated in offering an internship to a university student.

Our experience with internships is that they generally result in a positive experience for the company, manager, and student. The results of the survey indicated that of the thirty-one managers who had experience with offering internships, thirty reported that the experience was a positive one (eighteen and twelve people reported very positive and somewhat positive experiences, respectively). Only one person reported that the experience was neutral and none of the respondents indicated that they had a negative experience. Furthermore, most managers who had worked with interns had done so multiple times. Fifteen of the respondents had employed interns two to three times and seven people had worked with interns ten or more times.

There are several benefits that accrue to the organization employing interns. First and foremost is the ability to recruit potential employees. Employers hope to get an early look at top students from the organization with which they have a relationship (NAMEFC, 2006). Some companies have established an ongoing internship program with a department, college, or university. The expectation is that the company will be rewarded by getting early access to the best students. If they are happy with their performance, they hope to have the inside track in hiring them upon graduation.

Many managers indicated that an internship program works especially well when the intern is assigned to a special project. Doing so ensures that the intern is assigned to a well-defined project. Such projects are often difficult to accomplish, given the day-to-day responsibilities of full-time employees. Interns are better able to focus on a special project that is their primary responsibility.

Another commonly mentioned benefit is that interns are able to provide a fresh perspective to business problems. They provide an outsider's viewpoint and they may be able to bring the latest analytical techniques, which they have learned in the classroom, to bear on a company's problems.

Internships are not without problems for the company and student. However, by far the most common response to the question regarding problems or difficulties encountered with the internship was that there were no problems. Those managers who indicated that they did experience problems indicated that the lack of a work ethic, the amount of the time required to train the intern, and the difficulty in coordinating the student's schedule with the company's needs were the most common difficulties encountered.

There are three major costs to companies hosting an internship, search costs, training and supervision costs, and direct monetary costs. Very few managers mentioned the time involved in identifying potential interns, reviewing applications, and interviewing candidates. Having a relationship with a university can significantly reduce the search costs because having a university partner who knows the company's needs can be of great assistance in identifying and screening quality candidates, and, in our experience, many companies rely heavily on their university partners to help manage the initial stages of recruiting an intern.

Interns in the food and agribusiness industry are typically paid an hourly wage or a stipend, as is common practice with most business internships. The great majority of respondents indicated that they paid interns an hourly wage of \$10 to \$15. A few companies paid more, \$16 to \$20 per hour, and very few companies offered unpaid internships.

The last major cost of hosting an internship is the time it takes to train and supervise the intern. Most companies will have an initial training to introduce the intern to the company, its policies, and its culture. This is often followed by training specific to the job the intern will be expected to perform. On an ongoing basis, most managers responding to our survey (60%) indicated that their interns required a few (one to three) hours per week of supervision. Twenty percent of managers indicated that their interns required four to five hours per week of supervision, while another 20% indicated that their interns were directly supervised for more than 5 hours per week.

Many factors motivated managers to offer internships. The most commonly mentioned reasons were an institutional affiliation, recruitment of top employees, generating positive exposure for the company, and the need to get project work done.

An effective internship program, from the perspective of the company host, should aim to provide positive exposure to the company and industry, make efficient use of the company's resources, and ensure that the intern is used productively. To this end, the following guidelines will help ensure a successful internship at a minimum cost of company resources:

- Partner with a university (department, college, or career services office). This will minimize the search costs to identifying and screening potential interns and provide access to the best candidates.
- Plan the intern's duties, training program, and job training in advance (Liztenberg and Dunne, 1996). It is helpful to both the intern and supervisor if the objectives of the internship are clear. In some cases interns have specific duties and perform functions that would otherwise be conducted by full- or part-time employees. In other instances, a major objective of the internship is to expose the intern to many departments within the company although this typically means that the intern does not spend enough time in any one department to become proficient at a job.
- An initial training period, usually lasting one to two days, is usually necessary to provide the necessary background to the intern and to train him or her in any specific job functions.
- Special projects are ideal for interns. They are typically well-defined and often suited to the two or three months that most interns spend at a company. Moreover, an intern may find it easier to complete a special project than a full-time employee who must continue to manage the day-to-day functions of his or her job.

### *Mentoring*

Unlike internship programs, which are widely used in U.S. universities and especially common in agribusiness programs, mentor programs are relatively rare. Moreover, internships are typically conducted as part of a formal program sponsored by the university or company, whereas a mentor relationship is more likely to be developed at the initiative of the student outside of a formal program. In fact, we were only able to identify one formal mentor program, the Santa Clara University program offered by the Food and Agribusiness Institute for MBA students (Baker, 1998). In this section, we draw heavily on our experience with that program and the information provided by students and managers who have participated in the mentoring program.

A mentor program pairs a student with an industry mentor. Although there are no established norms, some key components of a mentor program include matching interested students with industry managers, facilitating initial and ongoing contact between the student and mentor, and having the industry manager mentor the student by providing career advice, an internship, or employment assistance (Baker, 1998).

Twelve out of the fifty-nine managers responding to this question (20 percent) indicated that they had experience mentoring students. All of the respondents reported having a positive experience, with seven managers reporting a very positive experience and five indicating the experience was somewhat positive. Furthermore, most of the managers have served in the capacity of mentor more than once. Four respondents had served as a mentor two to three times, two had served four to six times, and one manager had mentored seven to ten students.

The benefits to participating in a mentor program are not evenly distributed. It was clear that many managers who have mentored students felt that the students received more benefit from the relationship than they did. Why then do managers volunteer to mentor students and, in many cases, continue to do so? Some managers did believe that they, their company, or their industry directly benefited from the relationship. Several managers viewed mentoring as an opportunity to get to know top students and evaluate them as potential employees. Indeed, in several cases the student went on to become an employee of the company. Still other managers felt that it was important to try to help the student gain a positive view of the industry (whether or not they went on to work for the mentor's company). Most of the respondents indicated their motivation to mentor students was a way to "give back" and to help students or the university with which they had a relationship.

Our experience is that most people involved in either a formal or informal mentor arrangement have been satisfied with the results. Issues raised by participants in the survey included lack of time (on the part of the manager), scheduling conflicts, and the lack of initiative on the part of the student. The largest obstacle managers saw to a fulfilling mentor relationship for the student was that they had less time available than they would like to devote to the relationship.

The amount of time mentors devoted to working with their students varied greatly. However, in most cases, the mentors and students had contact ranging from once a month to once a week. The typical meeting lasted for about an hour. There were very few other costs involved in mentoring a student other than the manager's and student's time. Where travel was involved, it was usually the student who traveled to visit the mentor.

Our experience with both formal and informal mentoring arrangements and the comments of several managers who have served as mentors were utilized in developing the following guidelines for managing a mentor program:

- A formal mentor program sponsored by a university can be useful in providing the structure and oversight necessary for all parties to get the most out of the relationship.

- It is critical that there be clarity on the objectives, expectations, and commitment required of the mentor and student. Doing so can help avoid misunderstandings.
- It is especially important that the mentor be realistic about the time required to serve as a mentor and the time he or she can allocate to the student.
- An early contact between the mentor and student is important to get the relationship started.
- Regular meetings should be scheduled, whether it is once a week, month, or quarter.
- Incorporating a company visit or internship as a part of the mentor program will be perceived as an added bonus to the student.

### *Site Visits*

It is common practice in many agribusiness programs to combine classroom instruction with practical experience. Many programs provide opportunities to visit firms in the food and agribusiness industry by arranging structured visits, often referred to as field trips. Such visits may be to a single company or part of a longer trip lasting as short as several hours or as long as a week or more. Most site visits start with an introduction to the company, its products, practices, and other pertinent information. Students usually enjoy observing a company's operations. A tour of the facilities and operations is not only an opportunity for learning but also serves to promote student interest. Throughout the visit, ample time is typically allotted for questions and discussion.

Managers' experiences with site visits were predominately positive. Of the fifty-nine managers responding to this question, twenty-six (44%) indicated that they had experience with hosting site visits to student groups. Fifteen of the twenty-six managers who had hosted site visits indicated that their experience was very positive and ten people indicated that it was somewhat positive. Only one person indicated that the experience was neutral. Another indication that managers enjoyed offering site visits to groups of students is that most managers had hosted site visits multiple times. Eleven of the respondents indicating they had hosted two to three field trips and seven managers indicating that they had hosted ten or more such visits.

The number of managers who reported that they and their firms benefited from site visits was surprising. Although our prior experience has been that most managers are willing to accommodate requests for visits, we believed that they did so out of a sense of commitment or loyalty to the university with which they have some kind of affiliation. However, all of the responding managers, with one exception, indicated that they benefited from hosting field trips. The two most commonly reported benefits were the opportunity to promote their company and industry and the

prospect of meeting potential future employees. Indeed one firm hired a student who had visited the firm on a field trip.

Promoting the company and industry is viewed as especially important to food and agribusiness firms. Many managers viewed site visits as an opportunity to explain what the company does and generate student interest in the company and industry. There is a perception that it is hard to keep the top students working in the food and agribusiness industry and that they may be lured away by higher salaries or more glamorous jobs in other industries. Managers viewed the site visits as a way to showcase the industry and promote industry opportunities directly to students.

A few managers indicated that they hosted site visits for other reasons, including the desire to receive feedback on the company and its business practices, to educate and learn from young, motivated people, and because of their relationship with a university.

Very few problems were noted as a result of hosting field trips. By far, the most common difficulty mentioned by managers was in scheduling a time convenient to both the host and visiting organizations. A few managers indicated that hosting a site visit could be time consuming and a distraction to running the business. Coordinating the visit of a large group of people and ensuring their safety was also mentioned by a few managers.

The cost of hosting a field trip was primarily the time required to meet with the student group. In many cases, the manager's time commitment is only the time spent meeting with students. Of course, this depends on the size of the group. For larger groups, it is often necessary to break into smaller groups and several people lead a tour of the operations and discussion. Most managers who responded to the survey indicated that two to four hours were required to conduct a site visit.

Some managers take field trips very seriously and spend a fair amount of time planning the event and coordinating activities. One manager indicated that to be successful they must spend time with advance planning and that they combine the visit with a project that the students work on in advance in preparation for the visit. The student group visits the company for three full days and on the final day the students present their findings to a group of senior managers.

Most company's out-of-pocket costs were minimal and limited to providing refreshments or promotional materials such as t-shirts or caps. In some cases, companies offered a lunch. These direct costs ranged from zero to less than a hundred dollars in most cases to several hundred dollars when a lunch was provided.

Much of the motivation to host a site visit is related to the previously mentioned benefits of hosting the visits, including the prospect of meeting potential employees and the opportunity to showcase the company and industry. Many managers also indicated that they were motivated by a desire to contribute to students' education and the relationship that they had with a professor or department.

Our experience with coordinating numerous site visits, hosting several visits, and the responses from managers indicate that the following guidelines will help ensure an educational and interesting visit with minimal use of company resources:

- A successful field trip requires advance planning.
- Have one person in charge for both the host and visiting organization.
- A detailed plan for the visit should be developed, including educational objectives, the people involved, topics to be covered, and a detailed agenda that indicates how time will be allocated between a tour, presentations, discussion, and other activities, such as refreshments or lunch.
- Mixing up activities such as a tour and presentations keeps the students engaged.
- Providing background information on the group and their interests will help the host develop an interesting and engaging program.
- Giving formal feedback to the host organization will make future visits more successful.
- Visitors typically enjoy receiving a "souvenir" from the organization, such as a t-shirt, cap, or mug.
- The hosts appreciate receiving a token of appreciation from the visiting group, such as a memento from the university.

## **Research**

### *Faculty-directed Research*

Faculty-directed research in partnership with industry is a natural association. In an applied field such as agribusiness, both partners have much to contribute. Industry partners may provide access to data, monetary support, equipment, and insight into the industry's problems. Faculty members offer the research tools and skills (Litzenberg and Dunne, 1996) to design research projects, collect and analyze the appropriate data, and interpret the results (Knight et al., 2006). Faculty members may also have access to qualified graduate or undergraduate students who can help carry out the research. Together, such partnerships often result in innovative research that addresses significant real-world problems.

Such partnerships may be formal or informal. In some cases, they may be facilitated by centers that receive industry funding to study specific industry issues. Alternatively, faculty members may develop relationships with companies or industry managers and negotiate for access to proprietary data or personnel that

would otherwise be unavailable to them. Another approach to conduct industry research is to work with industry groups that fund research, such as marketing orders<sup>2</sup>, commissions, or trade associations.

An example of a successful industry-academic research partnership is the University of Florida's Center for Food Distribution and Retailing (CFDR). The center takes a multidisciplinary approach that involves faculty members from many departments and conducts research on topics of interest to companies in the food distribution and retailing sector. The center has received strong financial support from industry and generated research findings that have been both publishable and useful to firms in the industry.

The results of our industry survey indicated that faculty-directed research in cooperation with industry was one of the least common types of partnering with industry. Of the fifty-seven managers responding to this question, eight (14 percent) indicated that they had had been involved in joint university-industry research projects. This is consistent with our prior expectation and experience that many faculty members do not look to industry as a partner when conducting research. Although joint industry-academic research does not appear to be a widespread practice, those who have experience with it recognize the benefits and potentially low costs.

Managers responding to our survey indicated that their experience in cooperating with university researchers was almost exclusively positive. Seven of the eight managers indicated that the experience was positive, with three reporting a very positive and four reporting a somewhat positive experience. Only one manager indicated that he or she viewed the partnership as neutral. Many of the managers had multiple experiences in working with faculty members on research projects. Five of the eight managers had cooperated with university researchers on more than one occasion and two of them had been involved with more than ten research projects. This provides further evidence that from the industry perspective, joint industry-academic research projects are viewed positively.

Industry managers identified a variety of benefits from working with university researchers. The most common response was that working with faculty researchers gave the firm access to research and development support. Specifically, respondents felt that access to researchers who could properly design and execute research projects was a major benefit. One manager indicated that working with university researchers gave their company positive exposure. Surprisingly, publication of the results was a benefit mentioned by two of the respondents. One manager indicated that there was positive exposure that resulted from having the company name

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<sup>2</sup> A marketing order is a mechanism for producers to conduct research, promotion, or advertising, among other things.



associated with a published study, while another indicated that publication lent credibility to the findings. Other benefits that were mentioned included, learning from the process, objectivity in collecting the data, and access to university equipment and personnel for future projects.

Although the majority of respondents did not identify any drawbacks, those that did pointed to university overhead charges that made the projects more expensive, the time involved to get results, and the conflict between keeping proprietary information private and the university's need to publish results. When asked to identify costs for these projects, the answers spanned a large range – from no extra cost to over \$100,000. Of course, the cost of the project varies greatly depending on the length and complexity of the project. In many cases the cost of the research would have been incurred irrespective of whether a faculty member was involved in the research.

The motivation to collaborate with university researchers was driven by the perceived benefits. For the most part, managers chose to partner with universities to gain access to the expertise of the university faculty, and state-of-the-art equipment, and because of the credibility associated with participation in a university study. One respondent indicated this was a good way to leverage already-stretched staff time to accomplish more projects.

We developed the following guidelines for conducting faculty-directed research with industry based on our experience working with industry on research projects and recommendations from managers:

- Faculty researchers and company personnel should work together closely to define a project that meets the company's need for research results within the company's budget.
- Which data and results will remain proprietary and which will be published should be agreed upon in advance.
- The contribution of each participant should be respected; faculty members will typically have the greatest expertise in experimental design and analytical techniques, while industry personnel will have a better understanding of what questions are most important to the company.
- The need for results in a timely manner is very important to industry.

### *Student Research*

Students have many opportunities to work with industry on research projects. Such projects range from long-term, in-depth research, such as a Master's or Ph.D. thesis to short-term research, such as class projects. The research may be conducted individually or as part of a group of students and with or without the supervision of a faculty member. While the research project may be initiated by a company manager, it is most often the student or a faculty member who contacts the

company regarding a potential research project. In some cases, some or all of the cost of the research is borne by the company. This is often true when the company has a clear need and the research is undertaken specifically to address this need.

The results of our industry survey indicated that student-centered research was a fairly common practice. Of the fifty-seven managers responding to this question, seventeen (30 percent) indicated that they had had experience with student research projects. Reaction to these arrangements was generally positive, with the great majority of respondents indicating that they had a positive experience (seven managers rated their experience as very positive, while seven indicated it was somewhat positive). However, two managers rated the experience neutral and one manager said they had a somewhat negative experience. Most managers had been involved in relative few student-centered research projects, with all but one reporting they had been involved in three or less such partnerships (the final manager had worked with students on research project four to six times).

Industry managers identified a variety of benefits from working with students on research projects. The two most commonly identified benefits were generating goodwill or “giving back” to the university, and that the research that was conducted was useful to the company. Additionally, some managers found that working with students was a good way to gain exposure for their company with the students, while others believed that they gained a fresh perspective on issues.

Few drawbacks to working with students on research projects were identified, although some managers indicated that the time they committed and the time it took to complete the project were negatives. One respondent reported a negative experience where the students did not perform up to expectations, and another manager felt that they needed a better feedback mechanism at the end. One manager also noted that working with a student on a research project did not allow for the type of in-depth experience with the student that an internship did since the student was focused on school at the time they worked on the project.

The amount of time that managers reported spending on student research projects was generally low. It ranged from one hour to 40 hours over a semester or quarter. Additionally, most managers reported that there was no financial cost associated with the research projects, other than the investment of their time. The few managers who did incur expenses indicated that the cost ranged from hourly labor costs of \$12 to \$15 per hour to several thousand dollars. One manager reported they had worked on multiple student projects, ranging from no expense to funding a Masters’ thesis.

Nearly all managers indicated that their motivation for being involved in student-centered research was to “give back” to the university. This may have been a result of a personal connection with the student as an employee or family friend, or a tie to

a university they attended. Three managers indicated the student was a resource and able to conduct the work that was needed, and two indicated that it helped market the company (or the company's products) to the students.

The following guidelines provide direction for managers and faculty members in managing student research project in collaboration with an industry partner:

- It is important to ensure that there is a good match between the needs of the student or student groups and what the company can provide. Faculty members have a significant role to play in matching students to companies.
- Some initial planning is important to ensure that the student(s) and industry manager have clear expectations on what is expected of each party in terms of access to data, meetings, reporting, and any monetary compensation.
- When students are working on a project for a company it is important to understand the company's need for timely results. Students should be made aware of the commitment required to deliver a quality product in a timely fashion.
- Industry managers should have realistic expectations regarding what they will receive from a student project. The quality of the project will depend on many factors, including the length and depth of the project, the educational level of the students (undergraduate or graduate), and the quality of the students.
- For managers, this is an opportunity to invest time in developing the next generation of leaders.

### *Consulting*

A third type of research partnership between academia and industry is consulting. Faculty members are often sought after by managers to provide their expertise to industry. For faculty members, consulting offers an opportunity to both supplement their faculty salary and gain industry experience (Batista, 2005). Of the fifty-seven managers responding to the questions regarding hiring faculty members as consultants, six managers (11 percent) indicated that they had done so. Half of the managers who had used faculty consultants had also worked with faculty members on joint research partnerships.

The experience managers had working with faculty consultants was exclusively positive. Seven of the eight managers indicated that their experience with hiring faculty consultants was very positive, while the remaining manager reported a somewhat positive experience. Most managers who had worked with faculty consultants had done so multiple times. Only two had worked with consultants one time, and the other six managers had hired faculty members as two to six times.

There are several benefits that accrue to the organization employing a faculty member as a consultant. The most common responses focused on the expertise or

research experience that the faculty member brought to the table. Other benefits were identified as aiding with strategic decision making, training employees, providing new ideas, and the ability to bring in qualified help quickly. One respondent also identified an indirect benefit of exposure to potential future employees through the faculty member as they discussed the firm in classes.

Only two of the eight managers who had employed faculty consultants identified any problems they encountered with the consulting experience. The drawbacks identified by managers were the time it took to get university approval for the consultant and management acceptance of the message delivered by the consultant. One manager indicated that faculty consultants don't charge enough!

Of course, length of the consulting arrangement and the costs associated with hiring faculty consultants spanned a wide range. The range of costs for the consulting contracts varied from a few thousand dollars to almost \$50,000, with most of the projects costing less than \$10,000. The time commitment required of the industry managers was reported as a few hours per week for most managers, although one manager indicated that he or she worked with the consultant for eight hours per week for the duration of the project. Most of the projects ranged from a few weeks to six months long.

Most industry managers indicated that they sought out faculty consultants with the expectation of receiving the benefits identified above. That is, they sought their expertise, specialized knowledge, or experience. One manager indicated they chose a university consultant because of the credibility associated by having a university faculty member affiliated with the project.

The following guidelines may be useful in managing a consulting arrangement between a company and university faculty member:

- Identify a faculty member with the proper expertise and experience.
- Be clear about expectations, including the scope and specific objectives of the project, and the role of each of the party to the agreement (project design, data collection and analysis, reporting).
- The parameters surrounding access to proprietary information should be discussed.
- Potential conflicts of interest, including the desire to publish on the part of the faculty member should be discussed up front.
- A firm estimate of the time needed to complete the project and monetary compensation should be made. A detailed contract will help avoid misunderstandings.
- For industry managers, timing is usually critical. It is especially important to ensure the timely delivery of results.
- Frequent contact between the industry manager and faculty member will help ensure that the project remains on track.

## **On-Campus Activities**

### *In-class Visits*

Classroom visits by industry managers (or similarly, visits to student organizations such as an Agribusiness Club) may be the least costly and most common interaction between industry and students. The use of guest speakers is common practice in academics, particularly in the professional schools.

Typically, the individual industry manager (or a team from a company) will travel to the university to meet with students in a classroom setting. Usually limited to approximately one-hour of contact time, the manager often shares his or her experiences, discusses the application of a particular tool or method, presents information about the industry or company, and, occasionally, offers information about job and internship opportunities with his or her company.

Students typically enjoy industry speakers, especially when the both the instructor and speaker have worked together to develop a presentation that complements the instructor's presentations. This involves some coordination on the part of the instructor and speaker to ensure that the speaker understands the instructor's expectations and is prepared to meet them. As with other forms of industry-academic interactions, arranging for guest speakers to visit the classroom is easier when a relationship exists between the prospective speaker and the faculty member or institution.

Over half of the managers responding to the survey indicated they had participated as a guest speaker in the past (54%). Twenty-one of the thirty-one managers who had served as a guest speaker indicated this was a very positive experience, and nine indicated it was somewhat positive. Only one manager felt the guest speaker experience was neutral and no managers indicated that their experience was negative. Most managers (twenty-six out of thirty-one) had been a guest speaker multiple times.

Managers identified many benefits from speaking to students. As expected, promoting the company to the students was the most frequently cited benefit, although the contribution to student learning was a close second. Other benefits identified by managers included learning about the students (who in some cases are an important customer segment or demographic), learning new ideas from listening to the questions they were asked, exposure to the opinions of future leaders, and the opportunity to interact with bright, young minds. Several managers indicated that they appreciated the opportunity to identify prospective employees. Another frequently identified benefit was the ability to teach the students about the industry, and to try to increase interest among the best students in pursuing a

career in the food and agricultural field. Others identified networking, providing students with real-world experiences, and simply having fun as benefits.

Only a few managers identified drawbacks of speaking to a class, with the most common being the time commitment. In addition to the time required for travel and making the presentation, finding the time to prepare the presentation was a significant part of their commitment. A few managers commented that they needed a greater lead time in order to have sufficient time to prepare their presentation. Other difficulties identified by managers included students sleeping or not paying attention during their talk, the need for a longer presentation (more than one hour) to really give the students value, and preparing an interesting presentation while preserving the confidentiality of sensitive information. One manager indicated it was hard to speak in front of so many students and another said that the biggest drawback is you leave the classroom feeling very old!

For industry managers, the time and expense of participating as a guest lecturer was minimal. Most indicated it took from a few hours to a day, including travel time, and that the only expense was travel and the time away from the office.

In general, the motivation for serving as a guest speaker was to “give back” to the university. Others mentioned the importance of building relationships, sharing experiences, promoting the company, scouting talent, and learning what students thought.

Managers who have taken the opportunity to be guest speakers offered many pieces of advice for an effective classroom presentation. We have added our own experiences in developing the following guidelines:

- The instructor and guest lecturer should discuss the classroom visit in advance (Litzenberg and Dunne). Specifically, it is important to agree on the objective of the class and what topics will be addressed by the guest.
- It is helpful for students to have a copy of the presentation ahead of time so that they may be prepared and develop relevant questions.
- Students generally find interactive presentations engaging and appreciate the opportunity to have their questions answered.
- Students enjoy presentations that incorporate examples and personal experiences.
- Instructors should provide guests with information on the students' backgrounds prior to the class meeting.
- Many guests use the opportunity to promote their industry and company to students and attempt to stimulate student interest in a career with their company or industry.

### *Industry Advisory Boards*

Industry advisory boards are commonly used to link faculty members and departments with members of industry. Board members may include managers and executives who actively work in or are retired from industry. Industry advisory boards typically provide advice and assistance in areas where they are best suited to do so, including fundraising, providing jobs and internships, arranging site visits, serving as guest speakers, and advising on curricular matters (Baker et al., 2008). Twenty of the fifty-six managers who responded to the survey (36%) indicated that they had served on an industry advisory board. Most of those who had served had served for more than one year and many had served for four or more years. As with the other industry-academic interactions, respondents indicated that their experience was largely positive. Nearly half found this experience to be very positive (nine respondents), and most of the remainder found it to be somewhat positive (eight managers). Three managers indicated they were neutral as to whether serving on an advisory board was a positive or negative experience.

The benefits identified from participating on an advisory board varied, but the most common benefit (identified nine times) was that serving on the board was a way to network. Interestingly, most of the comments regarding networking referred to peer networks, not networking within the university. Three respondents indicated that the opportunity to “give back” to the institution from which they graduated was a benefit. Another three managers felt that serving on an advisory board was a learning experience. Several other benefits were mentioned by a few managers, including the ability to have input into the university programs that would educate future employees, exposure for the company with the university and students, and access to cutting edge research. Only one manager felt there had been no benefits from serving on the board, although this manager did rate the experience as very positive.

The time it takes to prepare, attend meetings, and travel to and from meetings was the primary difficulty identified to participation on an industry advisory board. Most managers indicated that they spent at least one day per year to participate on the board. The time commitment varied greatly and was dependent on the distance travelled, frequency of meetings, and the level of involvement with the board. Two drawbacks to serving on an advisory board were identified. One manager felt that they did not have the opportunity to provide much input, while another thought that there was a lack of continuity between meetings.

Most managers indicated that the direct cost to serving on an industry advisory was very little. In most cases the costs were limited to travel expenses. Several managers indicated that the only significant cost to them was the value of their time. Two members of an advisory board indicated that they spent between \$4,000

and \$6,000 per year and another two managers indicated that the cost of their contributions exceeded \$6,000 per year.

One might expect an industry advisory board to be a source of input for curriculum development, as the university is the training ground for their future employees. Additionally, many advisory board members are chosen because they are graduates from a department or college that is associated with the advisory board on which they serve. As such they have a unique and valuable perspective on curricular issues. However, only two managers indicated that providing any kind of input was a benefit of serving on the board, and two indicated that the lack of opportunity to provide input was a drawback of serving on the board. This may indicate that in some cases industry advisory boards are being used ineffectively or that some advisory board members are not be utilized to the full advantage of the institution that they advise.

In general, the motivation for serving on the advisory board was to “give back” or to provide input. Although making contacts or networking was the main benefit identified, it was less often cited as a motivation for joining the board, suggesting that this is an unanticipated benefit for those that serve.

We have developed the following guidelines for effectively managing an industry advisory board, drawing on the work by Baker et al. (2008):

- Be clear about the commitment expected of advisory board members, primarily in terms of time and money.
- The board should be organized into working groups or committees that match board members expertise with the needs of the university, college, or department. Areas of contribution include fundraising, curricular advice, providing jobs and internships, arranging site visits, and serving as guest speakers.
- Board meetings should run purposely (Litzenberg and Dunne, 1996) and efficiently and board members should be given ample opportunity to provide input.
- Exploiting the industry networks of board members can greatly expand the contribution an individual board member can make.

## **Concluding Remarks**

In this paper, we have identified and discussed eight mechanisms for university faculty members in the field of food and agribusiness management to collaborate with industry managers and executives: internships, mentoring students, site visits to companies, faculty-directed research, student research, consulting, in-class visits, and advisory boards. We used a web-based survey to obtain the input of industry managers on their experience with such partnerships, including the benefits and drawbacks of these experiences, the costs of and motivation for partnering, and



their advice for managing the partnerships. For a brief summary of the various types of collaboration, the key benefits, potential problems, and the costs to industry of each type of partnership, the reader should refer to table 1.

Our experience in partnering with industry managers and the results of our survey lead us to believe that several types of cooperation between industry and academia are fairly common. Collaboration between industry and students through in-class visits (guest speaking), internship programs, site visits, student research, and industry advisory boards appears to be widely used as a means of exposing students to the practice of agribusiness management. Collaboration of faculty members with industry through mentoring students, faculty-directed research, and consulting appears to be less commonly practiced.

Student enrichment programs, including internships, mentoring, and site visits represent an important contribution to the education of students of agribusiness. This is especially important for an applied discipline where students may be expected to have some industry experience and where those students with such experience will have an advantage in the job market. Managers' experiences with student enrichment programs is usually positive, which may explain why most managers continue to participate in student enrichment programs once they become involved. The support for these programs was motivated by efforts to promote the company and recruit students, an institutional affiliation, and the desire to support the education of students.

Industry-academic collaboration on research tends to lag other forms of cooperation, although students frequently work with industry managers on research projects. Industry managers who have worked with faculty members on research projects (either faculty-directed research projects or consulting projects) indicated that the experience was favorable and that they benefited from the faculty member's expertise and the credibility associated with affiliation with a university. Joint industry-academic research, whether through faculty-directed research or industry consulting, would appear to be fruitful ground for greater industry-academic cooperation.

On-campus activities (in-class visits and industry participation on advisory boards) are used by many faculty members and departments as a means of partnering with industry managers. Both of these activities represent a good means of initiating contact with an industry manager, inviting them to campus, and opening the door to other forms of involvement. For graduates of a program, a return to campus as an industry expert is often an honor. For those with no affiliation with the university, an invitation to campus is a good step towards developing a relationship.

In this paper, we have explored many different forms of collaboration between faculty members and industry managers. Although faculty members may be

reluctant to ask members of industry to take on an additional responsibility and work with them or students, we were struck by the overwhelmingly positive experiences reported by members of industry in their various partnerships with the academic community. They were generally motivated to work with faculty members and most often felt that they and their companies benefited from the partnerships. We conclude by recommending that both industry and faculty members explore these partnering opportunities with each other for the benefit of both groups as well as students affiliated with the academic programs.

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## Appendix

**Table 1.** Key Benefits, Drawbacks, and Costs to Industry by Type of Industry-Academic Partnership

Type of Relationship	Benefits to Industry	Potential Drawbacks for Industry	Costs to Industry (Time and Resources)
<b>Internships</b>	<ul style="list-style-type: none"> <li>• Ability to recruit potential employees</li> <li>• Early access to top students</li> <li>• Assistance with special projects</li> <li>• Fresh perspective to business problems</li> </ul>	<ul style="list-style-type: none"> <li>• Problems were usually non-existent or minor</li> <li>• Lack of student work ethic</li> <li>• Training time required</li> <li>• Coordinating with a student's schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Search costs to identify qualified applicants</li> <li>• Training and supervision costs</li> <li>• Direct monetary costs (many paid \$10 to \$15/hour, some paid \$16 to \$20/hour)</li> </ul>
<b>Mentoring</b>	<ul style="list-style-type: none"> <li>• Opportunity to meet top students</li> <li>• Promote industry to students</li> <li>• Way to "give back" to the university</li> </ul>	<ul style="list-style-type: none"> <li>• Many managers thought students received more benefit than the mentors</li> <li>• Lack of time for proper mentoring</li> <li>• Scheduling conflicts</li> <li>• Lack of initiative from students</li> </ul>	<ul style="list-style-type: none"> <li>• Time allocated to mentoring (ranges from once a month to once a week)</li> </ul>
<b>Site Visits</b>	<ul style="list-style-type: none"> <li>• Opportunity to promote the company</li> <li>• Meeting potential future employees</li> <li>• Receive student feedback on company and business practices</li> <li>• Chance to educate and learn from young people</li> </ul>	<ul style="list-style-type: none"> <li>• Scheduling a convenient time for the business and faculty/students</li> <li>• Time consuming activity</li> <li>• Distraction to a running business</li> <li>• Coordinating large groups</li> <li>• Potential safety concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Time required to plan and coordinate activities</li> <li>• Out of pocket costs of refreshments and promotional materials (\$0 to \$500, in most cases)</li> </ul>
<b>Faculty-Directed Research</b>	<ul style="list-style-type: none"> <li>• Access to R&amp;D support</li> <li>• Positive exposure for the firm</li> <li>• Credibility associated with publication of results</li> <li>• Learning from the research process</li> <li>• Objectivity in collecting data</li> <li>• Way to leverage limited firm resources</li> </ul>	<ul style="list-style-type: none"> <li>• University overhead charges increase costs</li> <li>• Conflicts in dealing with proprietary information</li> </ul>	<ul style="list-style-type: none"> <li>• Ranges from \$0 to \$100,000 or more, depending on size, length, and complexity of research project</li> </ul>

Table 1. Continued

Type of Relationship	Benefits to Industry	Potential Drawbacks for Industry	Costs to Industry (Time and Resources)
Student Research	<ul style="list-style-type: none"> <li>• Firm goodwill/“giving back”</li> <li>• Research results are useful</li> <li>• Exposure to students</li> <li>• Gain fresh perspective</li> </ul>	<ul style="list-style-type: none"> <li>• Time commitment can be significant</li> <li>• Long time frame to complete projects</li> <li>• Students may not perform to expectations</li> <li>• Need for proper feedback mechanisms for students and faculty advisors</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal (1-40 hrs over a term)</li> <li>• Time spent directing the student</li> </ul>
Consulting	<ul style="list-style-type: none"> <li>• Expertise or research experience of the faculty</li> <li>• Aiding in strategic decision making, training employees</li> <li>• Fresh ideas</li> <li>• Quality assistance can be brought in quickly</li> <li>• Exposure to potential future employees (faculty spreads the word to students)</li> </ul>	<ul style="list-style-type: none"> <li>• Time it takes to get university approval for the faculty to consult</li> <li>• Management acceptance of the message delivered by the consultant</li> </ul>	<ul style="list-style-type: none"> <li>• Time spent (1-8 hrs/wk over period of 1 week to 6 mos.)</li> <li>• Ranges from a few thousand dollars to tens of thousands of dollars depending on the project size, length, and complexity</li> </ul>
In-Class Visits	<ul style="list-style-type: none"> <li>• Promotion of firm and industry to students</li> <li>• Contribution to student learning</li> <li>• Learning about students</li> <li>• Learning new ideas from students</li> <li>• Exposure to opinions from future leaders</li> <li>• Teach students about the industry</li> <li>• Identify prospective employees</li> </ul>	<ul style="list-style-type: none"> <li>• Time commitment (for travel and preparation)</li> <li>• Students not paying attention in class</li> <li>• Need for longer presentation time</li> </ul>	<ul style="list-style-type: none"> <li>• Time and travel (few hours to a day)</li> </ul>
Industry Advisory Boards	<ul style="list-style-type: none"> <li>• Networking with fellow managers and executives</li> <li>• “Give back” to the university</li> <li>• Valuable learning experience</li> <li>• Provide input to university programs</li> <li>• Access to cutting edge research</li> </ul>	<ul style="list-style-type: none"> <li>• Not enough opportunity to provide input</li> </ul>	<ul style="list-style-type: none"> <li>• One to several days per year, depending on frequency of meetings</li> <li>• Minimal to less than ten thousand dollars per year</li> </ul>





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## **Spatial Marketing Patterns for Corn Under the Condition of Increasing Ethanol Production in the U.S.**

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### **Abstract**

Events external to agriculture have set in motion the conditions for structural change in the marketing of corn in the U.S. These included a rapid increase in the price of crude oil from \$40 per barrel to over \$100 caused by hurricanes, geopolitical events, an increased global demand for energy from countries like China and India, and in December 2007, the U.S. raising the renewable fuel standards. The results of this research show that there could be significant changes in the historical utilization and marketing of corn in the U.S. The change in movement patterns provides one source of visible evidence that a structural change is underway.

**Keywords:** ethanol, corn, spatial marketing, structural change, crude oil

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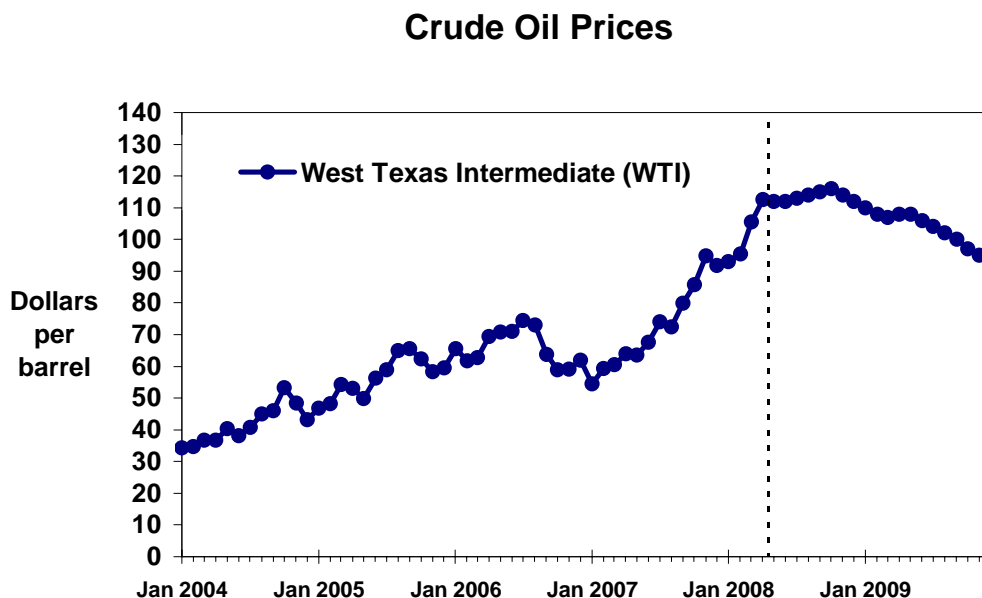
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## Introduction

The economics of energy versus food is leading to major structural changes in the marketing of corn in the U.S. A recent historical perspective shows that when crude oil was priced in the range of \$35 to \$50 per barrel and corn was \$1.80 to \$2.20 per bushel, the financial feasibility for ethanol plants was viable, but required risk capital from sources that believed the investment would be worthwhile. New construction of ethanol plants was happening at a modest pace. In 1999, less than a decade ago, there were 50 ethanol plants producing a little over 1 billion gallons per year. The production of corn in the U.S. was sufficient to meet the needs of the livestock sector, sustain exports at traditional levels, and supply the growing demand coming from ethanol production. See appendix A.

A series of events external to agriculture set in motion the conditions for structural change. As shown in Figure 1 for 2004, the West Texas Intermediate price of crude oil started to increase to price levels over \$50 per barrel brought about by increases in world demand that exceeded comparable increases in world supply. Added to the price situation was Hurricane Katrina in August of 2005 that knocked out refining and distribution capacity in the U.S. Gulf region. This led to temporary shortages of refined fuels and a spiraling up of prices that eventually contributed to crude oil prices over \$70 per barrel during 2006. By January 2007, global demand had slowed in response to higher prices and oil prices declined to under \$60. Supply and demand economics seemed to be working to the relief of the world's economies.



Short-Term Energy Outlook, May 2008

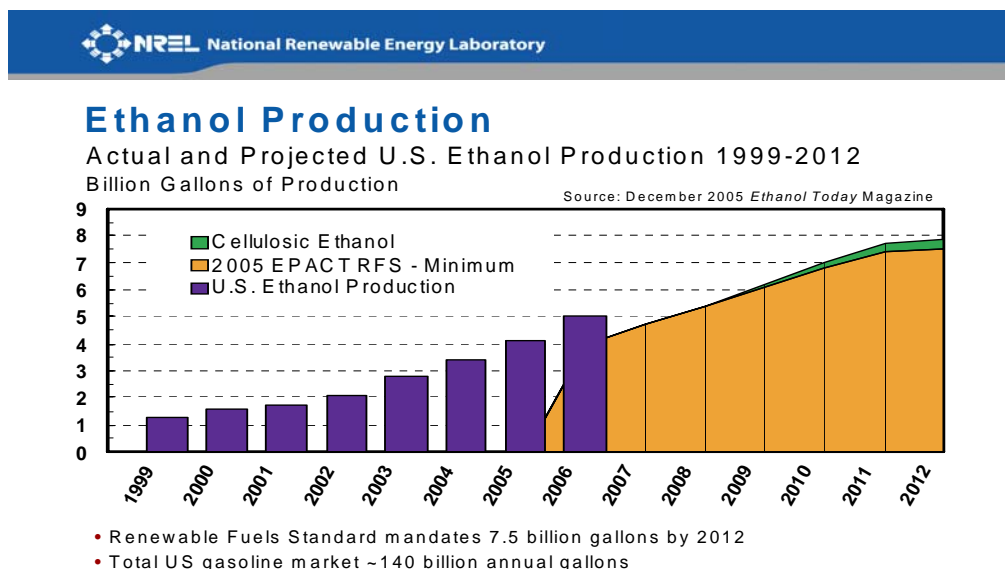


**Figure 1.** Crude Oil Prices

The relief was short-lived. Geopolitical events during the spring and summer of 2007, such as unrest in Nigeria, contentious relations with Venezuela and Iran, combined with the peak summer season gasoline demand, sustained gasoline prices at record high levels. Longer-term effects were also becoming factored into oil prices. The prolonged Iraq war, growing energy demand in China and India, the declining value of the dollar, and increasing purchasing power in Europe, former Soviet Union countries and the developing world all contributed to a demand for oil that seems to be exceeding the current availability of supply. By September 2007 crude oil was back up over \$70 per barrel and by early May 2008 broke through \$100. As recently as June 2008, the price has exceeded \$135 and the outlook for the remainder of 2008 and into 2009 is uncertain.

Events internal to the agricultural sector also set in motion conditions for change. In 2005 the U.S. Congress passed legislation called the Renewable Fuels Standard that mandated 7.5 billion gallons of ethanol production by the year 2012. The legislation was strongly supported by state and national organizations interested in the welfare of corn producers. This was in addition to the federal excise tax credit of 51 cents per gallon that provides an incentive for the production of ethanol. In December 2007, the U.S. Congress passed, and the President signed, an energy bill that doubled the Renewable Fuels Standard for ethanol from corn to 15 billion gallons by 2015.

The following figure from the National Renewable Energy Laboratory shows actual and projected production of ethanol in the U.S. As of March 2008, existing ethanol production is at 8.6 billion gallons per year (Renewable Fuels Association), an eight-fold increase since 1999.



**Figure 2.** Ethanol Production



## Problem Statement

The economic stimulus for more ethanol production caused a “gold rush” mentality for investors of capital (comment by Todd Sneller, Administrator, Nebraska Ethanol Board, 2006). When crude oil prices ranged from \$50 to \$70 per barrel, corresponding retail gasoline prices were \$2.30 to \$3.00 per gallon (in the U.S.), and corn prices were at \$2.00 or even \$2.50 per bushel, the ethanol crush spread ranged from \$1 to \$9.50 per gallon (Chicago Board of Trade). General estimates on the investment cost for a 100 million gallon per year plant was around \$100 to \$120 million or \$1 to \$1.20 per gallon. The “gold rush” of investor capital to build plants was caused by a 12 to 18 month payback period for the initial investment (comment by Tom Hauser, loan officer, Omaha Bank for Cooperatives, 2006).

As more ethanol plants continue to be built, the more will be the demand for corn to supply the plants. As shown on the following map (DTN Ethanol Resource Center), most existing and proposed plants are in the Corn Belt area of the U.S. where currently there is a surplus of corn available. However, the problem is that as more plants are built, projections are beginning to show that the surplus states becoming deficit. Robert Wisner, a long-time economist at Iowa State University, has projected that under normal assumptions for corn production, the state of Iowa could be in a significant deficit position by the year 2008 (Iowa State University). Iowa has not been deficit in corn for decades, if ever. Not only could this happen to Iowa but also to other Corn Belt states.

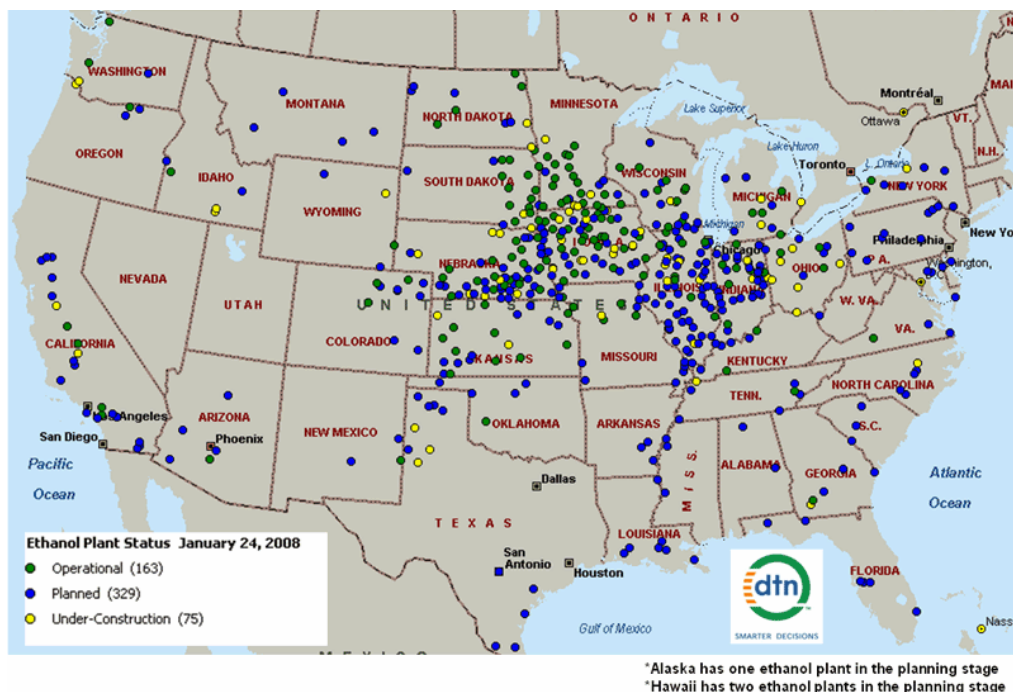


Figure 3. Ethanol Plants, March 2008

## Objectives

The objectives of this research are to:

1. Estimate the historical supply and disappearance of corn for each state in the U.S. National level estimates are periodically available but not at the state level, so these figures need to be developed. Once the historical figures are developed, then use projected national figures to estimate future supply and disappearance at the state level.
2. Determine the gallons of ethanol that are currently being produced and the expected gallons in the future based on plants under construction. Factor the current and projected ethanol production into the disappearance for corn at the state level.
3. Show what the geographic pattern of corn movements would be in the U.S. under the changing conditions of traditionally surplus states becoming deficit.

Basically, the questions to be answered are what states will likely go deficit with the surge in ethanol production, and how those deficits will be met.

## Procedure

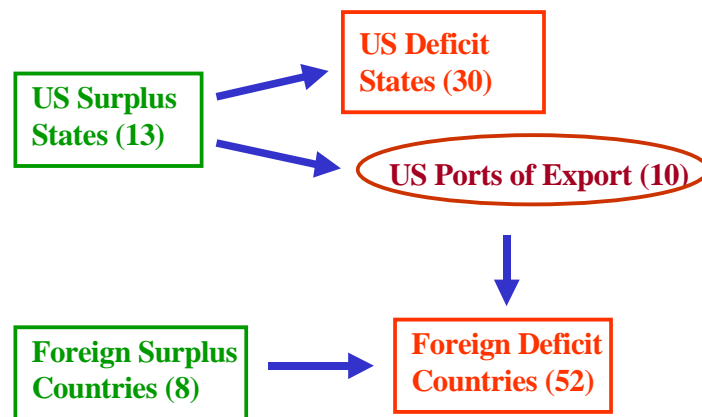
A global corn transshipment model was built and solved using computer software called Solver Premium 7.0 as an add-on to MS Excel. More details on transportation models including model structure, applications and computational methods for solution can be found in *Computational Economics* (Thompson and Thore 1992, 9-22, 113-119) and *Linear Programming* (Naylor and Byrne 1963, 83-99, 147-151).

The advantages of using a transshipment model are discussed in Thompson and Thore (1992, 177) where they state,

“It is rather curious to note that the spatial dimension seldom appears in textbook presentations of economic theory. Economic relationships are conveniently formulated with no reference to the geographical location of the participating economic subjects.” They go on to state, “And yet, how can one understand the spectacular development of modern economies without pointing to the development of new markets in developing countries and the search for raw materials and energy sources in remote locations? As transportation and distribution costs come down, the logistics networks that connect resources with final consumer demand become even longer and more complex.”

In contrast, general and nonlinear equilibrium models provide prices and quantities at the equilibrium of supply and demand, but have little or nothing to say about the spatial movements of a commodity. The choice for this research was to use the transshipment model because it explicitly describes spatial movement patterns along with quantities under various conditions.

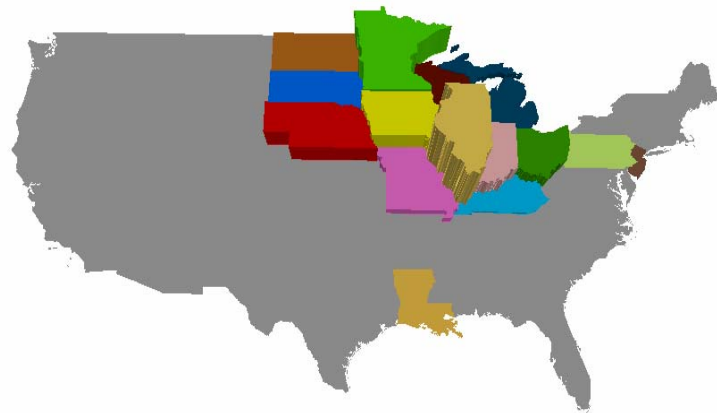
As shown in Figure 4 there were 13 corn surplus states, 30 deficit states, 10 U.S. ports of export, 10 foreign surplus countries and 52 deficit countries. The combination of all the surplus origins and deficit destinations results in a model with 16,000 possible routes. The transshipment model was solved for the pattern and quantity of corn shipped by minimizing the cost of transportation from the surplus to the deficit states, and from the surplus states to the ports of exports. Exports available from the U.S. were in competition with exports that originated from foreign surplus countries in serving deficit countries.



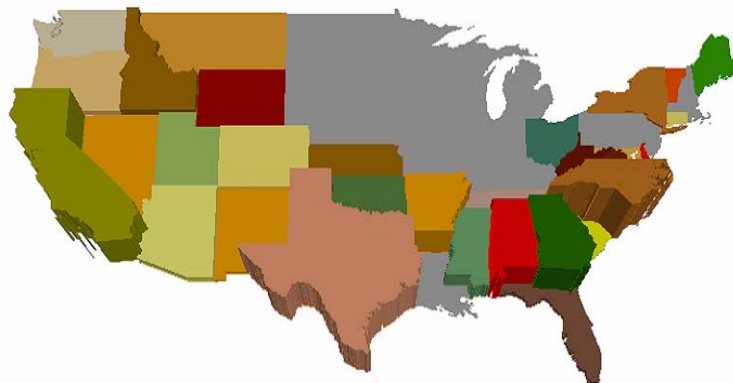
**Figure 4.** Global Corn Transshipment Model

U.S. figures on production, beginning and ending stocks, feed, food, industrial and seed uses, and exports are shown by the graphs in Appendix A (U.S. Department of Agriculture, Food and Agricultural Policy Research Institute). Actual data ranges from 1990 to 2007 and projections are from 2008 through 2015. The surge in ethanol demand for corn can be seen in the section on food and industrial use.

State level projections are given in Appendix B. Figures 5 and 6 graphically show the estimated net surplus and deficit states during the 2007-08 marketing year. The methodology for estimating surplus and deficits can be found on the Web site at the University of Nebraska-Lincoln Extension.



**Figure 5.** Net Surplus States, 2007-08 Marketing Year

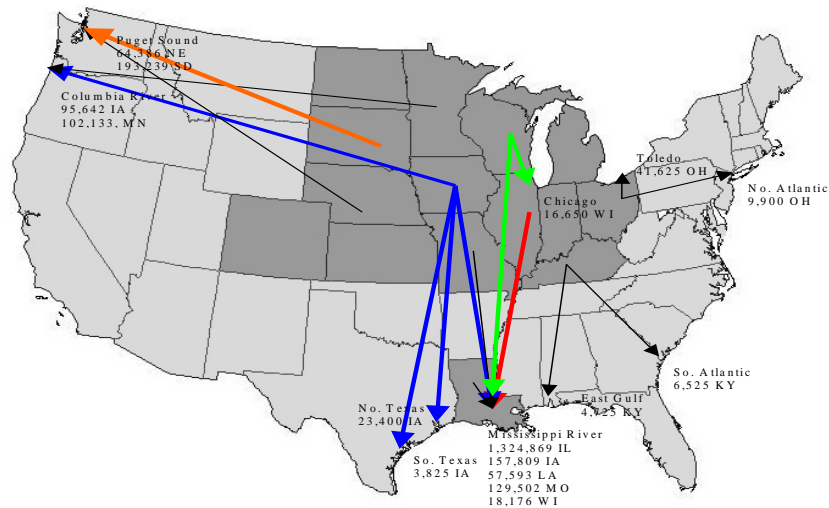


**Figure 6.** Net Deficit States, 2007-08 Marketing Year

The global model was solved for corn movements using 2007-08 estimates for the amount of ethanol expected to be produced, along with current estimates on state level corn production, beginning and ending stocks, feed, food, industrial and seed uses, and exports. The model solves for the least cost distribution of corn from the surplus states to the deficit states, through the ports of export, and from foreign surplus countries to deficit countries.

Identifying and quantifying trade barriers, trade facilitation, country specific grain policies, etc. for sixty foreign countries plus the United States in empirical modeling is extremely difficult. The approach applied in this research was to use the actual data on corn imports and exports from foreign deficit and surplus countries, respectively. The imports and exports were fixed at the three-year average for 2004-07. The actual data would reflect and be conditioned by the existing trade and





**Figure 8.** State-to-Port Projected Corn Movement for 2007-08.

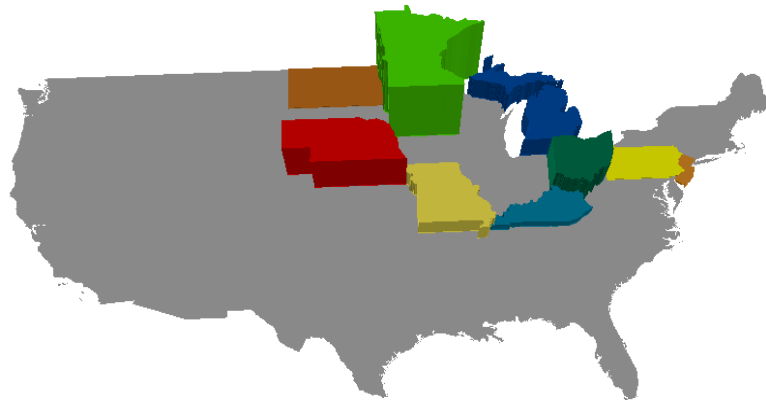
U.S. Production at 13.1 bil bu and Exports at 2.25 bil bu

## Projected Results for 2008-09

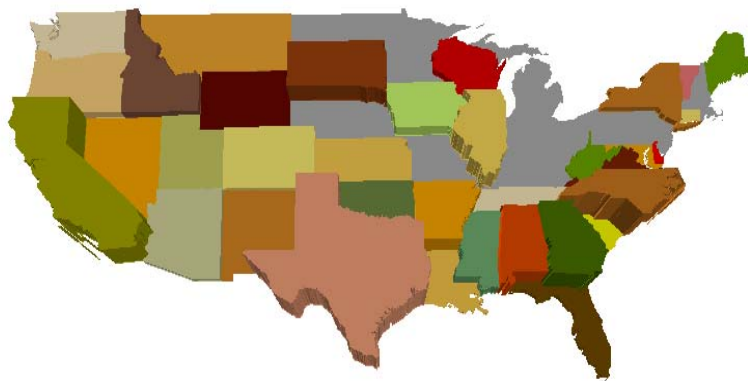
The results of the model for the 2008-09 marketing year are based on projected supply and disappearance data that includes production declining by 2.0 billion bushels from the record 13.1 billion in 2007-08. The reason for the projected decline is because planted acres of corn are expected to drop from 93 million to around 87 million, but other expectations are to a level of 83 to 84 million. While corn prices are at record high figures of around \$5 per bushel so are soybean prices at \$10 to \$12. It is expected that the soybean acres are “bidding away” acres from historical corn production. In addition, the cost of nitrogen fertilizer is at \$700 to \$800 per ton and significantly increases the cost of corn production. The scenario of 2.0 billion bushels less of corn production seems reasonable and for this analysis.

A second projection for the 2008-09 marketing year is the higher amount of ethanol production over the previous year. The amount is based on the known plants under construction and when they are expected to be operational. Ethanol production is expected to go from 8.6 billion gallons in 2007-08 to 10.8 billion by the 2008-09 marketing year for an increase of 2.2 billion gallons. The total corn required would be 4.0 billion bushels or about 36 percent of the projected corn production.

The net surplus and deficit states for 2008-09 are shown in Figures 9 and 10. The states of Illinois, Iowa and South Dakota that were significantly surplus in 2007-08, and had been for decades, now turn into deficit states in 2008-09 under the above assumptions. Wisconsin turns nominally deficit in 2008-09.



**Figure 9.** Net Surplus States, 2008-09 Marketing Year

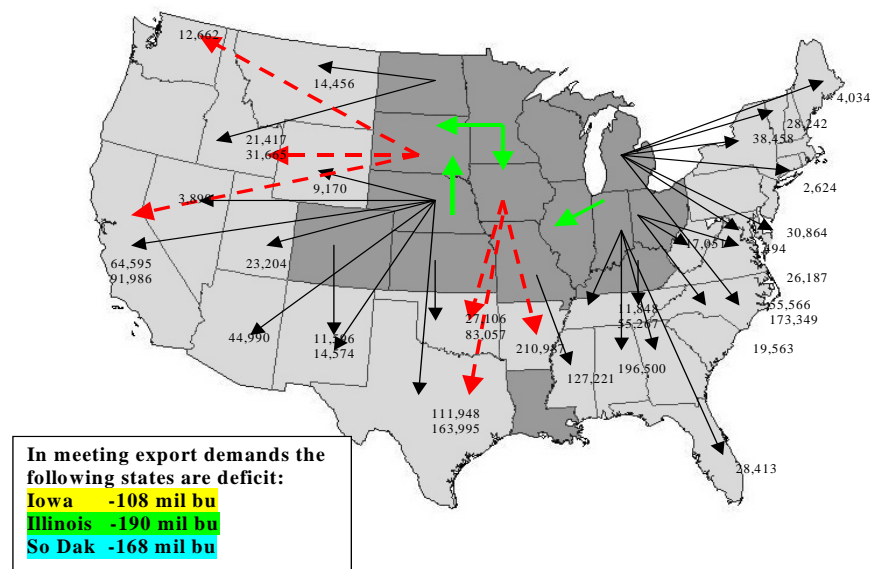


**Figure 10.** Net Deficit States, 2008-09 Marketing Year

Figure 11 shows the distribution of corn from surplus states to deficit states during the 2008-09 marketing year under the above assumptions. The dashed lines show the historical movement of corn from the formerly surplus states of Iowa and South Dakota to other deficit states, and those movements would disappear.

Once the surplus states become deficit in 2008-09 they would no longer supply their traditional deficit state customers, and instead would need to be supplied from nearby surplus states. The state of Illinois would be supplied by Indiana, Iowa by Minnesota, and South Dakota by Nebraska and Minnesota. Those traditional





**Figure 11. State-to-State Movement of Corn, 2008-09**

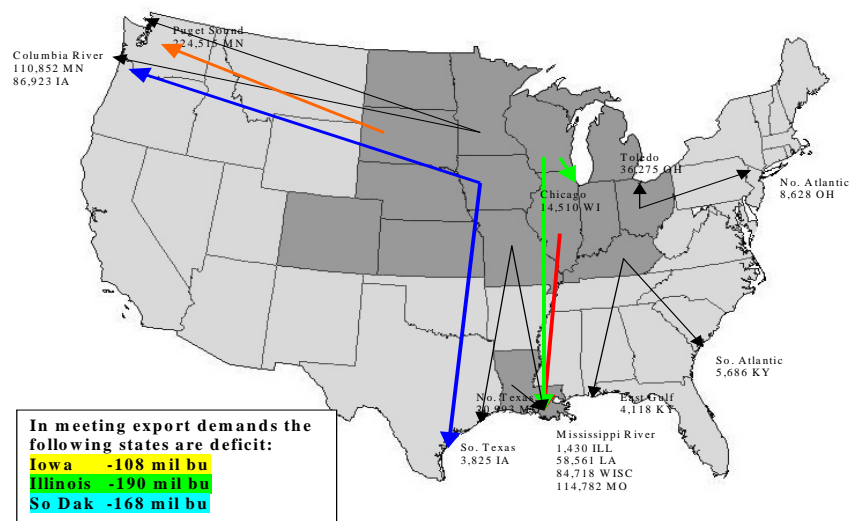
U.S. Production at 11.1 bil bu and Exports at 2.25 bil bu

deficit state customers no longer served would need to receive greater shipments from other surplus states. This would be a major structural change in the marketing of corn for these large corn-producing states. The reason they become deficit is because of the geographic concentration of ethanol plants in those states. Even though Nebraska is the second largest producer of ethanol, it remains a surplus state because of its lesser role in serving the export market.

Figure 12 shows the movement of corn from the surplus states to the ports of export for 2008-09 under the above assumptions. While the states of Illinois, Iowa and South Dakota became corn deficit because of the increased ethanol demand for corn, they still would be a major source of corn for the export market. Illinois would ship to the New Orleans port of export, Iowa to south Texas and Portland, and South Dakota to Puget Sound. This would not be different than their historical shipments (Fruin et al. 1990, 22-23, Hill et al. 1981, 16).

Estimates of corn surpluses and deficits were also made for 2009-10 that included ethanol production capacity reflecting the completion of additional plants currently being built. The same states as in 2008-09 remained surplus and deficit, and the corn movements given by the transshipment model were similar.





**Figure 12.** State-to-State Projected Corn Movement, 2008-09  
U.S. Production at 11.1 bil bu and Exports at 2.25 bil bu

## Conclusions

The results show that there could be significant changes in the historical utilization and marketing of corn in the U.S. The change in movement patterns provides one source of visible evidence that a structural change is underway being caused by the surging development of ethanol production. The structural change is not only affecting the production and marketing of corn, but also of soybeans, wheat and even cotton because of the related nature of crop rotation and producers decisions about what crop to plant given market signals. The increased demand for corn is creating a derived demand for increased acres planted to corn that would mostly come at the expense of soybean, wheat and cotton acres. In response, the prices of soybeans, wheat and cotton have substantially increased, by double or more over historical levels, during 2008. Those commodities are in price competition with corn to sustain their respective acres planted to assure adequate commercial supplies of the commodity.

One of the mainstay mechanisms for the marketing of corn by producers is the forward contract. These contracts are offered by agribusinesses that originate and merchandise grain. The contract offers the producer a fixed price for their corn that is to be delivered at some future agreed upon time period. The agribusiness hedges the forward purchase by selling a futures contract and assuming the obligation of meeting margin calls if the price increases. The producer favors the forward contract because the price is fixed and they do not need to meet any margin calls. With the increased U.S. and global demand for corn and the affect on prices, not

only for corn but also for soybeans and wheat, the availability of forward contracts is becoming scarce.

## **Implications for Agribusiness Managers**

As the ethanol industry grows and the related demand for corn shows a substantial increase, there are a number of implications for the managers of agribusiness firms that are in the business of marketing grain.

First, as the demand for corn by ethanol plants increases, agribusinesses in the marketing chain have to provide the logistical functions of origination, transport and storage. The ethanol plant is primarily focused on the processing of corn into ethanol and co-products and usually has storage capacity for only a short time period. The existing local grain elevator that has traditionally been in the storage business can provide storage so the ethanol plant has assured supplies during the post-harvest season. Producers can also provide storage on-farm. The origination and transport of corn can be done by the ethanol plant depending on their ability as new competitors with area agribusiness firms that have been marketing grain usually for years before the arrival of an ethanol plant. Given an agribusiness's historical relationship with their customer base – a relationship in rural communities that is typically a personal one - the ethanol plant can use the existing agribusiness to provide the needed origination and transport of the corn.

Second, and directly related to the results of this research, the interstate transportation of corn will need to be developed between agribusinesses at origins and destinations in the respective surplus and deficit states. This involves a seller or a buyer making arrangements with carriers, such as trucking companies or railroads, for shipments that have not been a routine part of the their business. Not only will arrangements with carriers be needed, but also a basic business relationship between those agribusinesses that can supply the corn and those that need it. This involves establishing a relationship of trust across state lines including provisions for pricing, quality, delivery, receipt and payment. The research from this study shows where potential new markets will likely exist for those agribusiness in surplus states.

A third implication for agribusiness managers has to do with the increased demand for corn and the affect this is having on prices for corn and other commodities. As discussed in the results section the availability of forward contracts is becoming scarce, which also has significant implications for producers wishing to use these contracts to manage price risk. The reason the forward contracts are becoming less available is because commodity prices have substantially increased from historically normal levels by double or more. The agribusiness offering the forward contracts finds itself having to meet exceedingly large margin calls. Agribusinesses borrow money to finance the margin calls, but lending covenants on other forms of debt can

become restrictive. In addition, the cost of borrowing the money can reduce the expected earnings from offering forward contracts. With the doubling or more of commodity prices, those earnings are in some cases becoming negative. The agribusiness can no longer afford to offer a risk management contract to the producer, and the producer is left to go directly into the futures market or accept the spot price.

How long the commodity prices will remain at these high levels and continue to show increased volatility is unknown, but the return to the historically normal pricing and marketing of corn seems unlikely for the next few years. Agribusiness managers are facing a number of new challenges.

## **Additional Research**

The research done in this study estimated the surpluses and deficits for corn with the projected increased in ethanol production. One of the co-products of ethanol production is distiller's grain or DDGs. DDGs can be substituted, up to a limit, for corn in the feed rations for cattle, hogs, dairy and poultry. This would lessen the feed demand for corn and make it available for the traditional customers in the market. For example, the state of Nebraska exports approximately half of its net surplus to California for feeding dairy cows. If that corn goes into Nebraska ethanol production, then the California market would need to find other sources. But Nebraska is also a major cattle feeding state and the substitution of DDGs into the feed rations may still allow the California market to receive the needed corn. Data and information is only now being developed on the inclusion levels of DDGs for feeding livestock and the adoption rate into feed rations by producers. With more complete information and data, the substitution of DDGs for corn can be factored into the estimates of surpluses and deficits for corn, and the movement patterns projected using the transshipment model. Again, the substitution of DDGs for corn will be a significant component in the structural change taking place in the feed grain-livestock economy being caused by the growth in ethanol production.

At a more global level, reflecting on the demand for energy and especially crude oil and refined fuels in areas of the world like China and India, it is evident that in recent years the demand for energy is showing healthy growth relative to current supplies. Increasing the supply of energy takes time, including adjustments to public policies that restrict the development of known energy sources. There are chain-like connections between the global supply and demand for energy, the surge in ethanol production, and the production of corn in the U.S. and rest of the world. The focus of additional research would be to estimate, as best as possible, the future demand and supply of energy in the various regions of the world and connect that back to the expected production and demand for ethanol, and hence corn. Imbedded in this global view is the issue of food versus fuel.

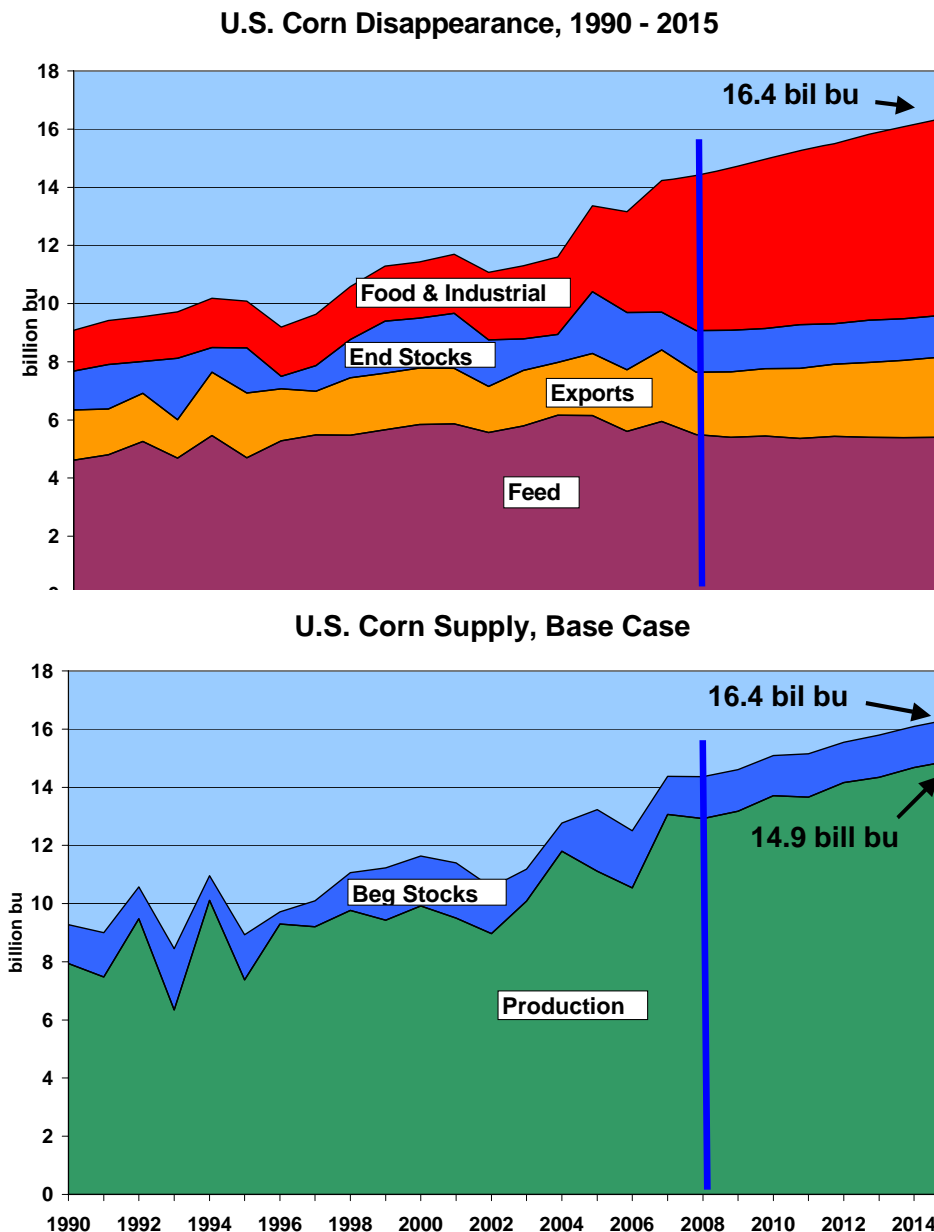
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## Appendix A.



## Appendix B. State Surplus or Deficits, million bushels, 2007-10.

State	2007	2008	2009	2010
Alabama	-238	-221	-216	-218
Arizona	-65	-61	-60	-60
Arkansas	-254	-233	-227	-228
California	-237	-247	-250	-257
Colorado	-67	-57	-51	-48
Connecticut	-9	-8	-8	-8
Delaware	-33	-29	-27	-27
Florida	-32	-29	-28	-29
Georgia	-283	-285	-285	-292
Idaho	-60	-72	-75	-79
Illinois	1,134	-190	-163	-126
Indiana	399	296	293	298
Iowa	315	-108	-90	-83
Kansas	-80	-87	-79	-76
Kentucky	46	40	45	51
Louisiana	21	-25	-23	-21
Maine	-4	-4	-4	-4
Maryland	-13	-9	-7	-4
Michigan	103	109	118	127
Minnesota	563	312	329	338
Mississippi	-151	-137	-133	-133
Missouri	163	86	94	104
Montana	-18	-16	-16	-16
Nebraska	300	182	193	199
Nevada	-6	-5	-5	-5
New Jersey	7	7	7	8
New Mexico	-29	-26	-26	-25
New York	-29	-49	-53	-57
North Carolina	-372	-342	-333	-334
North Dakota	57	6	-3	-11
Ohio	305	130	112	95
Oklahoma	-149	-136	-132	-133
Oregon	-51	-75	-80	-87
Pennsylvania	0	8	14	17
South Carolina	-29	-25	-24	-23
South Dakota	105	-168	-167	-167
Tennessee	-79	-102	-107	-110
Texas	-334	-358	-360	-370

**Appendix B. Continued**

<b>State</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Utah	-29	-27	-26	-26
Vermont	-11	-10	-10	-10
Virginia	-57	-51	-49	-48
Washington	-42	-51	-53	-57
West Virginia	-20	-18	-18	-18
Wisconsin	53	-58	-47	-42
Wyoming	-15	-14	-13	-13
Other States	-52	-41	-37	-47
<b>Total</b>	<b>2,725</b>	<b>-2,197</b>	<b>-2,082</b>	<b>-2,056</b>



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## **Heterogeneity in the Evaluation of Quality Assurance Systems: The International Food Standard (IFS) in European Agribusiness**

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### **Abstract**

Due to the growing demands of customers and several food crises, quality assurance schemes have become increasingly popular in agribusiness. With this trend in mind, it seems worthwhile to take a closer look at the satisfaction of participating European companies. The study focuses on the IFS, which has gained much relevance in the food industry. A questionnaire concerned with perceptions of the advantages and disadvantages of the IFS was answered by 389 companies. The results indicate that the overall evaluation of the IFS is primarily affected by the perceived usefulness of the catalogue of requirements and its evaluation. Furthermore, a cluster analysis was conducted and three clusters were identified, representing heterogeneous evaluations of the IFS.

**Keywords:** evaluation, quality assurance systems, International Food Standard, agribusiness

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## **Introduction**

Over the past few years, certification schemes in the agribusiness sector have gained great importance as an instrument of quality assurance. Various certification standards have been established to serve as an instrument of quality assurance within the food supply chain; these standards diverge according to their focus, target groups and goals (Deaton 2004; Fulponi 2006; Theuvsen et al. 2007). Within this context, certification is defined as “the (voluntary) assessment and approval by an (accredited) party on an (accredited) standard” (Meuwissen et al. 2003). A key feature of a certification system is the fact that inspections are carried out by independent bodies (third-party certification) beholden to standards laid down by external organisations (Luning et al. 2002).

Especially in Europe, large parts of the agrifood sector have already been certified. Driving forces for the implementation of these standards are players in the private sector, such as retailers and food processors (Jensen/Hayes 2006). Their main objective for the establishment of certification systems is the overcoming of information asymmetries (Akerlof 1970) in the supply chain and, hence, the reduction of risks linked to product liability and safeguarding of due diligence (Holleran et al. 1999; Jahn et al. 2005). Certification schemes are established in order to guarantee that product characteristics are met and/or production processes are persistent (Holleran et al. 1999).

These days, European agribusiness has to face up to various assurance systems (European Communities 2006; Sodano 2006). The implementation of these standards remains controversial in theory and especially in practice. As a consequence, many companies do not participate voluntarily but rather have been pressured to do so by powerful customers, such as large processors or retailers (Beck/Walgenbach 2002; Walgenbach 2007).

Whereas previous research primarily focused on the motivation of the companies to implement ISO 9001 and on the evaluation of the generic ISO 9001 standard by companies of various sectors (Calisir et al. 2001), the number of in-depth analyses of the efficiency and effectiveness as well as of the proper design of quality assurance and certification schemes in agribusiness is comparatively low—though rising (Canavari/Spadoni 2004; Jahn et al. 2005; Theuvsen/Peupert 2004; Lazo et al. 2006; Schulze et al. 2007). However, none of these contributions investigates the companies' assessments of sector-specific quality assurance schemes, such as GLOBALGAP (the former EurepGap), the BRC Global Standard or the International Food Standard (IFS). Against this background, it seems worthwhile to take a closer look at the overall evaluation of companies with quality assurance systems in the agribusiness sector. For this reason, the following study provides a conceptual framework and empirical data which analyse heterogeneity in the evaluation of the IFS. All in all, three research objectives have been formulated: (1)

analysis of the overall evaluation of the IFS by certified companies, (2) identification of the influencing factors on the overall evaluation of the standard and (3) differentiation of the companies into various groups with regard to their evaluation of the IFS.

We first present a general overview of the various standards within the agribusiness sector with a special focus on the International Food Standard. Next, since studies on the evaluation of sector-specific schemes are very rare, we offer a broad literature review on motivations for implementing ISO 9001 as well as on its cost/benefits ratio and the main drivers for the adoption of ISO 9001. As most agribusiness standards are based on the ISO 9001 and the standard is common within the agrifood industry, it seems worthwhile to study ISO 9001 literature in order to find information on the evaluation of the scheme and corporate satisfaction with it. Subsequently, we provide insight into the sparse literature focusing especially on QAS in the agribusiness sector. The research framework includes the constructs applied, which were derived from the literature review, the data collection and measurements. Finally, we describe and discuss the results of our analysis and draw some conclusions.

## **Certification Approaches in Agribusiness**

### *Certification Standards: ISO 9001 and Specific Agrifood Quality Schemes*

In times of increasing globalization, E-procurement and just-in-time production, earlier systems for incoming goods inspections have become insufficient. In these globalized markets, standards like the ISO 9001 serve as an assurance accepted by companies all over the world (Gunnlaugsdóttir 2002). Whereas, in the beginning, certification systems emphasized pure product control, these days such systems seek to establish comprehensive quality management. One main reason for this is product liability legislation, which defines a producer as any person who labels a product with a name, trademark or any other distinguishing mark. With regard to this, purchasers wish to safeguard against compensation for loss.

ISO 9001 certification is widely spread in companies all over the world (Walgenbach 2007). Its value is amplified by an emphasis on quality and economic competitiveness (Gunnlaugsdóttir 2002). ISO 9001 is constructed as an intersectoral generic management system guaranteeing that production processes consistently meet a certain standard of quality; consequently, the focus is on organisational structures rather than on the product itself. However, one should not neglect the fact that the aim of the ISO 9001 standard is quality control systems in general; these include processes from product design to after-sales services (Singels et al. 2001). Hence, only essential minimum characteristics of such a system can be standardized (Chow-Chua et al. 2003).

Since it is an internationally recognized scheme, agribusiness companies are also sometimes certified according to ISO 9001 (Zaibet/Bredahl 1997; Unnevehr et al. 1999; Briz et al. 2005). The ISO 9001 standard is most common in downstream agribusiness branches, whereas it has almost no relevance at the farm level. Nevertheless, the implementation of ISO 9001 is criticized, especially in agribusiness. Besides the traditional criticism that ISO 9001 is “generic, procedurally-oriented, expensive and burdensome” (Grigg/McAlinden 2001), the agrifood sector has to face the problem that ISO 9001 was not originally designed for these industries. In consequence, great “translation problems” have occurred (Walgenbach 2007: 30). Holt and Henson (2000) highlight two main tensions between the ISO 9001 requirements and the food industry: Firstly, auditors are unfamiliar with the industry, and, secondly, the procedures that comply with ISO certification do not always guarantee product safety and do not meet the due diligence defence in food safety cases. Hence, the primary reason why agribusiness companies should adopt ISO 9001 is not food safety but “those aspects of the production process that increase the value of the product” (Unnevehr et al. 1999: 1098).

However, product safety has been a major concern for agrifood firms since the 1990s, when the European agribusiness sector was afflicted by a number of crises and scandals that revealed an information asymmetry between suppliers/retailers and consumers (Tuncer 2001). As a consequence, consumer confidence in the ability and capacity of traditional governmental regulators to deal with the safety and quality issues of food products and processes declined. Today there is high consumer demand for information about food production and for a guarantee of food safety and quality (Hatanaka et al. 2005; Fulponi 2006). Hence, especially in the agrifood sector, quality assurance takes on a special position: Most foodstuffs are characterized by process traits that are hardly detectable by the end consumer. In the absence of an antagonist market, the consequence would be failure (Akerlof 1970; Nelson 1970).

Because ISO 9001 is not able to handle these fundamental agribusiness problems satisfactorily (Grigg/McAlinden 2001), many European countries, especially the private sector, have launched specific initiatives in response to the crises and scandals to implement quality assurance standards. Consequently, various sector-specific schemes have been established (Jahn et al. 2005; Sodano 2006; European Communities 2006) that contribute to overcoming information asymmetries (Auriol/Schilizzi 2002) and better meet the food safety requirements of the branch.

Most of these agrifood systems are small or have a more-or-less regional focus (Label Rouge or Gepruefte Qualitaet Bayern, for instance); however, there are a handful of certification schemes that already cover substantial areas and are widely known within the business (European Communities 2006). In Germany, for example, the national Quality and Safety (QS) system has already conducted more

than 110,000 audits, mainly in the meat industry, covering about 85 % of all German fattening pigs (EMA 2006). The animal feed industry and all important German slaughterhouses have also been covered. Additionally, about 14,900 retail stores have been audited since 2001 (QS 2006). IFS, BRC and GLOBALGAP are also widely used certification schemes developed by large retailers. Currently, more than 6,000 food producers all over the world are certified according to the IFS, approx. 96 % of these in Europe (Tromp et al. 2007; IFS 2006). In addition, the BRC Standard is the counterpart of IFS for food producers supplying retail branded goods to the United Kingdom (BRC 2008). GLOBALGAP focuses on primary producers, directly delivering to retailers. More than 51,000 certificates have been issued by GLOBALGAP in the fruit and vegetable sector in more than sixty countries, covering an area of more than two million acres (830,000 hectares) (EurepGap 2005).

In order to systematize the rather large number of different standards, the following criteria can be applied (Theuvsen/Spiller 2007):

- Focus: product characteristics (e.g., Protected Designation of Origin (PDO), Protected Geographical Indication (PGI)); process characteristics (e.g., environment-friendly, welfare standards); system characteristics (IFS);
- Target group: consumer-oriented schemes (e.g., organic farming, Fairtrade); business-to-business standards (e.g., IFS, GLOBALGAP, BRC Global Standard);
- Goal: guarantee of legal minimum requirements in a mass market (e.g., IFS, IKB in the Netherlands, QS in Germany); product differentiation (e.g., organic farming schemes);
- Contents: product quality (e.g., PDO schemes); process quality (e.g., organic farming standards); product safety (e.g., IKB);
- Standard owner: state-run systems (e.g., organic farming in Denmark), international standardization organisations (e.g., ISO 9001 and 22000), stakeholder approaches (e.g., Fairtrade), producer schemes (e.g., farmers' associations in the case of the British Assured Farm Standard), private inspection bodies (e.g., Vitacert by the German Technical Monitoring Institution/TÜV); retailer driven schemes (e.g., BRC Global Standard and IFS);
- Area of application: local (e.g., Geprüfte Qualitaet Bayern in Germany); national (e.g., Danske Slagterier in Denmark); international (e.g., IFS, ISO 22000);
- Number of stages involved along the food supply chain: single-stage systems (e.g., IFS, GLOBALGAP); multi-stage approaches (e.g., the German QS System covers the whole supply chain).

### *The IFS Certification Approach in the Food Industry*

In 2002 German retailers working together in the quality assurance board of the EHI Retail Institute developed the IFS. Since then, because major retailers have subscribed to the system, the IFS has gained a good deal of relevance in international business relations and especially in the European food industry. After its initial development in Germany, most of the retailers requested that their suppliers adopt the IFS, and the majority of these retailers no longer accept suppliers who have no IFS certificate. Consequently, the IFS became one of the most important quality assurance schemes. In view of the IFS' increasing acceptance in 2003 the French Fédération des Entreprises du Commerce et de la Distribution (FCD) joined the effort and produced an updated version of the standard. Thus, today the property rights are shared by the Hauptverband des deutschen Einzelhandels (HDE) and the FCD.

One of the main reasons for the continuous proliferation and development of the IFS has been the rising number of retailer-owned private labels in the European food industry. Product liability legislation defines a producer as any person who labels a product with a name, trademark or other distinguishing mark. Because of this, retailers with private labels have been directly affected by product liability laws and have introduced a growing number of external audits of their private label suppliers. Since many suppliers deliver to several retailers, unnecessary double-checks took place, contributing to the growing costs of quality assurance in the food sector. The IFS provided a neutral instrument based on third-party audits that could decrease costs and improve quality at the same time (Buhlmann et al. 2004). For this reason, the standard has achieved broad acceptance in the German and French retail sectors and moved towards setting a certification standard—not only for private labels but also for manufacturers' brands. By 2007 some 6,000 certificates had been issued (Tromp et al. 2007). Therefore, the IFS has largely replaced the ISO standard in the European food industry.

The International Food Standard is divided into four parts: the IFS Protocol, the Catalogue of Requirements, the Requirements for Certification Bodies and Auditors and the IFS Report. The main chapter, called the “Catalogue of Requirements”, is based on the structure of the ISO 9001; the main technical chapters are quality system management, management responsibility, resource management and product realization, measurements, analyses and improvements. The similarity between the IFS and the ISO 9001 was one of the main considerations in the development of the new standard. Furthermore, the IFS depends, for the most part, on the evaluation system and structure of the BRC, which also refers to the ISO 9001.

Nevertheless, a closer look reveals that the two standards—ISO 9001 and IFS—are also characterized by a remarkable difference. Unlike the ISO standard, the IFS is

distinguished by several industry-specific regulations, for instance, the introduction of various food product categories and regulations particularly important for the food industry (medical examinations, staff hygiene, potable water analysis, pest control and so forth). Furthermore, the standard includes various K.O. criteria mainly important for food safety. These criteria must be fulfilled; otherwise, a certificate cannot be assigned. By meeting the requirements of the standards, a company can be certified at the foundation level or the higher level (Buhlmann et al. 2004).

Bearing in mind the fact that the IFS strongly parallels the structure of the ISO 9001 and that it includes several appendages of such management systems, the literature review also refers to studies based on the costs and benefits and, moreover, the advantages and disadvantages of the ISO 9001.

## **Literature review: Motivation, Benefits and Drivers for Implementing a Quality Assurance System**

### *Empirical Evidence for ISO 9001 Implementation in International Business*

Whereas many managers refer to ISO 9001 as a “paper tiger”, others believe that this approach can generate an efficient operational quality management system (Curkovic/Pagell 1999). The following broad literature review analyses studies dealing with the motivations for implementing ISO 9001 as well as with the evaluation of the advantages and disadvantages of the standard (Table 1, see appendix).

The reasons for implementing a quality assurance scheme are diverse. On the one hand, companies participate in such schemes primarily because of internal motivation, as reported by Gotzamani/Tsiotras (2002) for Greek companies and Skrabec et al. (1997) for US firms. These enterprises expect to reap the benefits of such a system by improving the productivity and efficiency of the organisation (Singels et al. 2001, Jones et al. 1997). By identifying inefficient processes, cost reductions can be achieved and the cost/benefit ratio improved (Walgenbach 2007). In contrast, Gunnlaugsdóttir (2002) and Terziovski et al. (2003) identify predominantly external reasons, such as customer demands or access to markets, as motivating factors for adopting ISO 9001 certification. Besides, Jones et al. (1997) report on a large number of firms that named both internal and external reasons for implementing ISO 9001.

Walgenbach (2007) extracted another dimension of motivation from his qualitative interviews. Besides the internal motivation to enhance business processes and external pressure by customers or public authorities, social forces were identified as drivers of QAS adoptions. This can be described as peer pressure, management fashion or “herd instinct”. One of the interviewees stated that “at the time when the

ISO descended on Germany like a cloud, when everybody talked about ISO, and nobody knew what it was, and you need two years to implement it—or three or five or even more [...] suddenly you were doing it [...]”. It becomes obvious that, during this initial phase of ISO 9001, implementation of the standard was a kind of competition between the companies or, rather, the competitors in the market (Walgenbach 2007: 35).

Evidence can be found that the implementation of the ISO quality system is associated with a number of benefits but also with a number of disadvantages (Brown/van der Wiele 1995; McLachlan 1996; Jones et al. 1997; Dick 2000; Casadesus/Gimenez 2000; Singels et al. 2001; Gotzamani/Tsiotras 2002; Santos/Escanciano 2002; Chow-Chua et al. 2003; Walgenbach 2007). Singels et al. (2001) differentiated between internal and external benefits. Internal benefits refer to the realization of a continuous improvement process seeking to advance the company’s activities and firm structure. External benefits evolve from the relationship between the company and third parties<sup>1</sup>. Casadesus/Gimenez (2000) reported that 65 % of Spanish ISO-certified organisations achieved a high level of internal as well as external and financial benefits. The same is ascertained by Kaye (2000) and Chow-Chua et al. (2003), who reported that firms experienced external benefits, such as rising market shares, as well as internal benefits, such as cost and waste reduction, better documentation procedures, higher perceived quality of products or services and more effective communication (Brecka 1994; Adanur/Allen 1995; Buttle 1997; Häversjö 2000). This contrasts with Terziovski et al. (1997) and Aarts/Vos (2001), who detected primarily internal rather than external dimensions, such as an increase in market share. These inconsistent results show that the extent and occurrence of the various benefits differ among the great number of studies (Skrabec et al. 1997; Buttle 1997). Chow-Chua et al. (2003: 938) explained this discrepancy as a result of differing firm sizes within the samples investigated; another explanation is differing evaluations of the benefit “gaining customer” (Skrabec et al. 1997).

In addition to these advantages, negative effects of ISO 9001 certification are also broadly discussed in the literature (Tsiotras/Gotzamani 1996; Buttle 1997; Jones et al. 1997). Disadvantages are mentioned mainly in conjunction with additional costs for obtaining the standard, “increase in paper workload, no attention to development of personnel, little attention to the support functions in an organisation” and the reduction of independent reflective thinking due to constriction caused by standardized and detailed (working) procedures and regulations (Singels et al. 2001: 63). Furthermore, missing product specification, general loss of flexibility and increased bureaucratic effort is criticized.

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<sup>1</sup> For a detailed list of detected “motivations, drivers and benefits of ISO 9000 certification” see Chow-Chua et al. (2003: 939).

## *Empirical Evidence for the Implementation of Quality Assurance Systems in the Agrifood Chain*

### **ISO 9001 Certification in the Agrifood Industry**

The following table presents the results of a literature review on the motivation, benefits and drivers for ISO 9001 implementation in the agrifood industry. Generally, the research relating to ISO 9001 certification in agribusiness is very limited (Capmany et al. 2000).

**Table 1: Empirical Studies of ISO 9001 in the Agrifood Industry**

<b>Author</b>	<b>Year*</b>	<b>Objectives</b>	<b>Method</b>	<b>Sample Size</b>	<b>Main Results</b>
- Zaibet, L.; Bredahl, M.	- 1997 - (1994)	- Costs of achieving ISO certification - Cost reduction due to ISO implementation	- Qualitative interviews	- four firms in the UK meat sector	- Cost of achieving certification is not so high that it represents a constraint. - Costs are mainly imputable to training and acquisition of new equipment for calibration. - Primary gain is achieved in reduced production costs: management costs were reduced by 7 % and control costs by 20 %.
- Capmany, C.; Hooker, N. H.; Ozuna, T.; van Tilburg, A.	- 2000	- Determine <i>ex ante</i> and <i>ex post</i> perspectives of the QMS - Compare the results with those of firms from other industries - Ascertain the level of satisfaction with the QMS - Reasons for attaining certification	- t-tests	- 197 firms in the United States; - 11 agribusiness firms	- Decision to become certified was generated internally (within the agribusiness firm) in all cases, although six firms also mentioned external forces. - Costs accrued during the ISO 9000 certification process and its maintenance seem to be offset by the benefits. - Reasonably high level of satisfaction with ISO certification among agribusiness firms.
- Turner, C. R.; Ortmann, G. F.; Lyne, M. C.	- 2000 - (1998)	- Establish the extent of adoption of ISO 9000 quality assurance standards - Reasons for certification - Costs and benefits of adoption	- Discriminant analysis	- 92 South African agribusiness firms	- Desire to improve customer service and the need to improve operational efficiency (reduce wastage) were the most important factors influencing certification. - Financial, managerial and production benefits followed certification. - ISO 9000-certified firms tended to be larger, established firms with parent company affiliation exporting to developed countries. - Most important variable distinguishing ISO 9000 adopters from non-adopters was firm size.
- Grigg/ McAlinden	- 2001 - (1997/1998)	- Examine trends in the uptake of ISO 9001 standards - Assess the attitudes of industry managers towards ISO 9001	- Quantitative data - Qualitative interviews	- 71 firms - 14 food & drink firms in Britain	- 40% had worked on an ISO 9001 certification. - Implementation varied according to company size and specialty. - ISO 9001 was not adopted due to upstream pressure. - Alternative sector-specific standards (BRC, EFSIS) are more important.



<b>Author</b>	<b>Year*</b>	<b>Objectives</b>	<b>Method</b>	<b>Sample Size</b>	<b>Main Results</b>
- Mumma, G.A.; - Albert, J.A.; - Warren, C.; - Abdulkadri, A.; - Mugalla, C.I.	- 2002 - (1999)	- Impact of ISO 9001 on internal benefits  - How the benefits relate to the reasons for registering for the standards	- Regression analysis	- 117 US Agri-business firms	- Highest ranked reason for seeking ISO 9001 certification was to improve internal operational efficiency.  - Second was to access new markets, and third was customer requirements.  - ISO's primary goal is to facilitate international trade.
- Böcker, A.; - Bredahl, M. E.; - Northen, J.	- 2004 - (1999)	- Investigation of whether motivation for certification affects firm performance	- Factor and regression analysis	- 27 British agri-business firms	- Main motivations: future demand, improved documentation, quality, efficiency, increased flexibility and customer demand  - Gains of certification are positive.  - Four factors: Immediate gains in competitiveness, improved documentation, expansion, quality and customer orientation  - Immediate gains in competitiveness and quality orientation explain differences in the judgement of the impact of certification on performance.
- Maza, M. T.; - Ramírez, V.	- 2004 - (1998)	- Examination of the results obtained in relation to the main achievements and modifications that occur after certification	- Principal component analysis (PCA)	- 95 Spanish agri-business firms	- Main achievements following implementation: maximised quality and profits  - Main achievements after implementation: changes in staff attitude and in mentality
- Canavari, M.; - Spadoni, R.	- 2004	- Investigation of whether firms that had implemented a quality management system in compliance with ISO 9000 standards registered improvements in several areas of their business	- Factor and cluster analysis	- 71 agri-food firms in Italy	- Three motivation factors: Efficiency, customer satisfaction, market pressure  - Three clusters: "Unwilling" (less convinced of the utility to reach quality objectives, but useful attribute for the firm), "Quality control" (concentrated on the internal quality objectives, while generally neglecting the role of QMS on customers), "Total quality" (wider range of objectives)
- Briz, J.; Arribas, N.; - Garcia, M.; - Briz, T.; de Felipe, I.	- 2005 - (2002)	- Determination of the major costs of implementing and operating ISO 9001  - Major problems in the implementation phase  - Major perceived benefits	- Factor analysis	- 199 firms in the Spanish food and drink industry	- Net benefits outweigh the costs  - Time required to gain ISO certificate depended on in-house capability in quality management.  - Small firms hired external consultants to achieve certification.  - Three factors for seeking ISO 9001: competitive advantage, operational efficiency, regulation driven

\*Year of paper (year of survey, if reported)

Source: authors' representations

The results of the studies dealing with ISO 9001 certification in agribusiness imply that these firms respond to the standard in almost the same way as other firms (Capmany et al. 2000). Therefore, the findings of nonagribusiness contributions are

applicable to the agrifood business. Internal and external benefits and even shortcomings corresponded with those reported by companies in other branches (Holleran et al. 1999; Casewell et al. 1998; Grigg/McAlinden 2001; Mumma et al. 2002), although some differences occurred due to the special characteristics and heterogeneity of the agrifood sector.

In order to facilitate exports, it is predominantly companies belonging to the food and beverages industry that implement the standard and, only to a lesser extent, companies in other agribusiness sectors (Zaibet/Bredahl 1997; Unnevehr et al. 1999; Maza/Ramírez 2004; Briz et al. 2005). Therefore, the external factors “staying in business” and “foreign market access” are of great importance in a highly competitive international market marked by great retailer power (Zaibet/Bredahl 1997; Turner et al. 2000; Briz et al. 2005). For this reason, responding to customer demands turned out to be a key determinant for “staying in business” and thus the motivation for adoption. Conversely, Böcker et al. (2004) rank these factors, and especially the variable “foreign market access”, as the least important motives. However, Capmany et al. (2000) confirm in an *ex ante* query that market-oriented benefits (“provide a marketing/competitive advantage”) are primary incentives for seeking certification. At the same time, the results indicate that “competitive advantage” as a motive for certification will become less important with time since only “early adopters” can achieve a market benefit.

In line with the empirical results presented above, further findings indicate that small firms in particular have little motivation to pursue ISO 9001 certification. Especially against the background that, for some agribusiness firms, customers do not perceive ISO 9001 as necessary and it does not efficiently meet the business's needs, companies are now concentrating on implementing industry-specific quality standards (Grigg/McAlinden 2001).

### *Reasons for Adopting Agrifood Standards*

The benefits of ISO 9001 certification are surpassed by those of industry-specific standards. Besides common gains, such as market entry or enhancement of process quality, agrifood standards can directly advance product quality and traceability, reduce a firm's environmental impact and even have positive socioeconomic effects. However, these advantages greatly depend on the respective standard and its objectives.

Most literature dealing with the reasons and benefits for adopting agrifood standards focus on developing countries. Very little research is carried out on reasons for adopting QAS in Europe and its performance outcomes here. The following table presents an overview of current research.

**Table 2: Empirical Studies Analyzing Reasons for Adopting QAS and Performance Outcomes in the Agrifood Industry**

Author	Year*	Objectives	Method	Sample Size	Main Results
Zuhair, A. H.; Green, R.; Herath, D.	2006 (1998)	<ul style="list-style-type: none"> <li>- Analyse the relationships between the degree of adoption of food safety and quality practices and establishments' characteristics</li> <li>- Associations between the adoption and market performances of food processing enterprises</li> </ul>	Regression analysis	854 food processing companies in Canada	<ul style="list-style-type: none"> <li>- Adoption intensity is very closely linked to establishments' characteristics/activities.</li> <li>- Size, country of control and innovativeness have great influence.</li> <li>- Adoption intensity is positively associated with the market share and productivity level.</li> </ul>
Jayasinghe-Mudalige, U. K.; Henson, S.	2006 (2003)	<ul style="list-style-type: none"> <li>- Economic incentives for firms to adopt food safety controls</li> <li>- Impact of a number of firm- and market-specific characteristics</li> </ul>	<ul style="list-style-type: none"> <li>- Quantitative research (Factor analysis)</li> <li>- Qualitative interviews</li> </ul>	251 red meat and poultry processing plants in Canada	<ul style="list-style-type: none"> <li>- Market-based incentives have a greater impact than government regulatory actions.</li> <li>- Firm reputation and "right thing to do" are strong motivating factors.</li> <li>- Firm and market characteristics influence the food safety responsiveness of firms.</li> </ul>
Kleinwechter, U.; Grethe, H.	2006 (2004/ 2005)	<ul style="list-style-type: none"> <li>- Analyse the adoption of EurepGap</li> </ul>	Qualitative interviews	28 EurepGap certified and 33 non-EurepGap certified Mango producers in Peru	<ul style="list-style-type: none"> <li>- Access of information is an important factor in adoption.</li> <li>- Implementation costs are 3.8 % of the product price.</li> <li>- Factors influencing the costs: starting point, target level and involvement of exporter</li> <li>- Exporters are the key factors for implementation.</li> </ul>
Gawron, J.- C.; Theuvsen, L.	2006 (2005)	<ul style="list-style-type: none"> <li>- Analyse the perceived advantages and disadvantages of the IFS</li> </ul>	<ul style="list-style-type: none"> <li>- Cluster analysis</li> <li>- Case study</li> </ul>	65 food manufacturers in Germany	<ul style="list-style-type: none"> <li>- High standard deviations show a broad spectrum of perceived benefits.</li> <li>- Advantages: high reputation among the customers, improved product safety, improvement of business processes, comprehensible structure of IFS requirements and improved transparency</li> <li>- Disadvantages: lack of reasonability and comprehensibility of requirements, low action orientation, low managerial practicability</li> </ul>
Chemnitz, C.	2006	<ul style="list-style-type: none"> <li>- Analyse the reasons for compliance with EurepGap</li> </ul>	Semi-structured interviews	63 Moroccan tomato producers	<ul style="list-style-type: none"> <li>- Most important motivation for certification is the fear of losing market share.</li> <li>- Compliance costs are only weakly correlated with firm size.</li> </ul>
Fouayzi, H.; Caswell, J. A.; Hooker, N. H.	2006 (2003)	<ul style="list-style-type: none"> <li>- Motivation to adopt QAS</li> <li>- Effects of implementation and the relationship with suppliers and customers</li> </ul>	Bivariate analysis	38 US-Members of the international fresh-cut farmers association	<ul style="list-style-type: none"> <li>- QAS adoption affected intra-firm (improved management and efficiency) and inter-firm (improvements in trade) factors.</li> <li>- 90 % of the firms reported they were somewhat or very satisfied with their QAS.</li> </ul>

Author	Year*	Objectives	Method	Sample Size	Main Results
Schulze, H.; Jahn, G.; Spiller, A.	2007 (2005)	- Investigation of the acceptance of the German organic certification system	Partial Least Squares (PLS)	126 organic growers	<ul style="list-style-type: none"> <li>- Perceived effectiveness is less important for the evaluation than the operational management and bureaucratic costs.</li> <li>- Risk perception and the motivation to produce organic food do not influence reputation, but they influence satisfaction.</li> <li>- The most important factor for enhancement of the effectiveness of the system is improvement of the thoroughness of the auditor.</li> <li>- Neither farm size nor years in organic business have a high influence on perceived costs.</li> </ul>
Enneking, U.; Obersoer, T.; Kratzmair, M.	2007 (2004)	<ul style="list-style-type: none"> <li>- Measuring satisfaction with three different QAS</li> <li>- Analysing the differences in satisfaction among the three schemes</li> </ul>	Regression analysis	315 Bavarian hops producer	<ul style="list-style-type: none"> <li>- Overall evaluation of the three systems is not very different.</li> <li>- Differences occur with regard to motivation for adoption, internal management improvements and extra earnings.</li> <li>- Perceived benefits are primarily conveyed by improved image, sales and managerial efficiency.</li> <li>- Personal or firm characteristics have no influence on satisfaction.</li> <li>- Costs have a lower influence on satisfaction than benefits.</li> </ul>
Herath, D.; Hassan, Z.; Henson, S.	2007 (1998)	- Exploration of the association between the adoption of food safety and quality assurance practices and firm characteristics	Regression analysis	854 food processing firms in Canada	<ul style="list-style-type: none"> <li>- Adoption of food safety and quality practices varies widely among individual firms.</li> <li>- Reasons for variations: firm size, country of ownership and control, level of innovativeness, level of export orientation, forms of food safety inspection and subsector.</li> <li>- Incentive of being able to access foreign markets plays an important role in influencing adoption.</li> <li>- Firm size and subsector are the most important indicators for the probability of adopting HACCP.</li> </ul>

\*Year of paper (year of survey, if reported)

Source: authors' representations

In the food business in general, higher transparency, traceability and positive effects on performance and cost structures are identified as strengths of quality systems (Jatib 2003; Fouayzi et al. 2006). Through QAS adoption, reductions in product failures, recalls, customer complaints and warranty claims were achieved. The main external benefits were the attraction and maintaining of customers as well as satisfaction with sales and market share (Fouayzi et al. 2006). Larger companies in particular expect an effective saving potential; smaller firms, in contrast, hope to gain a competitive advantage (Caswell et al. 1998).

One of the most common complaints is that standards offer few advantages for day-to-day operations in the agrifood sector but result in a huge bureaucratic workload (Jahn et al. 2003; Canavari/Spadoni 2004; Gawron/Theuvsen 2006). Many companies feel incapacitated by the strict regulations imposed by quality assurance schemes. In particular, certification standards that impose the same requirements on all products and their production processes often negatively affect companies' performance.

Costs differ among the various agrifood standards since they have different objectives. However, costs are associated mainly with training staff to establish and

maintain the system, record keeping and the implementation of monitoring procedures, laboratory work and assumed process modifications (Antle 1999; Fouayzi et al. 2006).

Kleinwechter and Grethe (2006) identify access to information and lack of knowledge as major difficulties in implementing GLOBALGAP. Especially for farmers in developing countries, the costs of compliance can create a substantial economic burden and, therefore, represent the most relevant stumbling block to adoption. Since these problems can be solved with the assistance of export companies, vertical integration in developing countries would appear to be a key factor in the adoption of GLOBALGAP. Producers stated that the decision for gaining certification was highly influenced by exporters (Chemnitz 2006).

## **Research Framework**

### *Research Concept: Procedures and Constructs*

Despite the large number of studies analysing the performance of and motivations for adopting ISO 9001 in diverse businesses and, to a smaller extent, also in agribusiness, only a few studies (Calisir et al. 2001; Calisir 2007 and partially Terziovski et al. 2003) focus on the overall evaluation of the standards analysed. Therefore, these questions still remain unanswered: How do companies in agribusiness evaluate quality assurance schemes in general, and which key factors affect this evaluation?

Furthermore, inconsistencies among the empirical results of earlier studies hint at a large heterogeneity between and even within the samples analysed (Casadesús/Giménez 2000). There is evidence that these inconsistencies result from the use of different research questions and methodologies (Chow-Chua et al. 2003; Terziovski et al. 2003) or from an erroneously applied methodology (Häversjö 2000). However, it seems that various company characteristics are also relevant (Gawron/Theuvsen 2006; Casadesús/Giménez 2000; Rayner/Porter 1999). Most studies were conducted in diverse countries and in diverse industries, as well as on companies at different stages in quality awareness and on organisations of different sizes (Häversjö 2000). All in all, it has to be assumed that different groups within the samples may evaluate different elements of the standards in different ways. However, influencing factors on the assessments of standards have not yet been analysed for different companies/groups within the sample.

It is against the background of these inconsistencies that the research concept of this study was designed. Its main goal is to identify groups that are internally similar regarding evaluation of IFS performance elements but, at the same time, different from other groups in their evaluation (exploratory analysis).

First of all, it is necessary to identify the factors influencing the overall evaluation of the IFS through a confirmatory analysis. For this reason, all constructs, which are, for the most part, derived from the literature, are explained in the following.

The first construct “**perceived cost/benefit ratio**” was broadly applied in early research. The studies indicate that certification generally entails benefits for most companies; however, due to heterogeneity, the extent to which this is true differs widely (Skrabec et al. 1997; Buttle 1997; Häversjö 2000). The main benefits for agribusiness companies concern competitive advantage in the market (Briz et al. 2005). Nevertheless, in an *ex post* analysis of the advantages of ISO 9001 for agribusiness customer satisfaction, Capmany et al. (2000) identify product traceability, information quality and sales as the most important improvements. Brecka (1994) reports greater benefits with regard to lower operating costs, and Gunnlaugsdóttir (2002: 42f.) generally states that the “time, cost and effort of obtaining certification of the quality system is substantial”, but that most companies, nevertheless, consider the standard “to be of great value” and “well worth the cost”.

The “**perceived costs of certification**” construct is defined as the effort to comply with the formal requirements for certification as perceived by a company. This includes, for instance, the costs of documentation, process modification or organisational adaptation. A large number of agribusiness companies indicate that the costs are low or moderate (Capmany et al. 2000; Briz et al. 2005). However, Briz et al. (2005) and Gawron and Theuvsen (2006) report different perceptions of certification costs. Generally these costs are dependent on the size of the company and a company’s prior experience with the implementation of quality standards (Holleran et al. 1999; Böcker et al. 2004).

Although the standards are generally nonmandatory, most customers demand they be implemented by their suppliers. Therefore, today most schemes have the status of a “licence to operate” in most businesses. Correspondingly, in the literature it is assumed that the implementation of QAS is often due to perceived pressures from the external environment, for instance, large customers such as Aldi, Carrefour or Tesco in the food business (Singels et al. 2001; Gunnlaugsdóttir 2002; Walgenbach 2007). Since external reasons predominated in many studies (Casadesús/Giménez 2000; Grigg/McAlinden 2001; Gunnlaugsdóttir 2002; Terziovski et al. 2003), “**perceived external pressure**” seems to be another important variable.

The “**perceived effectiveness of the auditor**” construct refers to the control performance of the auditor. We define this construct as the degree to which a respondent believes that the auditor is reliable enough to detect noncompliance with regulations. Beyond single case studies, anecdotal information or rumours,

statistical analysis clearly indicates the threat of weak auditing procedures in quality certification systems (Schulze et al. 2006).

Terziovski et al. (2003) assume that the effectiveness of certification further depends on determinants such as the style of the auditor. The latter impacts appraisal of the certification because there is evidence that some auditors have no experience with their client's industry, its quality system or its procedures or products/services. This results in poor audit quality and has a negative influence on the QAS as a whole. Therefore, since the auditor's skills play an important role, we introduced **“perceived expertise of the auditor”** as a further construct.

The **“perceived quality of the IFS compared to other QAS”** adverts to the evaluation of various quality standards regarding aspects like transparency, efficiency, relevance or bureaucratic accomplishment. Standards such as the BRC and the IFS target the same industry and, therefore, compete against each other.

Another important construct is the **“evaluation of the catalogue of requirements”** of the QAS. Meeting the requirements of the QAS catalogue can incur high costs because some requirements are difficult to implement or even considered unnecessary. This can lead to poor overall evaluation of the standard. The **“perceived communication of the standard owner”** is also important. By making practical information available, requirements can be explained, advantages and disadvantages can be visualised and, thus, the implementation of QAS can be expediently supported.

Moreover some descriptive variables play a major role.

Holleran et al. (1999) allude to the fact that the costs and benefits of a QAS implementation are firm-specific and partially refer to already existing quality schemes. Hence, the **“number of other QAS”** (Enneking et al. 2007) in a company adverts to the experiences gained during the implementation process and day-to-day operations with such standards. In line with Kleinwechter/Grethe (2006), Holleran et al. (1999: 678) state that “firms lacking a quality assurance system may experience higher costs from adopting ISO 9000, but may realize greater benefits”. Juran (1999: 30) points out that “...companies that are at the beginning stages of their quality journeys find that the ISO 9000 series of standards provides them with a guide for implementing a basic quality system. But for companies with good quality systems, the standard often just adds costs, delays and burdensome documentation, rather than providing any competitive advantage”.

In addition, there is evidence that small firms evaluate the motivations, benefits and drivers of QAS in a different way from larger ones (Skrabec et al. 1997; Gotzamani/Tsiotras 2002; Chow-Chua et al. 2003). Since smaller firms generally possess a more immature quality system, combination effects are possible. Skrabec

et al. (1997) found that it is mainly these firms that enjoy the highest benefits from ISO 9001 implementation. This corresponds to findings by Gotzamani and Tsiotras (2002) and Juran (1999). In their survey of small and medium-sized firms, Rayner and Porter (1999) reported that small companies implement ISO 9001 without any further knowledge of its benefits or even the personnel and time investments it requires. However, in their survey of US fresh-cut producers, Fouayzi et al. (2006), surprisingly, found no significant relation between size and satisfaction with quality management systems (QMS) or number of QAS. To measure such economies of scale, the references “**number of employees**” (see Casadesús/Giménez 2000; Böcker et al. 2004) and membership in a “**larger production group**” are included.

The last aspect considered is the “**country**” a company is located in; this construct deals with the different quality awareness and the different experiences with quality management systems in different countries. As Quazi and Padibjo (1998) stated in their study of small firms in Singapore, the majority of companies implementing ISO 9001 were from foreign countries; hence they demand support from the government by creating a quality culture.

The factors mentioned above serve as a starting point for identifying different groups with the help of a cluster analysis. Therefore, only those factors are used in a prior step (regression analysis) that have significant influence on the overall evaluation of the IFS. Up to now, such an analysis—combining exploratory and confirmatory methods—has been lacking, and it can be considered a new approach. Thus, this study contributes to the growing body of quantitative studies on QAS (e.g., Chow et al. 2003; Singles et al. 2001; Calisir et al. 2001; Calisir 2007) that has gradually replaced the case and qualitative studies (e.g., Quazi/Padibjo 1998) dominant at the beginning of QAS research.

## **Data Collection**

In February 2006, all firms that at that time were certified according to the fourth version of the IFS (1,799) were questioned using an online survey. Due to the Europe-wide character of the study, the questionnaire was translated into German, English and French and sent to companies all over Europe. A total of 389 valid questionnaires were returned (21.6 % of all certified companies). The average interview took 64 minutes. The target group of the survey was the respective quality assurance manager (62.7 %) or quality assurance staff (14.6 %). Respondents were located mainly in Germany (55.0 %), France (9.3 %), Italy (6.9 %) and Austria (6.4 %). On average, 346 employees work in the companies and 38.8 % of the companies are part of a larger production group. The companies represent eighteen different subsectors of the food-processing industry: beverages (20.7 %), agricultural/horticultural produce (16.1 %), meat products (incl. preparations; 13.2 %), dried goods (12.9 %) and dairy products (12.1 %). The percentage of



retailer-branded food products in relation to the total food production volume is between 31 and 40 %.

Since all European companies which were certified according to the IFS were included in the survey and 21.6 % of these firms responded, our sample can be regarded as representative. In order to assure that a nonresponse bias did not significantly influence the results, independent sample t-tests comparing the mean responses of early respondents and late respondents were conducted for each of the variables. This Armstrong-Overton test for nonresponse bias determined that the nonresponse bias was not significant (Armstrong/Overton 1977).

## **Measurements**

With regard to the empirical results identified by the meta-analysis, different measurement scales that had been partly tested in previous surveys were combined. All constructs were measured by means of Likert-scaled or semantic differential items (-3 to +3). The overall evaluation of the IFS was indicated by asking respondents about their general opinion of the IFS (scale from +3 = totally satisfied to -3 = totally dissatisfied).

Descriptive statistics and a confirmatory factor analysis were used to analyse the sample. After minor modifications, a principal component analysis was applied for data reduction and to build up factors according to the hypothetical constructs based on the literature review. These constructs were tested with Cronbach's alpha ( $\alpha$ ). Additionally, to exclude any problems of multicollinearity between the factors, an item-to-item correlation analysis was conducted.

The analysis of the data is divided into four parts. First, we present selective descriptive data of the companies' attitudes towards the IFS, followed by a factor analysis to capture the dimensions of the potentially influential aspects. Multiple linear regression analysis is conducted to measure the impact of the factors identified on the overall evaluation of the IFS. Lastly, cluster analysis is applied to differentiate the companies into various groups with regard to their evaluation of the IFS by using the significant variables of the regression analysis.

## **Results**

The descriptive results for the exogenous variables provide first impressions of company attitudes towards the certification scheme. All in all, the companies evaluated the IFS positively; 74.6 % of the companies are generally satisfied with the standard. This is a very positive evaluation compared to studies analyzing the acceptance of other schemes (Fitzgerald et al. 1999; Böcker et al. 2004). However, only 32.7 % would have implemented the IFS, even in the absence of any retailer requirements.

Regarding the benefits of the IFS, 70.6 % of the companies emphasized that the advantages of the IFS outweigh any disadvantages, 82.2 % said that the IFS provides some useful input for the operational management, and 51.3 % reported that the IFS improved their relationship with customers. Furthermore, 56.2 % of the companies agreed that the IFS has essentially contributed to increasing food safety, and 64.3 % noted that the IFS improved food safety management. With regard to the costs of the IFS, the amount of time the companies spent on the certification process is generally considered the most important factor, with 77.0 % agreeing with this statement. However, only 43.0 % of the corporations believed the operational expenses were justified by the benefits (cost/benefit ratio). A larger

**Table 3: Results of the Factor Analysis**

Construct	Mean	Standard Deviation	Factor Loading
Perceived cost/benefit ratio <sup>1</sup> , Cronbach's alpha = .883			
Would you agree that the IFS has improved your food safety management?	0.97	1.39	0.804
The administrative effort is justified by the benefits of the IFS.	0.22	1.41	0.753
The IFS has essentially contributed to increasing the safety of our food production.	0.63	1.56	0.747
The IFS makes our business processes more transparent.	0.29	1.58	0.742
The advantages of the IFS outweigh any disadvantages.	1.10	1.39	0.725
Would you agree that the IFS has improved relations with your customer?	0.49	1.59	0.677
The operational expenses of implementing the IFS are justified by its benefits.	0.34	1.38	0.666
Implementation of the IFS provides us with some useful input for our operational management.	1.64	1.11	0.579
Perceived quality of the IFS compared to other QAS <sup>1</sup> , Cronbach's alpha = .864			
Compared with other certification standards, the IFS is more transparent.	0.26	1.48	0.891
Compared with other certification standards, the IFS is more efficient.	0.21	1.42	0.871
Compared with other certification standards, the IFS is more relevant.	0.26	1.48	0.807
Compared with other certification standards, the IFS is less bureaucratic.	-0.10	1.61	0.759
Perceived communication of the standard owner <sup>2</sup> , Cronbach's alpha = .862			
With the information provided by the IFS offices, I am...	0.35	1.14	0.899
With communication with the IFS offices I am ...	0.48	1.17	0.862
With the information available on the Internet I am ...	0.57	1.02	0.772
Regarding the information on IFS, I am ...	0.76	0.95	0.701
Perceived expertise of the auditor <sup>1</sup> , Cronbach's alpha = .708			
What was your level of satisfaction with the work performed by the auditor during your most recent audit?	1.64	1.02	0.796
I was completely satisfied with the IFS auditor's expertise.	1.59	1.21	0.754
The IFS auditor really had no clue about the evaluation.	-2.02	1.11	-0.691
The IFS auditor made a number of useful suggestions informally.	1.44	1.32	0.584
Perceived costs of the certification <sup>1</sup> , Cronbach's alpha = .538			
We had to provide additional staff for the IFS certification process.	0.16	1.95	0.790
The amount of time we had to spend on the certification process was high.	1.63	1.29	0.789
Perceived effectiveness of the auditor <sup>1</sup> , Cronbach's alpha = .565			
'Black sheep' will be singled out by the audit.	0.82	1.51	0.743
The IFS auditor really tried to point out weaknesses.	1.56	1.19	0.657
The IFS auditor was very exact.	1.95	0.94	0.521

KMO = 0.826; explained variance = 63.50 %; <sup>1</sup> = Scale from +3 = totally agree to -3 = totally disagree; <sup>2</sup> = scale from +3 = totally satisfied to -3 = totally dissatisfied

Source: authors' calculation

proportion (44.8 %) of the companies had to provide additional staff for the certification process. Regarding the reliability of the control system, 57.6 % of the companies anticipated that “black sheep” would be discovered during the audit.

Next, 25 theoretically derived statements concerning exogenous factors were reduced by means of a factor analysis. After minor modifications for double loading and nonloading items, the measures demonstrated acceptable levels of fit and reliability (KMO = 0.826; explained variance = 64 %). All constructs revealed reliability, that is, an  $\alpha$  greater than 0.70 (Nunnally 1978). Only the two constructs “perceived costs of the certification” (0.54) and “perceived effectiveness of the auditor” (0.57) had a low reliability score. Due to the research concept, we did not eliminate these constructs.

Six factors were extracted: “perceived cost/benefit ratio”, “perceived quality of the IFS compared to other QAS”, “perceived communication of the standard owner”, “perceived expertise of the auditor”, “perceived costs of the certification” and “perceived effectiveness of the auditor”.

The impact of the exogenous factors (using the factor scores for the extracted constructs and further selected variables that refer to the presented constructs) on the overall evaluation of the IFS was measured applying a stepwise least-squares model using ordinary least squares (OLS) as the estimation procedure. The model was highly significant (F-value = 80.72) and 54 % (= adj. R square;  $R = 0.74$ ) of the overall evaluation is explained by the regression equation.

**Table 4: Results of the Regression Analysis**

Independent Variables	Coefficient	Std. Error	Beta value	T value
c	0.859	0.040		21.245***
Perceived cost/benefit ratio <sup>1</sup>	0.346	0.038	0.396	9.052***
Evaluation of the IFS catalogue of requirements <sup>2</sup>	0.275	0.043	0.294	6.380***
Perceived communication of the standard owner <sup>1</sup>	0.203	0.033	0.235	6.181***
Perceived expertise of the auditor <sup>1</sup>	0.195	0.032	0.227	6.173***
Perceived costs of the certification <sup>1</sup>	-0.099	0.032	-0.117	-3.077**

Dependent variable = “overall evaluation of the IFS”<sup>3</sup>; F-value = 80.72\*\*\*; Std. Error = 0.586; adj.  $R^2 = 0.54$ ;  $R = 0.74$ ; \*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ ; c = constant; <sup>1</sup> = factor values; <sup>2</sup> = scale from +3 = totally agree to -3 = totally disagree; <sup>3</sup> = scale from +3 = totally satisfied to -3 = totally dissatisfied; independent variables (not significant): “perceived quality of the IFS compared to other QAS”<sup>1</sup>, “perceived effectiveness of the auditor”<sup>1</sup>, “perceived external pressure” (= We would have implemented the IFS even in the absence of any retailer requirements)<sup>2</sup>, “country” (= Germany, France), “number of other QAS” (= BRC, ISO 9001), “number of employees”, “larger production group”.

Source: authors' calculation

The interpretation of the results shows that certification costs are not as relevant as expected. Instead, the factor “perceived cost/benefit ratio” turned out to be the most important one. Furthermore, the companies' evaluation of the IFS catalogue of requirements, the communication and information of the standard owner and the

perceived expertise of the auditor are more important for the evaluation of the certification standard than the perceived costs of the certification.

The main feature of our investigation was a cluster analysis using significant variables in the regression analysis to differentiate between the companies with regard to their heterogeneity in evaluating the IFS. The cluster analysis was conducted in several steps. We first identified outliers using the single-linkage method and removed them from the dataset (five cases). Then, the optimal number of clusters and the respective cluster means were identified using Ward's method. A three-cluster solution was chosen based on a scree test, a dendrogram and plausibility considerations. In order to refine this solution, a k-means cluster analysis was conducted.

Several criteria suggest that the three-cluster solution we obtained is of high quality. F-values are smaller than 1 for all cluster-building variables in each cluster (excluding two variables in cluster 3), indicating that the clusters are very homogeneous (Table 5). Furthermore,  $\eta^2 = 0.77$  on average implies that the cluster-building variables are significantly different and that within-cluster variance is low. In addition,  $\eta^2 = 0.59$  shows that 59 % of the variance among the cluster-building variables can be attributed to differences between clusters on average. The stability of the cluster solution is high. Cross tabulation indicates that 258 objects,

**Table 5:** Results of the Cluster Analysis: Active Variables

Factor/Item	Cluster 1	Cluster 2	Cluster 3	Total
	(29.1 %)	(40.7 %)	(30.2 %)	
	$\mu$	$\mu$	$\mu$	$\mu$
	f	f	f	f*
	t	t	t	p
Perceived cost/benefit ratio <sup>1</sup>	-0.22	0.82	-0.83	0.02
	0.50	0.31	0.70	204.47
	-0.24	0.82	-0.87	0.00
Evaluation of the IFS catalogue of requirements <sup>2</sup>	0.70	1.14	-0.18	0.61
	0.58	0.65	0.56	125.63
	0.10	0.60	-0.91	0.00
Perceived communication of the standard owner <sup>1</sup>	0.05	0.18	-0.19	0.03
	0.76	0.87	1.34	5.14
	0.02	0.16	-0.23	0.01
Perceived expertise of the auditor <sup>1</sup>	0.05	0.08	-0.12	0.01
	0.82	0.77	1.47	1.55
	0.04	0.07	-0.14	0.22
Perceived costs of the certification <sup>1</sup>	-1.15	0.32	0.69	0.00
	0.36	0.47	0.39	268.47
	-1.17	0.32	0.69	0.00

<sup>1</sup> = factor values; <sup>2</sup> = scale from +3 = totally agree to -3 = totally disagree;  $\mu$  = mean; f = variance of variable x/ variance of x in the total sample; t =  $\mu(x) - \mu^*(x)$ / standard deviation of x in the total sample; f\* = f-value (ANOVA); p = significance level (ANOVA)

Source: authors' calculation

corresponding to 68 % of the total, are classified congruently by Ward's and the k-means methods. In addition, the kappa number is equal to 0.50. Moreover, a discriminant analysis shows that 99 % of the objects are classified congruently by the k-means method and the discriminant analysis (Wilks Lamda = 0.16). To describe the clusters, an ANOVA was applied (Table 5 and Table 2, 3 and 4 in the appendix).

All in all, three clusters were extracted. The groups can be characterized as “The Unconcerned” (Cluster 1), “The Satisfied” (Cluster 2) and “The Dissatisfied” (Cluster 3).

*Cluster 1: “The Unconcerned” (29.1 %)*

The first group, “The Unconcerned”, was generally satisfied with the IFS but did not perceive many advantages for the companies. Most members of this cluster are larger companies with about 450 employees, and ten are very large scale manufacturers with more than 1,000 employees. Of the companies, 46.8 % are part of a larger production group, and 45.9 % are situated in Germany. The members of this cluster were forced to implement the IFS, but, after using the standard for a while, they detected certain advantages. Referring to the number of certification standards (BRC, ISO 9001 and GMP), they have a lot of experience and, therefore, perceived low costs during the initial IFS phase. Furthermore, the IFS requirements were not too difficult for them to implement, and they did not need additional staff for IFS certification. However, they adopted the IFS without retailer pressure. Since these companies did not see too many negative effects on the management process from IFS implementation and had so much experience with other standards, they were labelled “The Unconcerned”.

*Cluster 2: “The Satisfied” (40.7 %)*

The second cluster, “The Satisfied”, consists of 40.7 % of the companies and is, therefore, the largest group. The cluster is composed of small companies—mostly situated in Germany (56.1 %) and Italy (10.3 %). Only 34.8 % are part of a larger production group. All in all, they had a very positive attitude towards the IFS, regarding internal (e.g., useful input for operational management) and external (e.g., improvement in relations with customers) effects on the enterprise. However, they perceived high costs during the certification process. Their motivation to implement the IFS—even in the absence of any retailer requirements—was higher than that of other groups. Therefore, they seemed intrinsically motivated. Since the majority of the companies evaluated the IFS very positively, they were labelled “The Satisfied”.

### *Cluster 3: “The Dissatisfied” (30.2 %)*

Most respondents in the third cluster are medium-sized companies with an average of 311 employees. Most of them are situated in Germany (63.5 %) and France (20.0%). The members of this cluster have been certified, but, nevertheless, do not see positive effects on food safety or on their customers’ relations. They have less experience with other certification standards than companies in the other clusters. The IFS requirements were hard for them to implement, and they perceived high costs during the implementation phase of the IFS, especially the time they had to spend on the certification process, which was quite long, and to the need to engage additional staff. All in all, the cost/benefit ratio is negative for the companies of the third group; they are not satisfied with the IFS, and they would not implement the IFS in the absence of retailer requirements. Therefore, they were labelled “The Dissatisfied”.

## **Discussion**

The interpretation of the results of the regression model (see Table 4) shows that the evaluation of the IFS is better if the companies perceive a good cost/benefit ratio. On the one hand, a positive evaluation arises from the benefits offered by the standard, for instance an increase in food safety, a better relation with customers or a useful input for operational management. On the other hand, lower costs regarding operational expenses and administrative efforts can be realized.

Corresponding to our results, various studies concerned with ISO 9001 and agrifood specific standards have revealed that the primary motivation for certification was the enhancement of operational efficiency and reduction in production costs due to lower error rates (Mumma et al. 2002; Briz et al. 2005; Zaibet/Bredahl 1997; Holleran/Bredahl 1997 and Turner et al. 2000). A further decrease in costs results in reduced management and process control staff as well as enhanced management and lower transaction costs (Zaibet/Bredahl 1997). The results of the study, therefore, confirm the importance of the cost/benefit ratio already mentioned in the literature. Hence, in implementing a standard such as the IFS, it is important to fulfil firm expectations, particularly regarding the benefits of the system, because of the high position of retailer power.

Cooper (1995) generally claimed that a standard interpreted by a company as purely a conformance standard will never attract interest as a means of reducing costs. This lack of internal motivation will negatively influence the perceived benefits, and the perceived costs will always outweigh the advantages (Taylor 1995; Dick 2000). In these cases, the ISO 9001 is demoted to a “hollow achievement” (Jones et al. 1997: 650). However, the results of the study also show that the external pressure does not influence the certification costs and only moderately influences the overall evaluation of the standard. Another aspect with a significant

effect on the standard evaluation is the catalogue of requirements of the IFS (Gawron/Theuvsen 2006). One explanation for the strong relationship could be the strict and detailed criteria that characterise the IFS; if they do not match the companies' structure, this can cause resentment. Furthermore, clear communication by the standard owner is also an important part of improving the overall evaluation of the approach because it helps firms to better understand the requirements of the scheme.

The high standard deviations of the sample and especially the cluster analysis indicate that there are huge differences with regard to the evaluation of the IFS. Perceived cost/benefit ratio, perceived costs of the certification, the evaluation of the IFS catalogue of requirements, perceived external pressure, the origin of the companies and the implementation of other QAS are key factors explaining these deviations.

Regarding the cluster solution, Cluster 2 ("The Satisfied") contains those companies which demonstrate the highest level of satisfaction with regard to such features as perceived improvements in food safety. In contrast, the evaluation of Cluster 3 ("The Dissatisfied") is strongly influenced by the time spent in the certification process and the costs of hiring the additional staff needed to implement the standard. This cluster has the highest costs and perceives no benefits from the IFS. Cluster 1 ("The Unconcerned") experiences low benefits and low costs; however, benefits outweigh costs, and satisfaction is ranked at a medium level. Taking the number of certification schemes implemented as one explanation, one can see that Cluster 1 in particular has the most experience with other standards, such as ISO 9001 or BRC. Therefore, the implementation costs are quite low because all necessary actions, like completing additional documentation, have already been taken.

With regard to the perceived quality of the IFS, compared to other quality systems, the members of Cluster 2 consider higher transparency, efficiency, relevance and a lower bureaucratic workload as advantages. Cluster 3, however, evaluates these aspects negatively, and Cluster 1 has a more or less unconcerned attitude towards the perceived quality, which can also be explained by their experience with other quality standards.

A third difference between the three clusters is the perceived competence of the auditor and, in combination with this, his or her perceived effectiveness. Clusters 1 and 2 are characterized by a high satisfaction level regarding the auditor's work during recent audits and the accuracy of those audits. Most members of both clusters found that the expertise of the auditor was adequate and that the auditor made many useful suggestions. Most companies in Cluster 3 agreed.

With regard to perceived communication on the part of the standard owner, for example, availability of information or communication with the IFS office, Cluster 2 indicated a generally positive position. Cluster 1 evaluated these aspects similarly. Only Cluster 3 reported negative experiences in communications with the standard owner.

With reference to the empirical evidence for the implementation of QAS, the clusters can be classified according to their internal and external motivation.

**Cluster 1** (“The Unconcerned”): Forced by retailers, but, after the implementation period, the IFS offered certain advantages; motivation: intrinsic/extrinsic.

Certification schemes have to be implemented in day-to-day operations and then improve the organisation’s business. In particular, benefits such as more business and lower operating costs need some time to develop. At least for companies already certified for a longer time, these advantages may already have been partially realized and, therefore, they are much more conscious of them and reported them more often. Brecka (1994) proves that the benefits of QAS increase with time. However, there are also studies indicating the opposite is true. In fact, Jones et al. (1997) and Terziovski et al. (2003) found no evidence that companies progressively gain from certification, noting instead that organisations seem to experience declining benefits with time.

**Cluster 2** (“The Satisfied”): Improvement of cost-/ benefit ratio; motivation: intrinsic.

According to studies that analyze mainly the ISO 9001 and standards in the agrifood sector, motivation for implementing the ISO was predominantly to improve operational efficiency and reduce costs through lower error rates in the production process (Mumma et al. 2002; Briz et al. 2005; Zaibet/Bredahl 1997; Holleran/Bredahl 1997; Turner et al. 2000). Costs are also diminished through reductions in management and process control staff as well as enhanced management and lower transaction costs (Zaibet/Bredahl 1997).

**Cluster 3** (“The Dissatisfied”): Forced by large retailers; motivation: extrinsic.

Briz et al. (2005: 8) and Zaibet/Bredahl (1997) state that the importance of the external factor “staying in business” gains increasing importance in highly competitive markets characterized by great retailer power. This corresponds to findings by Lee and Palmer (1999), who revealed that external factors play a major role as key drivers for small firms seeking certification.

Certificates have achieved more and more the status of a “licence to operate” (Jones et al. 1997: 652). There is evidence that many suppliers put great effort into gaining the certificate but do not operate according to the ISO 9001 requirements in their



daily businesses (Gore 1994). However, Jones et al. (1997: 650) point out that ISO 9001 is a “long-term investment”. It takes time for the companies to make the QAS work and, thus, allow it to reveal its full potential. Hence, the huge expenditures for implementing and maintaining the system can only be acknowledged if they entail benefits. Consequently, the seeking of a certificate may initially be motivated by retailer demands, but, after a period of use, its costs pay off and its perceived advantages exceed its disadvantages. That is what Ortmann (1995) calls “the slow fabrication of objectives while acting”.

The results show that motivation is a very important variable when it comes to the reasons for seeking certification and ensuing performance (Huarng et al. 1999: 1015; Singels et al. 2001; Terziovski et al. 2003). Many authors allude to the fact that companies should not target the bare implementation of ISO 9001 (Tsiotras/Gotzamani 1996; Jones et al. 1997; Terziovski et al. 2003) since QAS do not *per se* achieve major benefits and inevitably improve an organisation’s performance (Jones et al. 1997; Beattie/Sohal 1999). The intention “must be the development of a solid quality assurance system which will lead to the future development of a total quality system” (Tsiotras/Gotzamani 1996: 75). The stance on merely “achieving a certificate” is a mentality arising from external pressures (Jones et al. 1997; Martinez-Costa/Martinez-Lorente 2007) and can result in fraud (Dick 2000).

## Conclusions

Taking the IFS as an example, this empirical study presents insights into the assessment of certification standards by processors in the agrifood chain. Its rapid diffusion shows that the IFS has become a *conditio sine qua non* for European food manufacturers. Nearly all important retailers require their suppliers to present an IFS certificate; therefore, it can, at best, be classified as quasi-voluntary (Meuwissen et al. 2003).

The results of the representative survey clearly demonstrate that the overall evaluation of the IFS is positive. All in all, food manufacturers perceive the IFS as a useful instrument for assuring product safety. The regression analysis indicated that clients are interested not only in receiving the certificate but mainly in food safety benefits. Furthermore, some respondents reported positive effects on their companies, such as a continuous improvement process or improved quality motivation of staff members. Nevertheless, the cluster analysis also showed a more sceptical assessment by at least some of the respondents.

From the IFS survey results (especially from the cluster analysis), three managerial implications can be derived. First, the companies that do not yet perceive any advantages from implementing the standard should consider the IFS more as a quality management instrument. Some companies have already noted improvement

in their internal business processes following IFS implementation. These companies can serve as benchmarks for more reluctant and sceptical food manufacturers. Second, the catalogue of requirements offers the most important opportunity for improvement. Through its use, the standard setter has a chance to clearly enhance the satisfaction of certified companies. This could be achieved by integrating more subsector-specific requirements and benchmarking the IFS against other certification standards. This could lead to an improvement of the reciprocal acceptance of standards and convince retailers to refrain from auditing their own suppliers and to rely more heavily on third-party audits governed by the IFS. In this way, criticism from food manufacturers can be reduced, as can audit amount. The third area of improvement is better communication quantity and quality by the standard setter. This can be achieved by means of a regular newsletter, better notification of changing requirements, more industry specific information and advice on implementing requirements.

The study was conducted with the support of the IFS Working Group (standard setter of the IFS), which demonstrated its willingness to improve the scheme. Among other things, the results served as a basis for improvements and the development of the new IFS version (Version 5), which was published in August 2007.

Our contribution highlights a variety of theoretical starting points for further research evaluating quality assurance systems in food supply chains. Moreover, the study gives initial indications for the positive and negative impacts of certification schemes on the internal processes of food companies. In the long run, the success of quality assurance systems, satisfaction and positive motivation are important because a scheme that is recognized as a bureaucratic burden will not lead to major quality improvements.

Due to the comprehensive sample, which is marked by a large sample size and an integration of various European companies along the whole food supply chain, the study presented provides a good initial understanding of the factors influencing companies' evaluation of the IFS. However, the empirical study is limited to the analysis of only one standard. Future research should seek to contrast its results with evaluations in other countries (e.g., Asia) or with other certification standards (e.g., ISO 22000; BRC).

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## Appendix

**Table 1:** Empirical Studies Analysing the Reasons and Performance Outcomes of ISO9001

Author	Year*	Objectives	Method	Sample Size	Main Results
Brecka, J.	1994	-	-	400 participating organisations	<ul style="list-style-type: none"> <li>- Benefits of QAS increase over time.</li> <li>- Greater benefits with regard to lower operating costs, reduced wastage, expanded market share and improved efficiency and productivity.</li> <li>- Customer pressured companies were less likely to report improved organizational performance.</li> </ul>
Jones, R.; Arndt, G.; Kustin, R.	1997	<ul style="list-style-type: none"> <li>- Relationship between the benefits of ISO 9001 and the company's initial motivation</li> <li>- Impact of time on perceptions of benefits received</li> </ul>	Frequency tests	272 Australian companies	<ul style="list-style-type: none"> <li>- 16 % rated performance-related reasons, 42 % externally-motivated reasons and 42 % rated internal and external reasons equally (mixed) as primary motives.</li> <li>- Internally motivated and mixed companies show stronger agreement that they have experienced benefits.</li> <li>- No statistical evidence to show that longer-certified companies experience more benefits than recently-certified companies, regardless of the reason for seeking certification.</li> </ul>
Buttle, F.	1997	<ul style="list-style-type: none"> <li>- Motivations to seek certification</li> <li>- Benefits which accrue from certification</li> <li>- Difficulties experienced during and after certification</li> </ul>	- Factor and regression analysis	1220 international companies in the UK	<ul style="list-style-type: none"> <li>- Profitability and process improvement are most highly valued.</li> <li>- Marketing considerations (gaining new customers, keeping old customers, increasing market share and growth in sales and improving customer satisfaction) were secondary in seeking registration.</li> </ul>
Skrabec, Q. R.; Ragu-Nathan, T. S.; Subba Rao, S.; Bhatt, B. T.	1997	- Analyze cost, benefits, roadblocks and reasons for registration to ISO 9001	-	300 US companies	<ul style="list-style-type: none"> <li>- Main costs: training and surveillance costs; indirect costs such as management and employee time can be substantial; registration costs are low.</li> <li>- Top current benefits: documentation, improved standards, and quality awareness</li> <li>- Estimated costs for system improvement via ISO 9001 can be considered low.</li> </ul>
Casadesus, M.; Gimenez, G.	2000	- Determine the benefits of adoption with regard to various firm characteristics	Cluster analysis	288 Spanish SMEs	<ul style="list-style-type: none"> <li>- 65 % benefited externally and internally from the standard; 6 % showed much fewer benefits.</li> <li>- 79 % are principally constituted by the companies most satisfied; high internal benefits.</li> <li>- 21 % are satisfied although they obtained fewer internal benefits.</li> <li>- 71 % are more satisfied with the external benefits.</li> <li>- 29 % perceived fewer external benefits.</li> </ul>
Singels, J.; Ruël, G.; van de Water, H.	2001	<ul style="list-style-type: none"> <li>- Do certified companies have better performance outcomes?</li> <li>- What motivates organizations to achieve ISO certification?</li> </ul>	Factor analysis	192 industrial and service firms in North Holland	<ul style="list-style-type: none"> <li>- ISO 9001 alone does not have a positive effect on corporate performance.</li> <li>- Motivation positively influences the organisation's performance.</li> </ul>

Author	Year*	Objectives	Method	Sample Size	Main Results
Calisir, F. Cahit, A. Bayraktar, Beskese, B.	2001 (1998)	<ul style="list-style-type: none"> <li>- Examine the relationships between companies' demographic characteristics</li> <li>- Difficulties encountered in ISO 9001 implementation</li> <li>- Improvements generated after attaining certification</li> <li>- Large companies' satisfaction with ISO 9001</li> </ul>	Regression analysis	73 large Turkish companies (>100 employees)	<ul style="list-style-type: none"> <li>- Corporate satisfaction depends on operational improvements and the overall success after implementation.</li> <li>- Benefits are increasing product/service quality, reducing error/defect rate in production/service and achieving standardization.</li> </ul>
Gunn- laugsdóttir J.	2002 (2001)	<ul style="list-style-type: none"> <li>- Time and cost to obtain ISO 9001</li> <li>- Motivation to seek certification</li> <li>- Was time and money well spent?</li> </ul>	Frequency tests	24 firms in Iceland	<ul style="list-style-type: none"> <li>- Adoption motivated by customer demand</li> <li>- Time required to gain a certificate is extremely long, and costs are substantial.</li> <li>- Improvement in record keeping</li> <li>- Investments are worth the cost.</li> </ul>
Chow- Chua, C.; Goh, M.; Wan, T. B.	2003	<ul style="list-style-type: none"> <li>- Has ISO 9001 standard compliance benefited listed firms which are already governed by a stricter standard of responsibility of wealth creation towards shareholders?</li> </ul>	<ul style="list-style-type: none"> <li>- Empirical survey (factor analysis)</li> <li>- Examination of annual reports (1987-1997)</li> </ul>	146 Singapore based companies	<ul style="list-style-type: none"> <li>- Certification leads to better overall financial performance.</li> <li>- Nonlisted certified firms experience better documentation procedures, higher perceived quality of products or services and more effective communication among employees than listed certified firms.</li> <li>- Problems include failure to establish adequate monitoring programs, to follow set procedures and to carry out appropriate management reviews of the new system as well as unclear authorization.</li> </ul>
Terziovski, M.; Power, D.; Sohal, A. S.	2003	<ul style="list-style-type: none"> <li>- Auditor's perceptions of ISO 9001 practice and its effectiveness for business performance</li> <li>- Relevance of the quality auditor within the relation between ISO 9001 certification and business performance</li> </ul>	<ul style="list-style-type: none"> <li>- Quantitative data (sample of certified companies and quality auditors)</li> <li>- Multivariate analysis</li> </ul>	<ul style="list-style-type: none"> <li>- 400 companies in Australia</li> <li>- 126 quality auditors</li> </ul>	<ul style="list-style-type: none"> <li>- Significant and positive relationship between the manager's motives for adopting ISO 9001 certification and business performance</li> <li>- Principal motivation to pursue ISO 9001 certification was found to come from customer pressure.</li> <li>- Auditing style has an insignificant (positive or negative) effect on business performance.</li> </ul>
Walgen- bach, P.	2007	<ul style="list-style-type: none"> <li>- Reasons for ISO 9001 implementation</li> </ul>	<ul style="list-style-type: none"> <li>- Qualitative interviews in 1996</li> </ul>	37 organisational units	<ul style="list-style-type: none"> <li>- Customer demands are not the main trigger for adoption; however external reasons were main drivers</li> <li>- Implementation was an occasion for structuring and led to the development of a system of bureaucratic control</li> </ul>
Calisir, F.	2007 (2004)	<ul style="list-style-type: none"> <li>- Determine the level of difficulties/obstacles associated with the implementation</li> <li>- Importance of achieving expected improvements</li> <li>- Level of success in achieving expected improvements</li> <li>- Influence of these factors on service companies' satisfaction</li> </ul>	<ul style="list-style-type: none"> <li>- Regression analysis</li> </ul>	86 Turkish service industry	<ul style="list-style-type: none"> <li>- Regression analysis indicates enterprise's quality in terms of reputation, interpersonal relations and motivation on the part of employees as significant variables.</li> <li>- Companies are more satisfied if they put greater emphasis on considering alternative approaches to educating top- and medium-level managers and receiving support from top management.</li> <li>- "Motivating personnel" was the most difficult problem.</li> </ul>

\*Year of paper (year of survey – if reported)  
Source: authors' representations

**Table 2: Results of Cluster Analysis 2: Statements of the Factor Analysis**

Constructs and Items	Cluster 1 (29.1 %)		Cluster 2 (40.7 %)		Cluster 3 (30.2 %)	
	$\mu$	$\sigma$	$\mu$	$\sigma$	$\mu$	$\sigma$
<b>Perceived cost/benefit ratio<sup>1</sup></b>						
Would you agree that the IFS has improved your food safety management?***	0.50	1.15	1.90	0.80	0.11	1.51
The administrative effort is justified by the benefits of IFS certification.***	0.43	1.10	1.01	1.00	-1.10	1.19
The IFS has essentially contributed to increasing the safety of our food production.***	0.15	1.38	1.72	1.03	-0.37	1.44
The IFS makes our business processes more transparent.***	-0.36	1.49	1.37	1.08	-0.58	1.38
The advantages of the IFS outweigh any disadvantages.***	1.15	1.11	1.90	0.80	-0.04	1.48
Would you agree that the IFS has improved your relations with your customers?***	0.48	1.51	1.34	1.17	-0.65	1.41
The operational expenses of implementing the IFS are justified by its benefits.***	0.49	1.16	1.08	1.13	-0.80	1.13
Implementation of the IFS provides us with useful input for our operational management.***	1.23	1.14	2.29	0.61	1.17	1.19
<b>Perceived quality of the IFS compared to other QS<sup>1</sup></b>						
Compared with other certification standards, the IFS is more transparent. <sup>p=0.27</sup>	0.11	1.44	0.41	1.55	0.22	1.39
Compared with other certification standards, the IFS is more efficient.**	0.07	1.30	0.53	1.50	-0.09	1.35
Compared with other certification standards, the IFS is more relevant.**	0.24	1.46	0.53	1.47	-0.09	1.42
Compared with other certification standards, the IFS is less bureaucratic.**	-0.17	1.40	0.20	1.59	-0.45	1.79
<b>Perceived communication of the standard owner<sup>2</sup></b>						
With the information provided by the IFS offices, I am...***	0.28	1.06	0.70	1.00	-0.05	1.27
With the communication with the IFS offices I am ...***	0.48	1.02	0.82	1.04	0.02	1.32
With the information available on the Internet I am ...***	0.63	0.90	0.80	0.94	0.21	1.16
Regarding the information on IFS, I am ...***	0.84	0.86	0.99	0.95	0.38	0.95
<b>Perceived expertise of the auditor<sup>1</sup></b>						
What was your level of satisfaction with the work performed by the auditor during your most recent audit?***	1.69	0.84	1.84	0.87	1.31	1.26
I was completely satisfied with the IFS auditor's expertise. <sup>p=0.06</sup>	1.64	1.16	1.72	1.14	1.37	1.31
The IFS auditor really had no clue about the evaluation. <sup>p=0.20</sup>	-2.13	0.95	-2.05	1.19	-1.86	1.13
The IFS auditor made a number of useful suggestions informally.***	1.31	1.35	1.77	1.12	1.09	1.43
<b>Perceived costs of the certification<sup>1</sup></b>						
We had to provide additional staff for the IFS certification process.***	-1.61	1.19	0.61	1.72	1.27	1.64
The amount of time we had to spend on the certification process was high.***	0.35	1.16	1.98	0.99	2.37	0.78
<b>Perceived effectiveness of the auditor<sup>1</sup></b>						
'Black sheep' will be singled out by the audit.***	1.03	1.28	1.12	1.46	0.28	1.58
The IFS auditor really tried to point out weaknesses.*	1.31	1.27	1.71	1.09	1.60	1.19
The IFS auditor was very exact.*	1.77	1.00	2.06	0.80	1.98	1.04

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$  (ANOVA); <sup>1</sup> = scale from +3 = totally agree to -3 = totally disagree; <sup>2</sup> = scale from +3 = totally satisfied to -3 = totally dissatisfied

Source: authors' calculation

**Table 3: Results of Cluster Analysis 3**

Items	Cluster 1 (29.1 %)		Cluster 2 (40.7 %)		Cluster 3 (30.2 %)	
	$\mu$	$\sigma$	$\mu$	$\sigma$	$\mu$	$\sigma$
<b>Overall evaluation</b>						
Before going into more detail, we would like to know your general opinion of the IFS. <sup>1***</sup>	1.20	0.74	1.43	0.68	0.34	0.72
<b>Perceived external pressure</b>						
We would have implemented the IFS even in the absence of any retailer requirements. <sup>2***</sup>	-0.52	1.86	0.39	1.43	-0.97	1.76
<b>Further single statements</b>						
I am very comfortable recommending IFS certification to other companies. <sup>2***</sup>	1.39	1.08	1.88	0.99	0.36	1.28
The requirements are too difficult to implement. <sup>1***</sup>	-0.59	1.09	-0.35	1.11	0.29	1.09

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$  (ANOVA); <sup>1</sup> = scale from +3 = totally satisfied to -3 = totally dissatisfied; <sup>2</sup> = scale from +3 = totally agree to -3 = totally disagree; <sup>3</sup> = scale from +3 = clearly more successful to -3 = far less successful

Source: authors' calculation

**Table 4: Results of Cluster Analysis 4: Descriptive Variables**

Items	Cluster 1 (29.1 %)	Cluster 2 (40.7 %)	Cluster 3 (30.2 %)	Total
<b>Country of origin</b>				
Germany*	45.9%	56.1%	63.5%	55.4%
France***	2.7%	4.5%	20.0%	8.7%
Italy**	9.0%	10.3%	0.0%	6.8%
Austria <sup>p=0.41</sup>	6.3%	8.4%	4.3%	6.6%
<b>Number of other QAS.</b> *** $\mu$ ( $\sigma$ )	2.38 (1.40)	1.49 (1.32)	1.38 (1.16)	1.72 (1.36)
BRC***	53.2%	32.9%	25.2%	36.5%
ISO 9001***	62.2%	38.7%	40.0%	45.9%
GMP*	12.6%	5.8%	4.3%	7.3%
<b>Number of employees.</b> <sup>p=0.15</sup> $\mu$ ( $\sigma$ )	449 (908)	283 (582)	311 (614)	340 (704)
Companies part of a <b>larger production group.</b> <sup>p=0.11</sup>	46.8%	34.8%	36.3%	38.8%

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$  (ANOVA)

Source: authors' calculation







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## **Innovation in Food Products: First-mover Strategy and Entropy Metrics**

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### **Abstract**

The objective of this research is to investigate food product innovation in the context of the first-mover strategy among food manufacturers within agrifood supply chains. The emphasis of the analysis is on developing a useful metric for tracking new product development in the context of first-mover strategy. Entropy is introduced as a novel and useful means of examining first-mover strategy and new product development (NPD) in general. Understanding the complexities of the first-mover strategy and tracking NPD with entropy metrics holds promise for enhancing the analysis of agrifood supply chains and assisting firms in deciphering broad strategies of their rivals.

**Keywords:** first-mover strategy, food product innovation, entropy, organic

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## **Innovation in Food Products**

The agrifood sector traditionally is regarded as a low-tech industry. Food manufacturing is characterised by low intensity of research and development (R&D), compared to other manufacturing firms, which is reflected by relatively low R&D investment per dollar of sales (Grunert et al). Compared to the pharmaceuticals sector or the information technology sector, food manufacturing industries consistently exhibit lower R&D spending (Morgan et al), yet there is enhanced interest in product innovations in this sector. Currently, numerous applications of modern biotechnology focus on engineering input traits in the development of arable crops. Designer genes in arable crops already are important on the business-to-business level. However, agrifood firms increasingly are alert to the potential for differentiating bulk food products by adding useful functionalities relevant to specialized business-to-consumer markets (Bröring, Cloutier, and Leker). Hence, food product innovation through new product development is an important economic driver of the dynamics within agrifood chains. R&D expenditures lead to innovation by food manufacturers and may be driven by a differentiation strategy. A consequence of this is that intangible resources of the firm, such as intellectual property, are more likely to lead to a sustainable competitive advantage over rivals than tangible assets.

A successful differentiation strategy through R&D expenditures results in subsequent first-mover decisions. That is, if a first-mover opportunity arises for the food manufacturer as a result of their R&D then it confers the right, but not an obligation, to develop a product (and/or perhaps even an entire market) within a future time period. To obtain this right for management the firm paid a premium in the form of R&D expenditures committed during prior time periods.

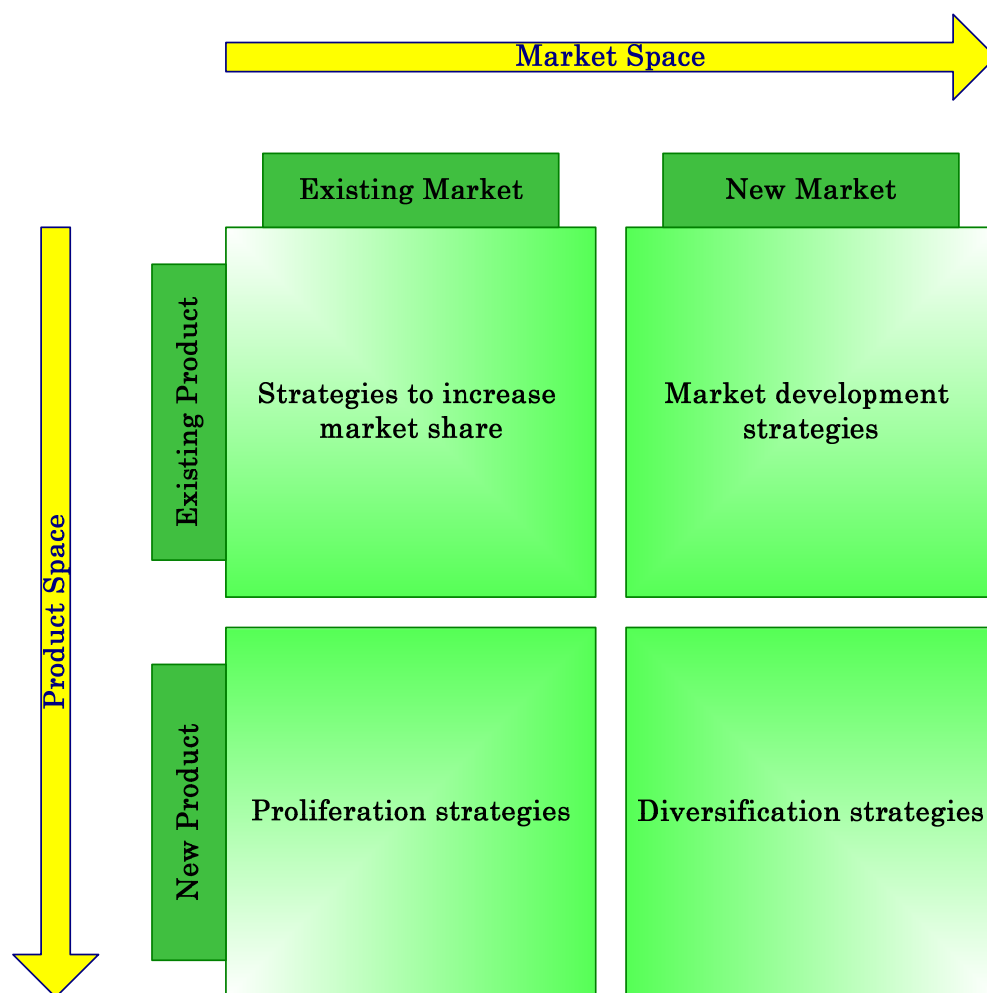
The objective of this research is to investigate food product innovation in the context of the first-mover strategy among food manufacturers within agrifood supply chains. The emphasis of the analysis is on developing a useful metric for tracking new product development in the context of first-mover strategy. Entropy is introduced as a novel and useful means of examining first-mover strategy and new product development (NPD) in general. Understanding the complexities of the first-mover strategy and tracking NPD with entropy metrics holds promise for enhancing the analysis of agrifood supply chains and assisting firms in deciphering first-mover strategies of their rivals.

There is modest development of first-mover advantages compared to second-movers based on economic theory (Lieberman and Montgomery; Lieberman). Some analysts have examined first-mover with regard to barriers to entry (Briggeman, et al). There also is some development of diffusion and sustainable strategies with regard to food product innovation (Bröring; Shanahan, Sporleder, and Hooker). Integrating these concepts with the first-mover theory, particularly with a focus on

tracking new food product innovation using entropy metrics, is the unique contribution of this research.

## Firm Strategy by Markets and Products

A general view of firm strategy may be based on the combination of products and markets (Ansoff). The managerial strategy, in a simplified way, becomes evident when considering the products the firm either currently has or may develop combined with the current markets for the products or markets the firm may develop for its products, Figure 1. For example, when the relevant circumstance is to manage current or existing products in current or existing markets, the general strategy is to increase market share. Thus, tactics employed are devoted to enhancing market share for these products.



**Figure 1:** Firm Strategy Matrix across Market and Product Alternatives

Another circumstance may be the managerial challenge of marketing existing products in new markets. For example, a nutraceutical drink initially marketed to health care professionals in hospitals and nursing homes may be rolled out to the general public and marketed through retail grocery stores. Providing customer information on the product's benefits to this market segment is clearly different compared with the existing market. The managerial challenge here is to deploy strategies that will enhance sales of the product in this new product space.

In NPD, strategies also differ depending on whether the market is established or new. In the cell denoting established markets of the strategy matrix (Figure 1), the strategy is to proliferate products by deploying specific strategies such as line extensions or re-positioning products within existing markets. Introducing a new product in a new market is the most uncertain challenge. Here the predominant strategy is diversification. New products aimed at new markets diversify the portfolio of the firm (Ansoff; Madique and Zirger).

### **First-mover Strategy**

First-mover firms in a market are thought to have an initial advantage of high price while second-mover firms have the advantage of lower costs (Montgomery and Lieberman). Pioneer firms face falling prices from firms that enter the market with imitations. Pioneer firms make their first-mover advantage sustainable through developing superior resources and capabilities compared to second-movers (Briggeman, Gunderson, and Detre).

Pioneer firms are first-movers typically thought to gain advantages over rivals from being first. These first-mover advantages may include strong image and reputation, brand loyalty, technological leadership, and being in an advantageous position relative to the 'learning curve' involved in managing a specific product or process innovation. Lieberman and Montgomery argue that there are three primary advantages that may accrue to pioneer firms: the preemption of rivals, the imposition of switching costs on buyers, and the benefit that accrues from being seen by customers as a technological leader compared to rival firms. Second-mover or follower firms have the advantage of lower costs through less expensive imitation of first-mover products or processes and the resolution of market or technological uncertainties faced by first-movers. In the aggregate, market pioneers deploy innovative products or processes with high initial costs and risks, but yield high potential returns. This also implies that second-movers or followers experience lower costs because imitation is less expensive than innovation.

Other potential advantages to second-movers include the ability of followers to free-ride on the first-mover's pioneering costs (such as the expense of gaining regulatory approvals, informing potential buyers of the innovation's advantages, and generally developing the infrastructure necessary to support commercializing the innovation).

Another factor may be the ability of followers to capitalize on first-mover mistakes and operate with less market or technological uncertainty when compared to the first-mover (Kerin, Varadarajan, and Peterson).

Capture and sustainability of first-mover advantages are related to complementary assets (Teece, 1986). Commercialization of innovation requires linking with complementary assets such as marketing expertise, brands, and logistics and supply chain networks, all in support of the innovation. In general, a firm's competitive advantage is a function of the unique organizational skills that determine how it combines and orchestrates assets over time (Teece, 1992). The extent to which a new product innovation can be mastered by existing complementary assets depends on the degree of innovativeness. Following Veryzer, product innovations can be distinguished along the dimensions "technological capabilities" and "market capabilities." Depending on the degree to which an innovation requires new capabilities, it may create conflicts within the existing firm. This view can be extended to include the capability requirements of an innovation on the customer side or even along the entire value chain (Bröring, Leker, and Rühmer). The more disruptive an innovation is from a customer's view, the more assets need to be changed; hence, the less likely is the adoption of that innovation. This is because the customer may not want to build complementary assets to make adopting the innovation feasible (in case of B2B markets), or the customer may not want to invest in extra search and information costs (in case of B2C markets). Sustainability may depend on the nature of the idiosyncratic investments induced by the innovation as well as the aggregate portfolio of tangible and intangible assets possessed by the first-mover firm (Teece, Pisano, and Shuen). The factors influencing capture and sustainability of economic rents not only include complementary assets required to support commercialization but also the nature of the technology (the complexity of the technology) and the legal protections that may be available for insulating the technology from second-movers through patents, copyrights, or trademarks.

The strength of appropriability regimes also may be a factor in determining the sustainability of economic rents to innovators (López and Roberts). Appropriability refers to the ability of various stakeholders to retain the economic rents generated from the commercialization of an innovation. Weak appropriability regimes imply that stakeholders will have difficulty in capturing sustainable economic rents from their innovation. Economic rents from commercializing an innovation are potentially shared among the innovator, customers buying the innovation, suppliers to the innovation, and second-movers or followers (Teece, 1986). Commercializing innovation by firms that lack complementary assets, or in the event that only 'generic' general-purpose assets are required, leads to weak appropriability.

Food products are in the experience goods category. Empirical evidence indicates that first-mover firms in experience goods tend to shape consumer tastes and

preferences in favor of the pioneering brand (Robinson, et al). Such preferences often are sustainable for the pioneering product. First-mover strategy is a common dilemma for managers and has special importance when the product is in the experience goods category. A priori, weak appropriability regimes are likely to characterize new product innovation by food manufacturers partly because they are manufacturing experience goods. The exception to this generalization about weak appropriability regimes may be when food manufacturers already possess one or more category-dominant brands. If the new product innovation is then introduced as a brand extension, strong appropriability may better characterize the situation.

In the context of the product/market strategy matrix, Figure 1, the cells that represent first-mover situations include all but the existing product-existing market cell. That is, first-mover strategy may be deployed by firms either through introducing new products or developing new markets. For example, a food manufacturer that develops a new organic product after developing a conventional product in the same category would be characterized within the product proliferation cell of the matrix. The new product into new markets cell is the most uncertain and potentially the highest relative product launch cost among the four cells.

## **Entropy Metrics for Tracking Food Product Innovation**

Entropy metrics are based on probability distributions and are appropriate for use in analyzing phenomena whenever the target of interest is a heterogeneous population that can be grouped into meaningful categories (Theil). Entropy metrics are employed in a wide variety of calculations in both social and physical sciences. For example, entropy has been used as a measure of firm diversification in the management literature (Hoskisson et al).

The typical analytic measure employed for assessing first-mover is market share. The entropy metric has useful features, compared to simple market shares, because of the disaggregation properties of the metric. Specifically, total entropy can be disaggregated into between-set and within-set entropy measures. This is a convenient feature when applied to food products because data are available for several levels of aggregation, such as product line and more aggregated classifications such as food categories, industry sectors, and even national boundaries. To illustrate, suppose the analytic target of interest is plant sterols (a cholesterol-lowering ingredient). New product development may include plant sterols in product lines such as rye bread, yogurt, and margarine. These product lines are typically aggregated into broader product categories such as bakery and dairy. The power of entropy is the between-set and within-set disaggregation. For this illustration, the between-set entropy would be bakery compared to dairy, while the within-set entropy would be yogurt compared with margarine. The entropy metrics thus coincide with normal and meaningful units of analysis and

consequently provide more information-rich measures (the appendix to this article provides a discussion of, and formal definition for, between-set and within-set entropy). A strategist attempting to analyze new product development in sterols would be keenly interested in how rapid and pervasive NPD is between these sets as well as within these sets. Further, the strategist might calculate the decomposed entropy metrics at time  $t$  and  $t+1$  to provide insight into the dynamics of sterol ingredient NPD. If one level of aggregation is the firm level, then between-set and within-set entropy metrics also could help monitor sterol ingredient NPD by firm and product line.

To illustrate the utility of entropy in tracking NPD, the trends in new organic food product development are tracked here to assess which innovations are using particular combinations of promotional claims as expressed on product labels. Each food category is a mutually-exclusive element of a particular food industry sector.

### *Tracking Organic NPD*

Organic adoption by food processors (*process innovation adoption*) can be observed by tracking new processed food product lines released into a given market and determining which product lines are using an organic promotional claim (as determined by the informational content of product labels). Use of an organic promotional claim on a new product line implies that the food manufacturer's product/brand manager made a decision concerning whether or not to adopt organic practices.

The product/brand manager's decision to adopt organic practices is a function of factors that maximize the expected benefits from adoption and minimize anticipated costs of adoption. Expectations (the likelihood of earning a given target return) and anticipations (the cost of process innovation adoption given the earning's expectation) are not directly controllable by the adopter. They are exogenous to the food manufacturer. Expectations and anticipations can be influenced by the expected consumer demand for product innovation (thus, the demand for a process innovation is derived from the demand for the product innovation), the current and future actions of potential competitors and the actions of suppliers of the process innovation's inputs. Regulation also influences expectations and anticipations.

For example, the National Organic Program (NOP) was initiated in 2002 by the U.S. Department of Agriculture (USDA) with the intent of defining what it means to be *organic* and to establish a third-party voluntary quality assurance certification standard nationally. The goal of NOP is to substantiate and standardize organic labeling to provide all economic agents in the organic market an assurance of product quality. The NOP also substantiates the certification of multi-ingredient processed goods using a ranked four-tiered labeling system that encodes the relevant product by its level of content of organic ingredients, which include:

- *100% Organic*
- *Organic* (contains at least 95% organic)
- *Made with organic ingredients* (contains at least 70% organic)
- *Some organic ingredients* (contains less than 70%)

Only the first two levels can use the official USDA organic seal on the front of the label. Regulation forbids the use of the word 'organic' on the front panel of products that only qualify for the last level of NOP certification. This may effectively nullify the potential adopter's expected benefits from adopting organic production practices. The benefit of adopting NOP requirements and qualifying for the nationally-recognized seal, for producers able to bear the initial investment costs, is the addition of a government-endorsed barrier to entry by the adopter's current and future potential competition and a substantiation of the quality of the adopter's product line. For the manufacturer, this benefit strengthens what otherwise might be characterized as a weak appropriability regime.

It is expected that consumers are willing to pay a higher price for new organic product lines bearing the USDA seal, yet it is uncertain as to whether consumers perceive a difference between *100% Organic* and *Organic* (or *Made with organic ingredients* and *Some Organic Ingredients*) (Hooker et al). It also is expected that the anticipated investment costs of adopting organic production practices is positively related to the level of organic ingredient content in the adopter's new product line. These expectations suggest that since the likelihood of earning a given target return is lower at the *100% Organic* level (due to uncertainty) and the expected cost at the *100% Organic* level is relatively the highest among the set of organic levels, an anticipated evolution of adoption would be an increasing share of the organic product innovations released into the market claiming Organic and/or only exert enough effort to achieve the 95% organic content threshold to qualify for the differentiating seal.

Uncertainty decreases over time due to the learning effects typical in innovation diffusion systems and the accumulating nature of information within these systems (Shanahan, Hooker, and Sporleder). Specifically, expectations about potential net earnings from adoption increase due to continued information gathering about the extent of the process innovation's market success. Thus, it is expected that the share of the organic product innovations released into the market claiming *100% Organic* will increase over time, yet at a lower rate of adoption relative to the *Organic* level. The rates of adoption among the lower two levels are expected to have decreased over time, as learning of the disadvantages of these marketing strategies' becomes increasingly apparent. Thus, an increasing share of the adoptions will bear the USDA organic seal.

The rate of process adoption is defined as the sum of all process innovation adoptions by all product line managers in all specified product categories at a



particular point in time. Useful product category specifications include brand, company, industry of origin, industry sector of origin, and food-type category (e.g. milk, cheese, yogurt, bread products, and cola). Product lines can also be aggregated into geo-space groupings, such as groupings by the origin region of production or distribution and market regions (where the product line is primarily sold). For the purposes of this study, product lines are aggregated up to food-type categories and then further aggregated up into an industry sector, where each food category is an exclusive element of the industry sector. For the purposes of this research, similar food manufacturers are aggregated into food-type categories (which roughly approximate the firm's industry).

Relative adoption rate variance across food categories and industry sectors is a function of the characteristics of the adopter set and the external environment. It appears likely that expected benefits and anticipated costs from the adoption of a given process innovation will vary across food manufacturers and food sectors. Further, adoption may be influenced by market structure, consumer demand, and the power of suppliers. In turn, there is no a priori reason to assume that rates of adoption across food categories will be the same. Certain food categories will be more innovative relative to others. However, due to inter- and intra-industry learning, uncertainty tied to the expected net benefits from adoption of organic practices will decrease over time and, given that the process innovation proves a sustainable advantage, adoption rates across food categories and industry sectors should converge over time. Thus, it is expected that the relative variance in process innovation adoption rates across food categories and industry sectors will decrease over time.

### *Entropy Metrics Applied to Organic NPD*

Designing entropy metrics to analyze food innovation, such as organic NPD, facilitates a more sophisticated framework that permits categorical decomposition; a metric unavailable in simpler statistical comparisons. Entropy metrics facilitate an n-dimensional distribution of product innovations over a defined space at particular point in time. These metrics can capture spatial dispersion of product characteristics by indicating product variety and product category specialization *simultaneously*. This is a powerful and novel trait for any metric to possess. More detail on the specific methods of entropy calculation is provided in an appendix to this manuscript.

Using entropy metrics enhances the ability to indicate the extent of n-dimensional variety at particular moments of time and allows for categorical decomposition analysis. There have been many uses of entropy metrics in industrial organization and technical change (innovation) investigations (Sporleder, Franken). Entropy statistics are based on the properties of any probability distribution and are

suitable for use in studying phenomena at any population level of heterogeneous entities that are naturally grouped into categories (Franken).

Suppose the following events are observed:

$X_m$  = The event that a product line innovation is organic at organic level  $m$  where  $m =$

- 1 if *100% Organic*
- 2 if *Organic*
- 3 if *Made with organic ingredients*, and
- 4 if *Some organic ingredients*

Each  $X_m$  can be aggregated into mutually exclusive sets of related event variants;  $W_k$ , is the event that a product line innovation is organic at organic level  $k$  where  $k = 1$  if  $m \leq 2$  and  $k = 2$  if  $m > 2$ . When  $k = 1$ , the product line is able to bear the USDA organic seal. The probability of  $X_m$  is

$$(1) P_m = \sum_{n=1}^N P(X_m \cap Y_n) = \sum_{n=1}^N P_{mn}$$

and the probability of  $W_k$  is

$$(2) P_k = \sum_{m \in k} P_m = \sum_{m \in k} \sum_{n=1}^N P(X_m \cap Y_n) = \sum_{m \in k} \sum_{n=1}^N P_{mn}$$

where  $Y_{ie}$  is the event that a product line innovation is organic and is of food type  $n$  where  $N = 47$ , the number of food type categories  $n$ . The probability of  $Y_n$  is

$$(3) P_n = \sum_{m=1}^M P(X_m \cap Y_n) = \sum_{m=1}^M P_{mn}.$$

The probability that a given combination of event variants occurs in a particular moment in time is calculated by taking the ratio of the total number of occurrences of the event relative to the total number of adoptions at a defined time. Thus, the probability an organic adoption is  $X_m$  and  $Y_n$  is  $P_{mn} = P(X_m \cap Y_n)$ , and the probability an organic adoption is  $W_k$  and  $Y_n$  is  $P_{kn} = P(W_k \cap Y_n) = \sum_{m \in k} P(X_m \cap Y_n)$ .

In this study, conditional entropy metrics are calculated which measure entropy in one dimension *given the occurrence of a particular variant of another dimension*. For example, the following conditional entropies are calculated for this particular study:

$$(4) \text{ Conditional Entropy in } X \text{ given } Y_n: H(X | Y_n) = \sum_{m=1}^M \frac{P_{mn}}{P_n} * \log_2 \frac{P_n}{P_{mn}}$$

$$(5) \text{ Conditional Entropy in } Y \text{ given } X_m: H(Y | X_m) = \sum_{n=1}^N \frac{P_{mn}}{P_m} * \log_2 \frac{P_m}{P_{mn}}$$

$$(6) \text{ Conditional Entropy in } Y \text{ given } W_k: H(Y | W_k) = \sum_{n=1}^N \frac{P_{kn}}{P_n} * \log_2 \frac{P_n}{P_{kn}}$$

$$(7) \text{ Conditional Entropy in } W \text{ given } Y_n: H(W | Y_n) = \sum_{k=1}^K \frac{P_{kn}}{P_k} * \log_2 \frac{P_k}{P_{kn}}$$

Average conditional entropy is equal to the weighted average of conditional entropies. The average conditional entropies used in this particular study are:

$$(8) \text{ Average conditional entropy in } X \text{ given } Y: H(X | Y) = \sum_{n=1}^N P_n * H(X | Y_n)$$

$$(9) \text{ Average conditional entropy in } W \text{ given } Y: H(W | Y) = \sum_{n=1}^N P_n * H(W | Y_n)$$

As stated above, absolute rates of adoption across organic content levels, food categories and industry sectors will vary inherently because the expected benefits and the anticipated costs of adoption of a given process innovation and the adopter's external environment will vary. As a result, absolute entropy measures over time also will vary but provide sparse additional information pertaining to changes in adoption rates. To control for changes in absolute adoption rates over time and to observe only changes in adoption rate variance across event variants, relative entropy metrics are needed (Sporleder). Relative entropy can be calculated from any absolute entropy measure as follows:

$$(10) R(\dots)_t = \frac{H(\dots)_t}{\log_2 N_t},$$

where  $\log_2 N_t$  is the maximum possible absolute entropy in time t. Decreasing relative entropy over time implies that adoption rates are increasing in variance across event variants and increasing relative entropy implies that adoptions rates are decreasing in variance across event variants. Using equation 10, relative entropy metrics per time period are derived so as to empirically test relative adoption rates across a specific dimension are behaving in accord with a priori reasoning. Relative entropy may be calculated for any particular dimension, set of dimensions, or across a particular dimension given the occurrence of a particular variant of another event dimension. A linear functional form is specified for each proposed relationship between relative entropy and time unless otherwise noted.

## Entropy Metric Results for Organic NPD

### Data

The dynamic Mintel/GNPD database ([www.gnpd.com](http://www.gnpd.com)) lists new food and consumer product information, including label pictures for goods on sale in 49 countries. These data consist of a total global population of over 320,000 innovations since the year 2000 and a total U.S. population of over 57,000 innovations as of July 2006. A simple search function can separate products using certain quality claims with results including: product name, description, time of product release, variants in product characteristics (flavors, sizes, etc.), ingredients and nutritional information, food categories and subcategories (which closely correlate to food manufacturing industries), distribution channels for the new product, and price in local currency and Euros. There are 1,761 new U.S. organic food products within the 47 chosen food categories. These data are used to empirically estimate entropy metrics for organic food products in the United States. Regressions empirically test selected hypotheses regarding innovation, the role of innovation propagators, and first-mover strategy. Table 1 reports the cumulative number of organic adoptions per food category and by level of organic content during all time periods.

**Table 1.** Cumulative Number of Organic Adoptions per Food Category and by Level of Organic Content; All Time Periods

Food Category	100% Organic	Organic >95%	Made w/ Organic 95% to 70%	Some Organic <70%	Total Organic Adoptions per Food Category	$R(X/Y_n)$
Baking Ingredients & Mixes	0	24	9	12	45	0.265
Bread & Bread Products	0	20	20	24	64	0.263
Butter & Yellow Fats	0	4	1	1	6	0.484
Cakes, Pastries & Sweet Goods	0	5	6	10	21	0.346
Cheese	0	15	13	9	37	0.298
Chilled Desserts	0	2	0	1	3	0.579
Chocolate Confectionery	2	20	20	12	54	0.299
Coffee	5	13	10	32	60	0.286
Cold Cereals	0	56	17	5	78	0.171
Cooking Sauces	0	16	11	9	36	0.298
Cream & Creamers	0	2	1	0	3	0.579
Dressings, Vinegar & Mayonnaise	0	22	24	17	63	0.263
Dry Soup	0	0	2	1	3	0.579

**Table 1 Continued.**

<b>Food Category</b>	<b>100% Organic</b>	<b>Organic &gt;95%</b>	<b>Made w/ Organic 95% to 70%</b>	<b>Some Organic &lt;70%</b>	<b>Total Organic Adoptions per Food Category</b>	<b><i>R(X/ Yn)</i></b>
Eggs & Egg Products	1	7	3	7	18	0.413
Frozen Novelties						
Impulse Ice Cream	0	4	2	1	7	0.491
Fruit	6	22	5	4	37	0.309
Fruit Snacks	1	7	2	3	13	0.451
Hot Cereals	0	11	0	1	12	0.115
Malt & Other Hot Beverages	0	3	2	6	11	0.415
Meat Products	0	8	2	6	16	0.351
Meat Substitutes	0	11	14	10	35	0.306
Milk	0	29	19	8	56	0.245
Nuts	0	2	3	2	7	0.554
Oils	3	11	14	12	40	0.346
Pasta	2	29	28	13	72	0.267
Pasta Sauces	0	16	7	3	26	0.277
Pickled Condiments	0	0	3	4	7	0.351
Potato Products	0	4	0	1	5	0.311
Rice	1	12	6	4	23	0.361
RTD Iced Tea	0	3	0	13	16	0.174
RTD Juices & Juice Drinks	4	63	15	19	101	0.221
Savory Biscuits/Crackers	0	16	11	20	47	0.278
Savory Spreads	0	13	3	9	25	0.299
Savory/Salty Snacks	1	26	32	21	80	0.260
Seasonings	2	7	10	10	29	0.375
Snack/Cereal/ Energy Bars	0	31	15	21	67	0.251
Snack Mixes	0	8	3	4	15	0.373
Stuffing, Polenta & Other Side Dishes	1	7	9	2	19	0.378
Sugar Confectionery	1	11	2	6	20	0.357
Sweet Biscuits/Cookies	0	22	15	23	60	0.264
Sweet Spreads	1	32	22	21	76	0.262
Table Sauces	0	30	19	7	56	0.239
Take Home Ice Cream	1	3	14	4	22	0.327

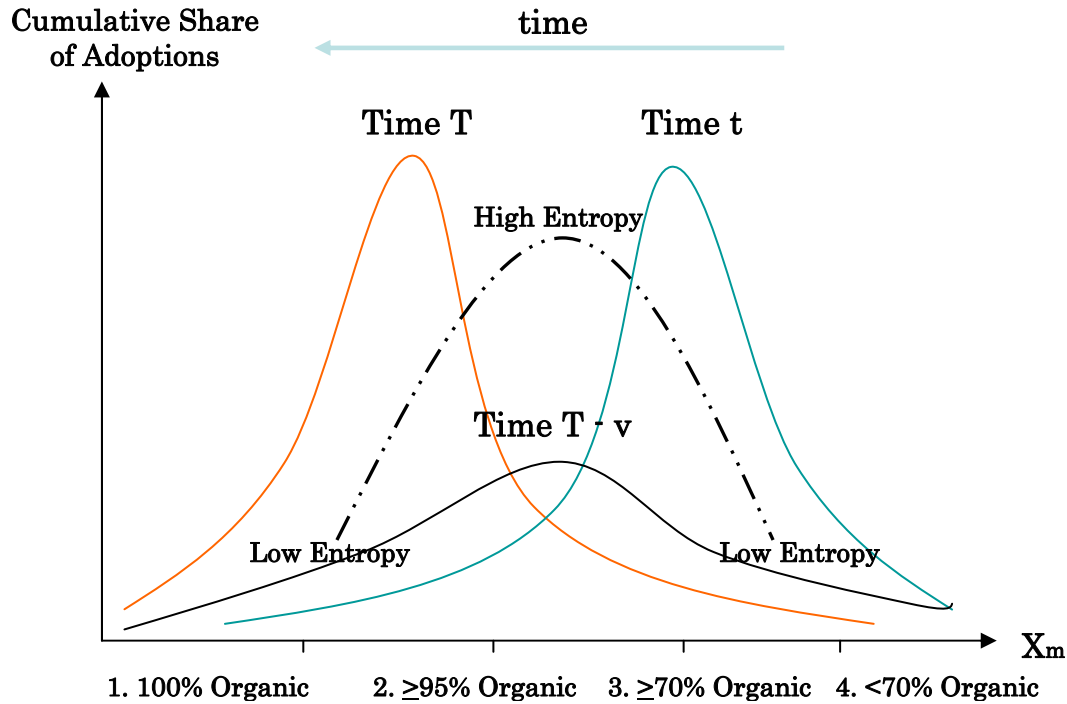
Table 1 Continued.

Food Category	100% Organic	Organic >95%	Made w/ Organic 95% to 70%	Some Organic, <70%	Total Organic Adoptions per Food Category	$R(X/Y_n)$
Tea	3	22	35	31	91	0.264
Vegetables	6	46	26	4	82	0.233
Wet Soup	1	33	17	4	55	0.233
Yogurt & Probiotic Drinks	0	14	22	6	42	0.263
<b>Total Organic Adoptions per Organic Level</b>	<b>42</b>	<b>762</b>	<b>514</b>	<b>443</b>	<b>1761</b>	

### *Temporal Trends in Relative Average Conditional Entropy*

Relative average conditional entropies,  $R(X/Y)$  and  $R(W/Y)$ , are expected to initially increase over time, reach a maximum value at a particular time, and then decrease thereafter. This reflects the organic food industry's temporal shift away from non-seal qualifying process adoptions and toward NOP seal qualifying adoptions. Prior to 2002 organic product innovations were not certified because the process innovation was not yet introduced. After 2002, more product innovations will display the seal, reflecting product/brand managers' increasingly certain expectations of rising benefits and lower costs of using the differentiating seal. The expectation is that there will an increasing number of new organic processed foods eligible to use the NOP seal over time, evident in an increasing clustering of adoptions at the 95% organic content level and a de-clustering of non-seal adoptions over time. The expected temporal trend in U.S. organic adoption among food products can be depicted graphically, Figure 2.

Given the above relative average conditional entropies hold, the relative average conditional entropy in  $X$  given  $Y$  and the relative average conditional entropy in  $W$  given  $Y$  over time will reflect the temporal shift away from lower organic qualification levels and toward seal-certified organic process adoptions, independent of the initial food category. Thus, the relative average entropy in  $X$  given  $Y$  and the relative average entropy in  $W$  given  $Y$  initially will be relatively low-- reflecting that most organic adoptions will not have the seal. Then entropy will increase, as early adopters are just beginning to learn of the certification process, and will reach a local maximum entropy at some point within the observed time period. Then entropy decreases thereafter as information pertaining to organic seal compliance has effectively diffused through the industry and increases a given organic adopter's ease of seal qualification.



**Figure 2.** Shift in Cumulative Share of Organic Adopters from Non-Seal Qualified Organic Adoptions to Seal Qualified Organic Adoptions over Time

Below are the specifications used to explore the correlation between the relative average conditional entropy in  $X$  given  $Y$  and the relative average conditional entropy in  $W$  given  $Y$  and time, respectively.

$$(11) R(X | Y)_t = \alpha_{X|Y} + \beta_{1X|Y} * t + \beta_{2X|Y} * t^2$$

$$(12) R(W | Y)_t = \alpha_{W|Y} + \beta_{1W|Y} * t + \beta_{2W|Y} * t^2$$

where  $\beta_{1X|Y}$  and  $\beta_{1W|Y} > 0$ ,  $\beta_{2X|Y}$  and  $\beta_{2W|Y} < 0$  and each time period is the number of quarters since the inception of the National Organic Program (15 quarters as of May 2006).

Results of the linear models, estimating the temporal relationship of each relative conditional entropy metric is reported in Table 2. The coefficients of determination (adj.  $R^2$ ) of the relative average conditional entropy in  $X$  given  $Y$  model is 0.24 and the relative average conditional entropy in  $W$  given  $Y$  is 0.23. The reported F statistics for the relative average conditional entropy in  $X$  given  $Y$  is 3.20 and the relative average conditional entropy in  $W$  given  $Y$  is 3.08. The coefficients describing the change in the relative average conditional entropy  $R(X/Y)$  and  $R(W/Y)$  given a change in time (0.0075 and 0.0061, respectively) and the relative

**Table 2.** Results of the Entropy Temporal Trends

Liner Model	$\alpha$	$\beta_1$	t-stat	$\beta_2$	t Stat	F Stat	Adj. R <sup>2</sup>
$R(X/Y) = f(t, t^2)$	0.1171	0.0075	1.70	-0.0006	-2.09	0.08	0.24
$R(W/Y) = f(t, t^2)$	0.0621	0.0061	1.95	-0.0003	-1.54	3.08	0.23
$E(X) = f(t)$	3.0927	-0.0407	-5.72			32.69	0.69
$E(W) = f(t)$	1.7991	-0.0321	-7.13			50.83	0.78
$R(X/Y_n) = f(\text{CUMA}_n^*)$	0.4233	-0.0026	-5.26			34.06	0.42
$R(Y/W_1) = f(t)$	0.1054	0.0233	7.20			51.85	0.78
$R(Y/W_2) = f(t)$	0.5608	-0.0247	-7.43			55.28	0.79

\* CUMA<sub>n</sub> = Cumulative Number of Adopters in Food Category i

average conditional entropy  $R(X/Y)$  and  $R(W/Y)$  given a change in time squared (-0.0006 and -0.0003, respectively) are found not statistically different from zero at the 95% level. These results provide modest evidence that the relative average conditional entropy in  $X$  given  $Y$  and  $W$  given  $Y$  did shift along the organic level dimension in the expected direction, away from non-NOP seal qualified organic adoptions and toward seal-qualified adoptions. However, endogenous factors influence the adoption decision, as evident in the degree of variation unexplained, and confirmation that the a priori shift is going in the expected direction needs further empirical verification.

### *Temporal Trends in Adoption Clustering*

The above statistical relationship between  $X$  given  $Y$  or  $W$  given  $Y$  and time does show the change in adoption clustering activity along the  $X/W$  dimension, but it does not reveal anything about the change in locality along the  $X/W$  dimension. In an effort to verify that the adoption clustering activity along the  $X/W$  dimension is shifting in the expected direction, temporal change in expected value or location in  $X$  and  $W$  are explored. Specifically, the trend relationship of the expected organic adoption location on the  $X/W$  dimension per time period is calculated. The time period covers the number of quarters since the inception of the National Organic Program (15 quarters prior to and including May 2006).

Results of the linear models describing the correlations between the expected location of organic adoptions on the  $X/W$  dimension and time are provided in Table 2. Based on the statistical results, 69% of the variation between the expected location of organic adoptions on the  $X$  dimension is explained by time and 78% of the variation in relative the expected location of organic adoptions on the  $W$  dimension is explained by time. F statistics indicate statistically significant models. In addition, coefficients describing the change in the expected location of organic adoptions on the  $X$  given a change in time (-0.0407) and the change in the expected location of organic adoptions on the  $W$  given a change in time (-0.0321) are statistically different from zero at the 95% level and exhibit the correct a priori sign. These findings suggest that the relative average conditional entropy in  $X$  given  $Y$



and the relative average conditional entropy in  $W$  given  $Y$  are shifting in the expected direction. That is, away from non-NOP seal qualified organic adoptions and toward seal-qualified adoptions.

### *Relative Conditional Entropy and the Cumulative Number of Organic Adopters*

The relative conditional entropy in  $X$  given  $Y_n$ ,  $R(X/Y_n)$ , denotes the variance or entropy in the organic level dimension in each food category  $I$ . This metric reveals whether there is clustering occurring at a particular event variant (relatively low entropy) or if organic adoptions are occurring at many levels along the organic level dimension (relatively high entropy) at a particular food category. A priori expectations are that the degree of relative conditional entropy within a particular food category is negatively related to the cumulative number of organic adopters within the particular food category. This is because higher levels of innovation imitation are expected to occur in food categories with higher levels of innovation (organic) adoptions and relatively weak appropriability regimes.

With respect to the organic case, as more organic adoptions occur within a particular food category, it is expected that later adopters will, in general, imitate early adopters and choose the same organic quality level. So, some organic adopters will choose a higher level of organic quality while others will choose to adopt a relatively lower level of organic. But over time, as more products within a particular food category enter the market, the occurrence of organic adoptions will converge onto the market's most successful organic level variant. Diminishing net benefits of adopting a particular level of organic quality per adopter is expected as the cumulative number of organic adoptions increases, due to an increase in the degree of competitive rivalry within a particular food category. However, data availability does not permit empirical tests of this particular hypothesis.

Conversely, it is possible to explore temporal trends between relative conditional entropy in  $X$  given  $Y_n$  and the cumulative number of organic adoptions per food category  $Y_n$  with the model as specified here:

$$(13) R(X | Y_n) = \alpha_{X|Y_n} + \beta_{X|Y_n} * CUMA_n$$

where  $CUMA_n$  is the cumulative number of organic adoptions in food category  $n$ ,  $\beta_{X|Y_n} < 0$  and each time period is the number of quarters since the inception of the National Organic Program (15 quarters as of May 2006).

Results of this temporal trend for relative conditional entropy in  $X$  given  $Y_n$  and the cumulative number of organic adopters per food category is in Table 2. The coefficient of determination (adj.R<sup>2</sup>) of the correlation is 0.42 and the parameter estimate is statistically significantly different from zero at the 95% level, has the correct a priori sign, and this evidence supports the a priori expectations.

### *Temporal Trends in Seal Qualified Adoption Rates*

It is expected that the variance in seal qualified adoption rates across food categories will increase over time. Thus, the likelihood that a given product innovation will bear the organic seal becomes less dependent on the industry origin of the product and there is increased diversity of organic food product types on the store shelves. To test this the relative conditional entropy in  $Y$  given  $W_k$ , when  $k = 1$ , or that the product bears the NOP organic seal, is expected to be positively related to the time and this expected relationship is explored. Also, it is expected that the variance in non-qualified adoptions across food categories will decrease over time because some product managers releasing product innovations to particular food categories will find that the obligations of seal-qualification are in excess of their firm's abilities or effort level, due to food category or industry sector-specific external constraints. To test this hypothesis, the relative conditional entropy in  $Y$  given  $W_k$ , when  $k = 2$ , or that the product does not bear the NOP organic seal, is expected to be negatively related to time. To compare adoption trends across food categories or industry sectors given a particular organic level, the analysis assumes that relative conditional entropies in  $Y$  given  $W_k$  ( $R(Y/W_k)$ ) are a linear function of time where  $\beta_{Yk}$  is the change in relative conditional entropy in  $Y$  given  $W_k$  or:

$$(14) R(Y | W_1) = \alpha_{Y|W_1} + \beta_{Y|W_1} * t$$

where  $\beta_{Y|W_1} > 0$  and

$$(15) R(Y | W_2) = \alpha_{Y|W_2} + \beta_{Y|W_2} * t$$

where  $\beta_{Y|W_2} < 0$  and each time period is the number of quarters since the inception of the National Organic Program (15 quarters as of May 2006).

As before, Table 2 contains the results of the linear models describing the correlations between each of explored relative conditional entropy in  $Y$  given  $W_k$  and time. The coefficients of determination (adj.R<sup>2</sup>) for the correlations are 0.78 and 0.79 for the relative conditional entropy in  $Y$  given  $W_1$  and the relative conditional entropy in  $Y$  given  $W_2$ , respectively. Thus, more than three-quarters of the variation in relative conditional entropies in  $Y$  given  $W_k$  are explained by time alone. The reported F statistics indicates a statistically significant relationships and this evidence supports the a priori expectations.

Most results of this preliminary design of entropy metrics are encouraging. The estimated parameter describing the change in relative conditional entropy in  $Y$  given  $W_1$  given a unit change in time has the expected positive sign and is statistically significant at a 95% level of confidence. This evidence suggests an increase in the variety of organic food products on store shelves qualifying for the NOP organic seal. In turn, the estimated parameter describing the change in

relative conditional entropy in  $Y$  given  $W_1$ , given a unit change in time, has the expected negative sign and is statistically significant at a 95% level of confidence. This further implies that some product managers releasing organic products into the market from particular food categories are finding that the obligations of seal-qualification are in excess of their ability to comply due to food category or industry (sector-specific) external constraints.

## **Conclusions and Managerial Implications**

An important aspect of food manufacturing first-mover strategy for firms is to understand the potential entrants that may develop after a firm becomes a pioneer. This analysis suggests that entropy is a useful metric for understanding the market dynamics when product innovation is a key aspect of the rivalry among firms within an industry. Because differentiation strategies are common as a means for gaining a sustainable advantage over rivals, the issue of first-mover strategy is critical to managerial understanding of the implications for R&D budgets and the theoretical relationship between R&D budgets and such factors as the role of innovation propagators.

In addition, supply chains are complex and food manufacturers' within-chain relationships are influenced by strategic planning. First-mover strategy may result in the development of different within-chain relationships. Simultaneously, first-mover strategy also may result in developing novel among-chain relationships as well. For example, recent research by one of the authors of this manuscript focuses on agrifood supply chains relative to nutraceuticals and functional foods. The analysis suggests convergence of food manufacturing and pharmaceutical industries. The supply chain relationships may evolve so that an innovative food manufacturer relies on a pharmaceutical company ingredient supplier for technological application knowledge (Bröring and Cloutier). Such cross-chain relationships carry important implications for first-mover strategy.

This research complements previous work on first-mover strategies and new product innovation which stresses the correct launch tactics, for example in Guiltinan. As the evidence about organic NPD presented here suggests, choosing the right certification scheme as a means to reduce information costs for the consumer (establishing complementary assets) appears to be an important issue to consider during product launch within a first-mover strategy. Clearly, there are several potentially important managerial implications from the research reported in this manuscript.

Finally, the development of entropy metrics useful for analyzing complex and dynamic markets, such as the agrifood industry, is in its infancy. However, there is empirical evidence reported here that at least encourages further development of the methods based on entropy metrics so that complex and interrelated levels and

categories of target markets can be better analyzed. In addition, certain entropy metrics provide insight into whether weak appropriability regimes prevail in various food sectors.

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## Appendix A.

### Calculating Entropy

Suppose that we observe event  $X_m$  out of  $M$  possible event variants. Each  $X_m$  occurs with a probability of  $P_m$ , where  $P_m \geq 0$  and  $\sum_{m=1}^M P_m = 1$  (where  $m = 1 \dots M$ ). Since  $P_m$  inversely influences the degree of surprise,  $h(P_m)$  presumes the following relationship:

$$(16) h(P_m) = \log_2 P_m^{-1}$$

where  $h(P_m)$  exponentially decreases from infinity to zero as the probability of an event variant occurrence increases. The expected degree of surprise of a probability distribution, or entropy, is:

$$(17) H(X) = \sum_{m=1}^M P_m * \log_2 P_m^{-1}$$

where it is assumed that  $P_m * \log_2 P_m^{-1} = 0$  when  $P_m = 0$  because it can be shown that  $\lim_{P_m \rightarrow 0} [P_m * \log_2 P_m^{-1}] = 0$  (Theil). Minimum entropy occurs when one event has 100% chance of occurring which means that  $H(X) = 0$ . This implies maximum concentration and minimal dispersion. Maximum entropy occurs when all  $n$  events have an equal chance of occurring and  $H(X)$  will equal

$$(18) \sum_{m=1}^M \frac{1}{M} * \log_2 M = M * \frac{1}{M} \log_2 M = \log_2 M.$$

Maximum entropy (and maximum degree of surprise) increases at a decreasing rate as  $m$  increases.

Total entropy can be disaggregated into among-set (category) and within-set (category) entropies. Suppose that each event variant  $X_m$  can be aggregated into mutually exclusive sets of related event variants  $W_k$  (i.e., a subset of  $X_m$  exclusively falls into  $W_k$ ). The probability of  $W_k$  occurring is:  $P_k = \sum_{m \in k} P_m$  where  $P_k \geq 0$  and that

$$\sum_{k=1}^K P_k = 1 \text{ (where } k = 1 \dots K \text{)}.$$

The *Entropy Decompositional Theorem* states that total entropy  $H(X)$  is equal to total between-set entropy plus the average within-set entropy (Sporleder; Theil): Total entropy is:

$$(19) H(X) = H_b(W_k) + \sum_{k=1}^K P_k * H_w(W_k)$$

Total between-set entropy is:

$$(20) H_b(W_k) = \sum_{k=1}^K P_k * \log_2 P_k^{-1}$$

and total within-set entropy is:

$$(21) H_w(W_k) = \sum_{m \in k} \frac{P_m}{P_k} * \log_2 \frac{P_k}{P_m}$$

Using (3) the extent of total spatial dispersion of all product innovations can be derived; with (4) the extent of spatial dispersion product innovations among the product categories can be derived and with (5) the extent of spatial dispersion of product innovations within each product category can be derived.

Multidimensional entropy metrics can also be derived. Suppose that we observe two events,  $X_m$  and  $Y_n$ , and there are  $M$  number of event  $X$  variants and  $N$  number of  $Y$  variants. The marginal entropies of each dimension within a total two-dimensional entropy measure are equal to the total entropy of each dimension:

$$(22) H(X) = \sum_{m=1}^M P_m * \log_2 P_m^{-1}, \quad P_m = \sum_{n=1}^N P_{mn}$$

$$(23) H(Y) = \sum_{n=1}^N P_n * \log_2 P_n^{-1}, \quad P_n = \sum_{m=1}^M P_{mn}$$

Total two-dimensional entropy is

$$(24) H(X, Y) = \sum_{m=1}^M \sum_{n=1}^N P_{mn} * \log_2 P_{mn}^{-1}$$

We can also calculate conditional entropy metrics, which measures the amount of entropy in one dimension given the occurrence of a particular variant of some other dimension. The calculation of conditional entropy statistics is similar to the calculation of within-set entropy.

Entropy in  $X$  given  $Y_m$ :

$$(25) H(X | Y_n) = \sum_{m=1}^M \frac{P_{mn}}{P_n} * \log_2 \frac{P_n}{P_{mn}}$$

Entropy in  $Y$  given  $X_n$ :

$$(26) H(Y | X_m) = \sum_{n=1}^N \frac{P_{mn}}{P_m} * \log_2 \frac{P_m}{P_{mn}}$$

The average conditional entropies are:

$$(27) H(X | Y) = \sum_{n=1}^N P_n * H(X | Y_n)$$

$$(28) H(Y | X) = \sum_{m=1}^M P_m * H(Y | X_m)$$

Average conditional entropy is always less than or equal to unconditional marginal entropy or  $H(X | Y) \leq H(X)$  and  $H(Y | X) \leq H(Y)$ .  $H(X | Y) = H(X)$  and  $H(Y | X) = H(Y)$  if and only if  $X$  and  $Y$  are independent.

### *Defining Multidimensional Entropy*

Multidimensional entropy equals the sum of marginal entropies minus expected mutual dependence and expected mutual dependence is equal to marginal entropy in a particular dimension minus the average conditional entropy in a particular



dimension given the occurrence variation in another event. Using these defined probabilities, distributions can be constructed and marginal, conditional and total two-dimensional entropy measures per time period calculated.

Total two-dimensional entropy can also be disaggregated into between-set and within-set entropies in the same manner as one-dimensional disaggregation as defined in equations (3) through (5). Suppose we wanted to aggregate the occurrence of organic adoptions at each quality level up to the occurrence of whether they receive the permission to use the NOP seal and to aggregate food categories into their respective industry sectors. Total two-dimensional entropy can be disaggregated into two-dimensional between-set entropy and two-dimensional within-set entropy using the following equations, total 2D entropy:

$$(29) H(X, Y) = H(W, Z) + \sum_{k=1}^K \sum_{l=1}^L P_{kl} * H(X, Y | W_k, Z_l)$$

Total between-set entropy:

$$(30) H(W, Z) = \sum_{k=1}^K \sum_{l=1}^L P_{kl} * \log_2 P_{kl}^{-1}$$

and total within-set entropy:

$$(31) H(X, Y | W_k, Z_l) = \sum_{m \in k} \sum_{n \in l} \frac{\sum_{m=1}^M \sum_{n=1}^N P_{mn}}{P_{kl}} \log_2 \frac{P_{kl}}{\sum_{m=1}^M \sum_{n=1}^N P_{mn}}$$





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## **Parma Agrifood Research Management Knowledge Network: PARMa KN<sup>1</sup>**

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### **Abstract**

The case focuses on the proposed development of the Parma Agrifood Research Management Knowledge Network (PARMa KN). The PARMa KN is intended to be a global network of leading professionals drawn from academia, industry, and the public sector. The proposal is for the group to be funded by the City of Parma and corporate, foundation, and individual donors. Its main objective would be to build value for society through the development of cutting-edge research, educational programs, and service activities for firms in the food and agribusiness sector. It is hoped that the new foundation will bring international expertise to food and agribusiness firms in Parma to help them to expand and remain globally competitive.

**Keywords:** consulting, trade association, industry association, SWOT, industry research

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### **IAMA Agribusiness Case 11.3**

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<sup>1</sup> This case was prepared for the Student Case Competition, XVII Annual IAMA World Forum and Symposium in Parma, Italy in June 2007 by Francesco Braga and Gregory A. Baker. The blind review of the case was coordinated by S. Andrew Starbird, a past Editor of the IFAMR.

## **Introduction**

Bernardo Ricci sat in the Executive Director's chair of the newly formed Parma Agrifood Research Management Knowledge Network (PARMa Knowledge Network or PARMa KN). Much had been accomplished in getting agreement from the organization's major donors (the City of Parma and several corporate, foundation, and individual donors) to fund the foundation. However, Ricci was taking the helm of a new organization with only a skeleton of a plan. Many of the activities in the areas of research, education, and services had been spelled out in the initial agreement. Ricci's job would be to clarify and provide more depth to the objectives and to develop a planning document to cover all aspects of the new foundation. He ran through a mental checklist of some of the key decisions that lay ahead: engage stakeholders, refine the foundation's objectives, develop an organizational structure, determine how the various activities would be financed.

He flipped on his computer and went to work. Ricci began by reviewing background documents on Parma covering economic data, the importance of traditional high value-added agri-food activities, the many challenges facing the province's economy, and the proposed scope and characteristics of PARMa KN, which he was charged with organizing and directing in an effective and sustainable manner.

## **Profile of the Province of Parma<sup>2</sup>**

### *Geography*

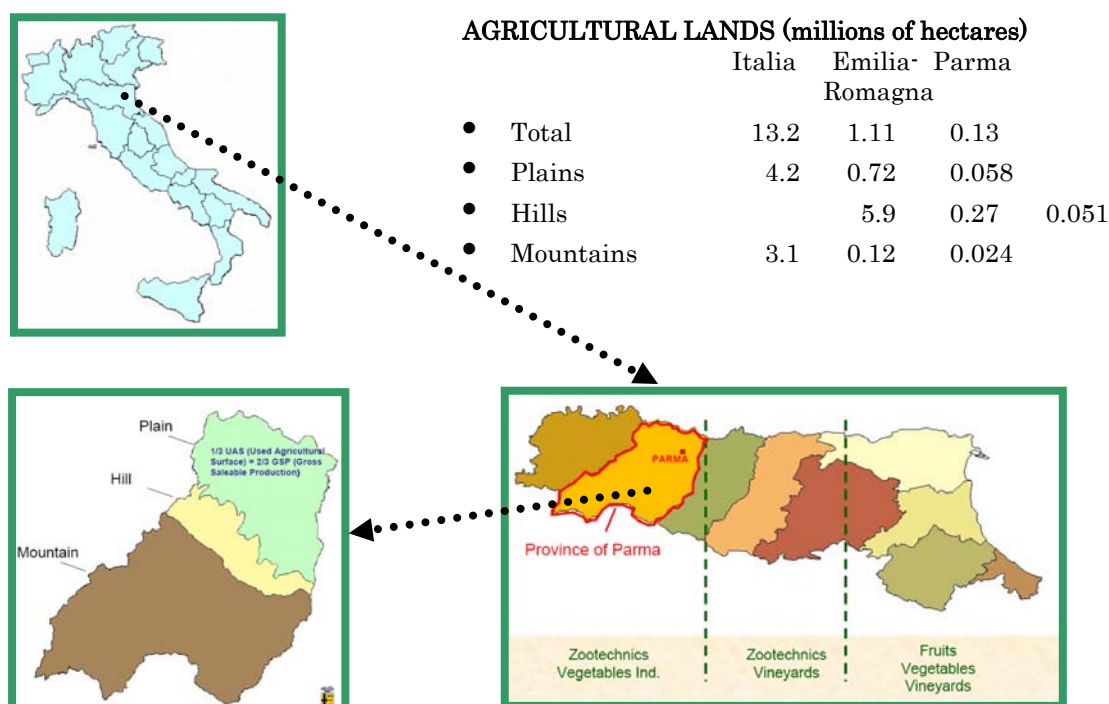
The province of Parma is situated in the Emilia-Romagna region of northern Italy. Its northern boundary is formed by the Po River, the largest river in Italy. It is favorably positioned, between three large urban areas. Bologna is approximately 60 km to the east, Milan, is about 80 km to the northwest, and Florence is about 120 km to the southeast. Parma has easy access to the Mediterranean Sea through the port of La Spezia, which is 1 hour south of Parma. The city benefits from close proximity to the highway and rail network connecting Italy to Northern Europe.

The province of Parma is flat in the north, hilly in the center, and mountainous in the south (figure 1). The availability of agricultural land in the province of Parma is shrinking and land values have increased, reflecting increasing urbanization (table 1). Figure 1 provides some descriptive data on agricultural land in the province.

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<sup>2</sup> All statistical information in this section, unless otherwise noted, was from the following publication, Parma in Cifre, (camera di Commercio, 2005), published by the Parma Chamber of Commerce.

## Parma and its Agricultural Lands



**Figure 1<sup>a</sup>.** Descriptive data on Agricultural Land in the Parma area.

**Source:** Province of Parma and other public sources, modified.

**Table 1:** Indicative average land values, Euros/Hectare, Province of Parma, 2006<sup>b</sup>

Vineyards, DOC	€60,000 - 65,000
Nursery products	€50,000 - 57,000
Cash crops and forage	€40,000 - 55,000
Vegetables	€40,000 - 55,000
Cash crops, hills and mountain areas	€9,000 - 21,000
Forests	€4,000 - 6,500
Fallow (hills and mountain area)	€5,500

**Source:** Commissione Valori Agricoli Medi (2007).

<sup>a</sup>At the end of the first quarter of 2007, 1€(Euro) was worth approximately US\$1.32; 1 hectare is approximately 2.5 acres.

<sup>b</sup> DOC stands for Denominazione di Origine Controllata, the Controlled Designation of Origin, as set out in Law 164, of Feb 10, 1992.

## People

Approximately 400,000 people live in the province of Parma, with 150,000 living in the city of Parma itself. The citizens of Parma and its province are blessed with an excellent quality of life, high average incomes, low unemployment, and many rich cultural traditions. Parmigiani, the citizens of Parma, are proud and fond of their traditions, in both the cultural and culinary fields. The Teatro Regio is one of the icons of Italian Opera; Parma, after all, is the home of Giuseppe Verdi and Arturo Toscanini. Parma is also home to Prosciutto di Parma and Parmigiano Reggiano; both have been produced here and the neighboring area for the last millennium or so. Today they represent two of the cornerstones of Italian agri-food production and exports. Despite its rather limited size, the province of Parma accounts for 40% of the Italian production of Prosciutto di Parma and 30% of the Italian production of Parmigiano Reggiano.

## Business

Striking as it may seem, given its economic importance, only about 6,000 people are employed in agricultural production, corresponding to 3% of the province's total workforce. Total agricultural production is valued at approximately €500 million, approximately 1/3 from crops, mostly cereals, and 2/3 from livestock products, mostly dairy. The province is a net importer of agricultural commodities, including, wheat, pork, and fluid milk, with imports of approximately €80 million in 2004. It is a net exporter of processed food, approximately €300 million 2004, and food industry equipment, approximately €250 million in the same year. Table 2 summarizes some key company and employment data for the agribusiness sector.

**Table 2.** Number of companies and employees, Parma province, by sector

	Total
Food Industry, number of companies, 2004:	1412
Meat processing and meat based products	375
Dairy and dairy products	363
Pastry, bakery products, desserts	340
Other food industry	349
Food Industry, number of employees, 2001	15,500
Manufacturing of food processing equipment, number of companies, 2004	779
Manufacturing of food processing equipment, number of employees, 2001	8,500

**Source:** Research department, Parma Chamber of Commerce, as reported in Parma in Cifre 2005 (Camera di Commercio, 2005).

In recent years, the province of Parma has been undergoing a process of geographical concentration and specialization in agricultural production, with increasing vertical integration of the supply chain and the consequent growth of

research, promotion, and regional development services and initiatives. This process has led to the birth of many service companies, a significant innovation in a region with a tradition in manufacturing and agriculture.

The economic activity in Parma may be described by its strong entrepreneurial dynamism, its many small and medium-sized enterprises, the use of advanced technologies and its strong heritage in agri-food businesses. The population density of more than 1 person/hectare and the positive provincial trade balance data highlight how Parma has been able to grow and prosper by specializing in adding value to agricultural commodities and by exporting high value-added, traditional agri-food products that are known the world over.

As of 2000, there were 11,000 farms in the province. The average farm is relatively small, approximately 15 hectares in the flatland and less than 9 hectares in the mountain area. However, the average farm size is growing, particularly in the flatlands with increases of 39% between 1990 and 2000 and 63% between 1980 and 2000. The number of farms decreased by 40% and 53% in the 1990-2000 and 1980-2000 time frames, respectively. Success factors to the region's agriculture include fertile ground, access to abundant irrigation water, centuries of tradition, and the value system of its rural population.

In 2004, the province of Parma was home to 46,000 companies, most of them small and medium-sized. Parma is also home to Barilla, the largest pasta maker in the world, and Parmalat, one of the largest dairy companies in Italy, which is currently undergoing reorganization following recent financial difficulties. Tourism is another important economic activity, and its importance is growing thanks to the many opportunities provided by the cultural and food traditions of the region. Parma also has a thriving university, the University of Parma, with approximately 20,000 students and several specialized research centers that are either privately or public funded.

### *Exports*

Parma's economy has undergone a significant process of internationalization. Key non-EU export markets are the US, Switzerland, and Japan. Food and agribusiness companies account for 50% of total exports from the region (23% food, 27% processing equipment). While food products are exported to high-income countries, such as France, Germany, UK, US, and Japan), food processing equipment (bottling lines, food preservation equipment, and meat and dairy processing equipment have a wider market that includes developing countries, such as Brazil and China, as well as countries developing their food production capabilities, such as Eastern European countries.

### *Other Food-related Organizations*

The European Food Safety Authority, founded in 2002, moved its headquarters to Parma from Brussels in 2005. Parma is also home to important international food fairs. The Cibus International Food Exhibition competes with Sial in Paris and Anuga in Cologne. CibusTEC is the most important fair in the food processing and packaging industry. In recent years there have been a growing number of research centers, such as the SSICA (Experimental Station for the Canned Food Industry) that have located in Parma.

### **Challenges Faced by the Food and Agribusiness Industry in Parma**

Despite the success of its high-quality food and agribusiness industry, Parma faces many challenges in maintaining its competitiveness and exploiting new opportunities. Many of these challenges are not unique to Parma, rather they are similar to those faced by other major food producing regions of the world seeking to secure their social, environmental, and economic sustainability. Some of the key challenges, in no particular order, include:

- securing the availability of flexible and competitive financing for new ventures;
- developing proper succession planning for family businesses;
- supporting and improving the effectiveness of international marketing strategies;
- effectively complying with the plethora of diverse regulations in foreign markets;
- securing compliance with EU food safety, traceability, labeling, and other regulations;
- developing effective and cost competitive currency risk management strategies;
- meeting increasingly stringent environmental quality regulations;
- managing human resource issues, including providing training to support industry competitiveness and to effectively deal with increasing government regulations;
- securing viable and vibrant new product development pipelines;
- coping domestically, and increasingly in export markets, with imitation products from lower cost producing areas; and
- securing access to and implementation of new research findings.

Many of these issues represent a particular challenge for Parma's smaller firms. These small and medium-sized businesses are typically family-run firms with a traditional emphasis on production excellence and relatively unsophisticated business processes. In some cases, the owner's adherence to tradition may serve as a barrier to obtaining modern support services. While Parma's traditional agri-food excellence is sound, it must actively develop innovative solutions to adapt to a business environment that is increasingly complex and international if it is to maintain market share and profitability.



## SWOT Analyses for Key Agribusiness Sectors

In 2006, the Province of Parma undertook a study to highlight the future opportunities and threats facing the agricultural economy of the region. This study highlighted four industries, Parma Reggiano, Prosciutto di Parma, Processing Tomatoes, and Tourism and Quality Chains. The SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) for these four sectors is highlighted in the following four figures (figures 2-5). Additionally, a SWOT analysis for the food equipment manufacturing sector provided by SPIP is included below (figure 6).

<u>Strengths</u> <ul style="list-style-type: none"> <li>• High product quality</li> <li>• High productivity of dairy farms, growing concentration</li> <li>• Geographic concentration of production area</li> <li>• Unique traditional supply chain</li> <li>• Worldwide quality image</li> </ul>	<u>Weaknesses</u> <ul style="list-style-type: none"> <li>• Marketing practices are outdated</li> <li>• Fragmented production: 223 dairies and 1632 farms</li> <li>• Large number of single-product smaller dairies, smaller farms</li> <li>• Conflicting marketing mix between producers, trade, and retail</li> <li>• Environmental regulation is an obstacle to further concentration</li> <li>• Difficulty in promoting marketing innovation at farm level</li> <li>• Most farms and dairies are single product: milk accounts for more than 90% of their production</li> </ul>
<u>Opportunities</u> <ul style="list-style-type: none"> <li>• Develop innovative, shorter marketing channels</li> <li>• Dairies: diversify production</li> <li>• Dairies: consolidation and rationalization, in particular for marketing</li> <li>• Pursue opportunities for organic certification and segmentation</li> </ul>	<u>Threats</u> <ul style="list-style-type: none"> <li>• Dairy farmers are aging</li> <li>• Farms: concentration of production in areas with higher environmental risks</li> <li>• Increasing focus on animal welfare and pollution</li> <li>• Increased regulatory pressure requiring new professional skills (e.g.: HACCP)</li> </ul>

**Figure 2.** SWOT Analysis for Parmigiano Reggiano Industry

**Source:** Province of Parma (2006), modified.

<u>Strengths</u> <ul style="list-style-type: none"> <li>• Market leader</li> <li>• Meat of high, certified quality</li> <li>• Good animal welfare measures</li> <li>• New packaging opportunities</li> <li>• Synergies in the agri-food district</li> </ul>	<u>Weaknesses</u> <ul style="list-style-type: none"> <li>• High production costs</li> <li>• Poor supply chain cooperation to coordinate supplies</li> <li>• Bargaining power of retailers</li> <li>• Single-product firms</li> <li>• Meat quality still variable</li> <li>• Worsening consumer perception</li> </ul>
<u>Opportunities</u> <ul style="list-style-type: none"> <li>• Consumers demands higher quality</li> <li>• Value-added products from different pork cuts</li> <li>• Export markets</li> <li>• Biogas and energy production</li> </ul>	<u>Threats</u> <ul style="list-style-type: none"> <li>• Increased production of generics in same geographical area</li> <li>• Water pollution issues</li> <li>• Higher production costs at farm level</li> </ul>

**Figure 3.** SWOT Analysis for Prosciutto di Parma Industry

**Source:** Province of Parma (2006), modified.

<p><u>Strengths</u></p> <p>Farm level</p> <ul style="list-style-type: none"> <li>• Integrated production, younger farmers, open to innovation</li> <li>• Highly specialized, good, efficient aggregation of supply</li> <li>• Good scientific support for innovation of varieties and cultural practices</li> </ul> <p>Processing industry</p> <ul style="list-style-type: none"> <li>• Larger companies, efficient and competitive worldwide</li> <li>• Local dedicated scientific support</li> </ul>	<p><u>Weaknesses</u></p> <p>Farm level</p> <ul style="list-style-type: none"> <li>• High land cost</li> <li>• Difficult to program crop production levels to meet industry's demand</li> <li>• Dependence on subsidies and some smaller operations</li> <li>• Limited participation in further processing</li> </ul> <p>Processing industry</p> <ul style="list-style-type: none"> <li>• Seasonality of single-product firms</li> <li>• Poor logistics infrastructure</li> <li>• Environmental concerns</li> <li>• Some smaller firms</li> </ul>
<p><u>Opportunities</u></p> <p>Farm level</p> <ul style="list-style-type: none"> <li>• Modernization and consolidation of smaller farms</li> <li>• New varieties</li> <li>• Investment to lower cost of production</li> </ul> <p>Processing Industry</p> <ul style="list-style-type: none"> <li>• Improved logistics</li> <li>• Diversify production, develop higher value-added products</li> <li>• Better collection, elaboration and use of information to support decision-making</li> </ul>	<p><u>Threats</u></p> <p>Farm level</p> <ul style="list-style-type: none"> <li>• Drop in production with a reduction in subsidies</li> </ul> <p>Processing Industry</p> <ul style="list-style-type: none"> <li>• International competition: Mediterranean countries, China</li> <li>• Reduced availability of domestic supplies</li> </ul>

**Figure 4. SWOT Analysis for Processing Tomato Industry**

**Source:** Province of Parma (2006), modified.

<p><u>Strengths</u></p> <ul style="list-style-type: none"> <li>• Three thematic roads: wines, culatello, mushrooms</li> <li>• Many smaller niches of excellence</li> <li>• Growth in the areas of teaching farms and processing firms</li> </ul>	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> <li>• Still amateurish, poor marketing, poor communication, infighting, disorganized</li> <li>• Lack of recognized quality and labeling standards for products, and standards for teaching farms and processing firms</li> <li>• Aging farm population</li> </ul>
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> <li>• Parma has great touristic appeal</li> <li>• New interest among larger segments of population</li> <li>• Possible higher level of organized tourism demand (e.g. corporate events, retreats)</li> </ul>	<p><u>Threats</u></p> <ul style="list-style-type: none"> <li>• New health and environmental regulations</li> <li>• Safety standards</li> <li>• Difficult to coordinate with tourism industry and other local establishments</li> </ul>

**Figure 5. SWOT Analysis for Culinary Tourism**

**Source:** Province of Parma (2006), modified.

<p><u>Strengths</u></p> <ul style="list-style-type: none"> <li>• Many small and medium-sized firms, flexible and responsive</li> <li>• Benefits from quality reputation of region</li> <li>• Many local processing firms that process locally grown crops</li> </ul>	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> <li>• High cost area, particularly for labor, land, utilities</li> <li>• Aging workforce</li> <li>• Lack of well-trained workers</li> </ul>
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> <li>• Increase use of technology and electronics in equipment</li> <li>• Export markets, particularly developing countries and Eastern Europe</li> </ul>	<p><u>Threats</u></p> <ul style="list-style-type: none"> <li>• Possible loss of local commodities that drive innovation</li> <li>• Increased difficulty in attracting affordable qualified labor</li> <li>• Possible loss of export sales to manufacturers in lower cost regions</li> </ul>

**Figure 6.** SWOT Analysis for Food Equipment Manufacturing Industry

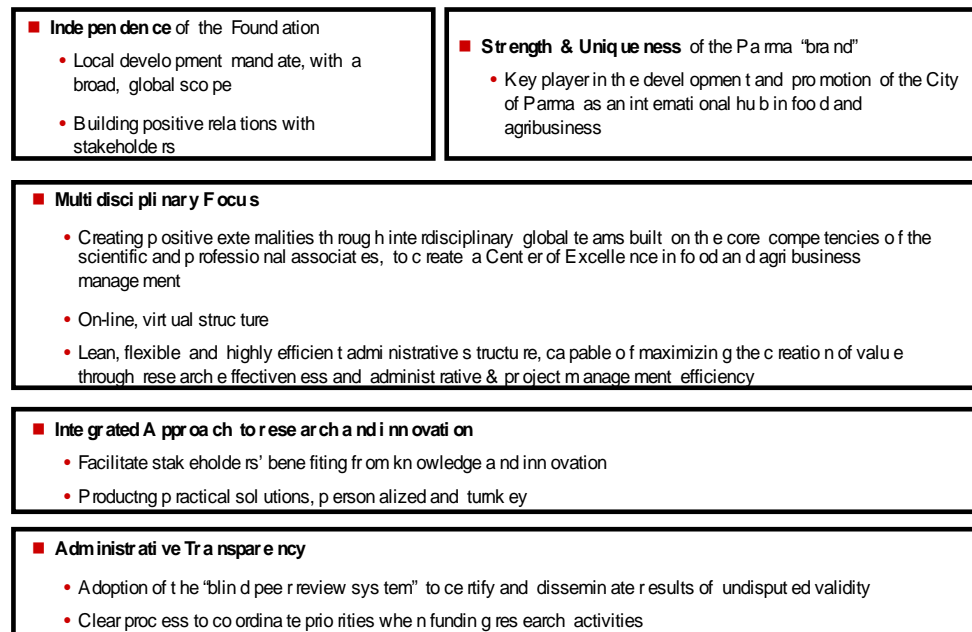
Source: SPIP (2007), modified.

## The Parma Agrifood Research Management Knowledge Network, PARMa KN

The PARMa KN is proposed as a global network of leading professionals drawn from academia, industry, and the public sector. Funded by the City of Parma and corporate, foundation, and individual donors, its main objective is to build value for society through the development of cutting-edge research, educational programs, and service activities for firms in the food and agribusiness sector. It is hoped that the new foundation will bring international expertise to food and agribusiness firms in Parma to help them to expand and remain globally competitive. This is viewed as being especially important for small and medium-sized businesses.

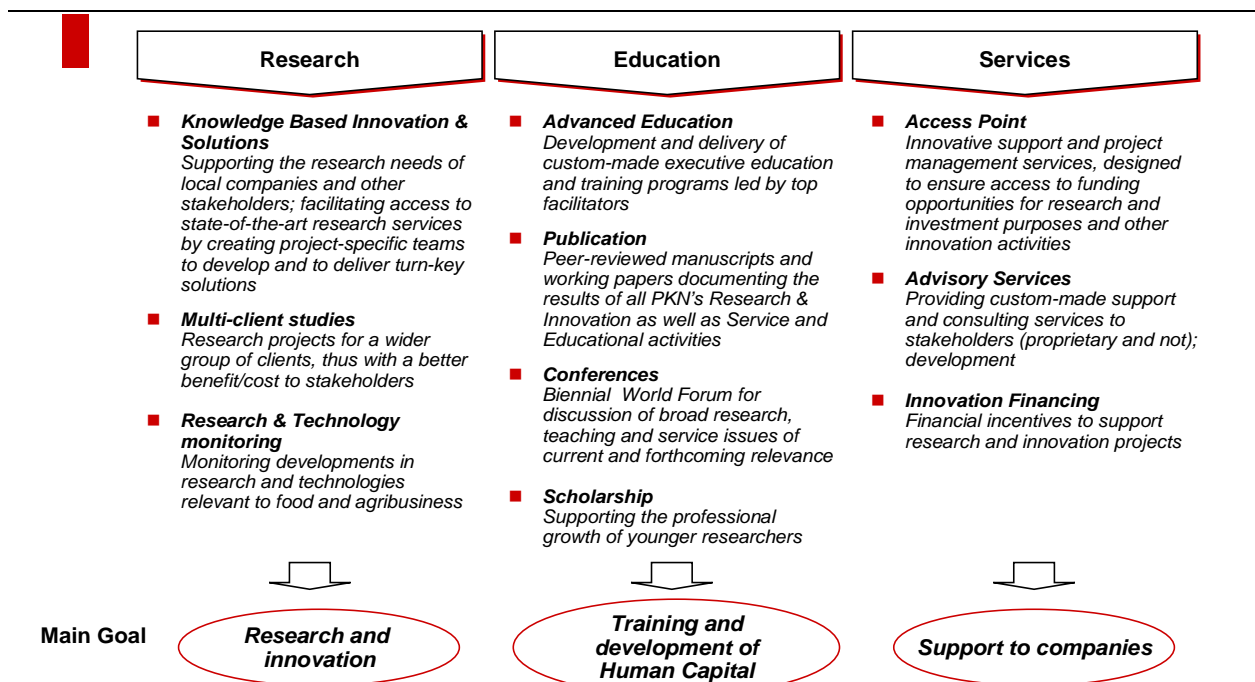
The organization will be organized as an independent foundation. Although funding details are still being negotiated, it is expected that the PARMa KN will start with an initial endowment of €5 million, a figure that is expected to grow to €10 over the next two years. The foundation is also expected to have a guaranteed annual income of €1 million initially, growing to €2-3 million after several years. Figures 7 and 8 describe some of the key characteristics of the proposed foundation.

The research activity will have two components - projects and publications. PARMa KN will also conduct research on a variety of topics to support the research needs of local companies and other stakeholders. PARMa KN will facilitate access to state-of-the-art research services by creating project-specific teams of international experts to provide innovations and information for the Parma food and agribusiness industry. A multi-client model will develop research projects for a group of clients to provide more cost effective access to research services. Research and Technology Monitoring will help companies understand the key developments in their sector, in order to be able to compete by employing cutting-edge technology and solutions.



**Figure 7. PARMa KN Qualifying Points.**

Figure 7 is provided courtesy of SPIP, modified.

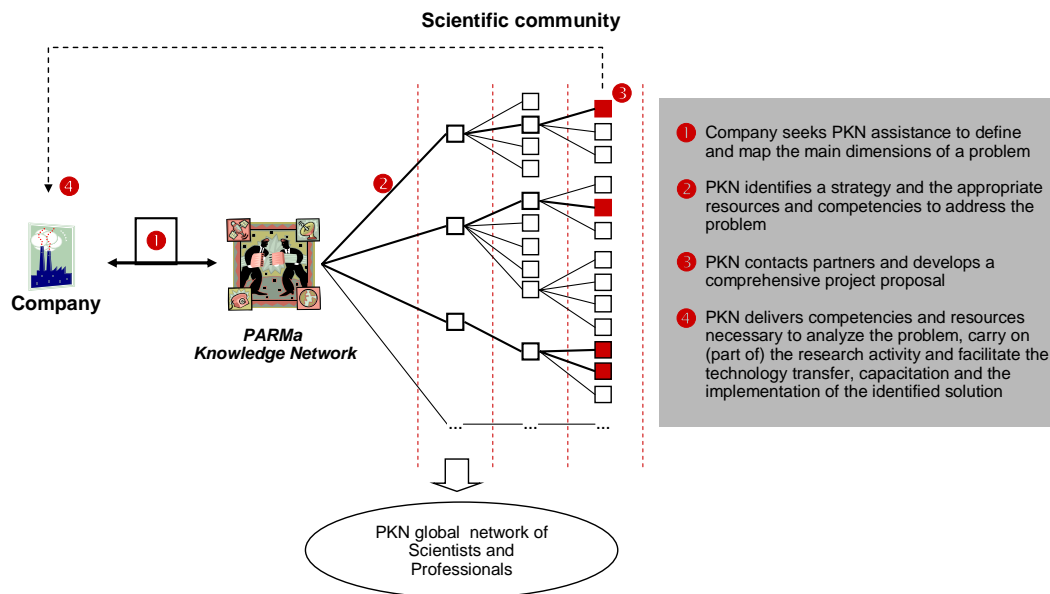


**Figure 8. PARMa KN's Research, Education and Service activities**

Figure 8 is provided courtesy of SPIP, modified.

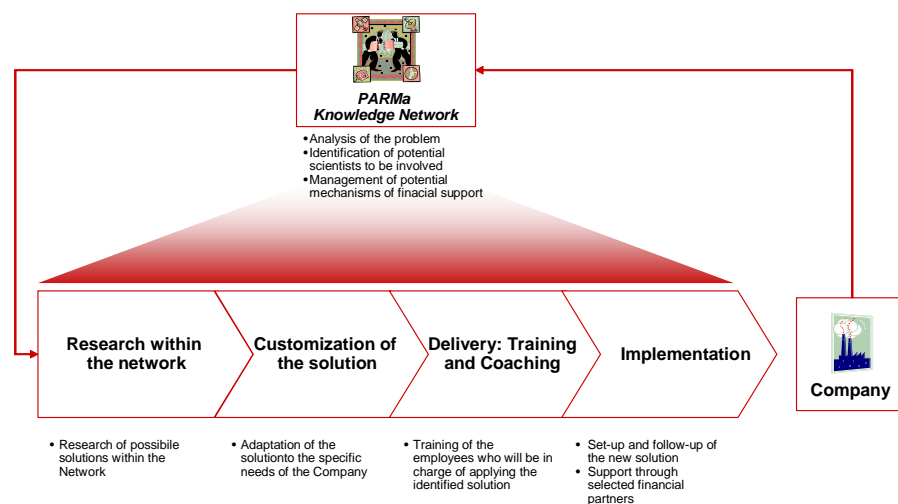
## Research

Figures 9 and 10 illustrate the process. An example of this service would be a project to determine how radio-frequency identification (RFID) tags could be economically incorporated into artisan food products, such as high quality Prosciutto di Parma. Although such a project could be undertaken for an individual company, the size of firms in the industry would make this most suitable as a project financed by multiple clients.



**Figure 9.** Knowledge-based services: Solving Issues, Building Value

Figure 9 is provided courtesy of SPIP, modified.



**Figure 10.** Supporting the different steps towards innovation.

Figure 10 is provided courtesy of SPIP, modified.

## *Education*

The principal educational activity will be executive and technical educational programs. PARMa KN will develop a series of such programs designed to meet the ongoing needs of food and agribusiness firms. Custom-designed educational programs will be developed based on demand. Two types of conference activities are envisioned: one-day seminars and a world congress. One-day seminars will focus on specific topics of interest to food and agribusiness firms. The world congress will be held every other year and will include a broad range of research, educational, and service topics designed to attract a worldwide audience. Publications will focus on topics of interest to the Parma food and agribusiness industry. They will be peer-reviewed documents resulting from PARMa KN's research, education, and service activities.

## *Service*

The principal component of the service activity will be consulting services provided on a custom basis to clients. One of the unique activities of PARMa KN is "Access Point" whereby support and project management services are provided to ensure access to funding activities for research and investment purposes.

## **Case Questions**

1. As the first executive director, what additional information would you want to obtain to get the organization off to a successful start?
2. Describe in detail the planning activities that Mr. Ricci should conduct in the first six months to ensure that the PARMa KN will meet the needs of its stakeholders? Specifically,
  - Identify who the key stakeholders are and their interests;
  - Identify the key planning activities that should be undertaken, explain why they are important, how you would structure them, and describe the output;
  - Indicate what you believe are the major priorities for the organization during the first six months and justify your priorities.
3. The PARMa KN will be funded initially by the City of Parma and corporate, foundation, and individual donors. However, PARMa KN will eventually need to generate much of the revenue needed to fund its activities. How would you structure the fees associated with the various activities conducted by PARMa KN?

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## **Industry Speaks**

### **Strategies for Solving the Food Inflation Problem**

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#### **Abstract**

This article addresses some of the partial truths and misinformation in media reporting over the booming food prices debate. Many studies are only linking biofuels to the inflation cause, while ignoring several other factors such as the growth of the world population, economic development and income distribution. An overview of the causes is discussed and 10 strategies proposed which policy makers, governments, and organizations can adapt to move the world forward towards long-term sustainability.

**Keywords:** food crisis, bio-fuels, strategy, sustainability, problem solving.

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## Introduction

During the last few weeks I've heard several important discussions in international forums regarding the booming food prices and its consequences world-wide. Between 2003 and 2005, the FAO's food price index rose 14.71%; in the two consecutive years which followed, it reached 34.19%; then in just one year from March 2007 to March 2008, the index bumped to an incredible 57.14% (FAO, 2008 a). As a result, inflation is a real concern in Europe (3.6%), China (8.3%), USA (4.0%), Russia (12.7%) and many other markets of different economic power. The poorest countries are suffering the most from soaring food prices. Poorer families spend a larger percentage of their budget on food consumption. We've seen the devastating proof in several of the least developed nations during the last 12 months. For example, in Haiti, the poorest country in the Americas, former Prime Minister Jacques Edouard Aléxis was expelled from his position in April by his own congress after being accused of negligence in failing to properly combat the problem. Within one week, in Africa, a fifty kilo bag of rice went from \$ 35 USD to \$ 70 USD. In Cameroon, Africa, official numbers reported 24 deaths after weeks of conflicts between local police and hunger mobs, but some human right activists say the real number surpasses the hundreds. According to FAO Director, General Jacques Diouf, soaring food prices pushed no less than 50 million people to hunger in 2007 only (FAO, 2008 b).

Following the first news about rising food prices and its consequences, journalists, researchers, scholars and opinion makers started to publish their studies and personal thoughts around the causes of these dynamics. In the first part of this article, I will address some incomplete views over the food prices debate. Many studies are only linking biofuels (a) to the inflation cause, ignoring several other factors, some of which we've known for a longtime, such as the growth of world population (b), and there are new ones, like economic development and income distribution (c) in populated countries such as India, Brazil, Eastern Europe, China, Indonesia, Thailand, South Africa, Argentina, Arabian countries, African countries, among others; stronger governmental programs (d) for aid and food consumption such as the *Bolsa Familia in Brazil*—reaching 10 million families; the major impact of urbanization (e) of society bringing megacities, increasing food consumption and changing consumption habits; oil prices (f) went up from \$ 35 USD to \$ 100 USD in five years, impacting production and transportation costs. The strong dollar devaluation (g); and farm/production shortages due to climate, droughts and diseases (h) and investment funds operating in futures markets and others in agribusiness. What is the percentage of responsibility for each of these nine factors that together have caused the problem? If it is only biofuels, why are other products not related to biofuels like rice and orange juice also having strong price increases?

## The Case of Biofuels

In the particular case of biofuels, several serious sustainable driven global investments in South America, Africa and Asia, among others, are being severely damaged by these articles and opinions. One respected and well informed economists, in a recent article published in the New York Times made the following statement:

*“...even seemingly good biofuels policies, like Brazil’s use of ethanol from sugar cane, accelerate the pace of climate change by promoting deforestation.”*

Biofuels production in Brazil is more than 1,500 miles away from Amazon region. An important representative from the United Nations (ONU) has classified biofuels as a “crime against humanity” and has requested the European Commission abandon its target of blending fossil fuels with 10% of biofuels. The General Director of Food Marketing Institute (FMI), has attacked biofuels by classifying their production as a “moral problem”. Several significant research studies have been published validating positive experiences and solutions on the sustainability of biofuels for decades and must be considered before emitting an opinion. Since the debate is gaining an ever bigger proportion, we must scrutinize studies being published in first level world journals, newspapers and magazines using sometimes obscure methodologies, and dangerously generalizing the results. Academics know the risks of generalization.

Unfortunately, not all biofuels can’t be put into the same basket because significant differences exist among ethanol sources and their energy-yield efficiency. Ethanol from the world’s two biggest producers, the USA and Brazil, differ considerably in terms of how they impact food prices. Fuel production demands are competing for a growing portion of the world’s biggest maize production (23.7% in 2007). The United States is producing ethanol from one of the most important crops for human and animal consumption. US ethanol is heavily dependent upon subsidies (\$ 6 billion USD in 2007) and US ethanol production does have some impact on maize prices internationally. Additionally, America’s maize production grows year after year mostly taking land from soy fields, which for instance decreased 16% in 2007 compared to the previous year (USDA, 2008). On the other hand, Brazil manages to produce its sugar cane based ethanol without subsidies, for less than half the cost per liter and more than twice the yield per hectare when compared to the US product. As far as land use is concerned, sugar cane has mainly taken areas from degraded pasture used for extensive cattle farming. In the state of Sao Paulo, where currently around 70% of the country’s sugar cane grows, the area designated to the crop grew over 37% from 2001 to 2006. Some 75% of such growth, or 725.204 hectares, occurred over former pasture areas. During that period, pastures also lost ground for soy, sorghum, cassava, potatoes and other important cultures to human and animal nutrition (CAMARGO, et al). Brazil’s livestock index is 0.9 units per

hectare, way lower than other world meat exporters, which leaves a huge gap for improvements in yield. Nevertheless, modernization is already taking place on Brazilian ranches through investments especially in genetics and animal nutrition, as well as through improvements in animal and soil handling.

Additionally, because of the need for culture rotation, 15 to 20% of the areas used for growing sugar cane are actually producing food (usually soy, peanuts or beans). This has contributed to Brazil's record food production year after year, despite increasing biofuel production. As said before, there are several studies showing that Brazilian ethanol and other biofuels are energy and cost efficient and represent a sustainable pathway towards the development of some of the world's poorest areas. Society must ask itself what are the interests and who are sponsoring these "studies"? A nice starting point is to analyze who loses margins with these changes and from the growth of biofuels.

## **Solutions for a Sustainable Future**

In this second part of the article, I suggest two ways to solve this food inflation problem. One, in my view, is going backwards towards an increase in protectionism, stimulating non competitive areas to produce and returning to the "self sufficiency" of war times; or to ban biofuels (a biofuels moratorium) is a possible solution for society to live on a more sustainable planet. I offer governments and international organizations, my contribution to the food inflation debate, a 10 point agenda that, in my opinion, is the right avenue to follow, in providing long term results.

1 – *Expand production horizontally into new areas, with environmental sustainability.* This expansion can be done in several countries—South America uses only 25% of its capacity, but on all continents, with millions of hectares that today are poorly used. In Brazil several studies by recognized institutions confirm the existence of more than 100 million hectares that can be utilized for food and biofuels production, without touching fragile systems and mostly growing over degraded pastures. These production and land expansions, if stimulated with sustainable contracts, will bring inclusion in farming, new entrepreneurs, job creation in less developed nations, income distribution and economic development, having even a positive impact in democracy. The following table shows that Brazil still have plenty of areas for food and biofuel production.

2 – *Vertical expansions, or, more production in areas that are already being utilized.* Several hectares in South America, in Africa, in Asia, and even in developed nations could produce more if more technology, investments were done. If one compares the amount of corn a USA farmer can generate in tons per acre is two or even three times higher than the average production of Brazil and other countries. With irrigation, some farms on the tropics can generate three crops per year.

**Table 1.** Availability of arable land in Brazil

	Millions of hectares	% of total area	% of arable area
Brazil	850	100	
Not arable or preservation area	510	60	
Total arable area	340	40	100
Cultivated area	63.1	7.4	18.6
Soy	20.6	2.4	6.1
Maize	14	1.6	4.1
Sugar cane	7.8	0.9	2.3
Sugar cane for ethanol	3.4	0.4	1.0
Pasture	200	23.5	58.8
Total available area	77	9.1	22.6

**Source:** ICONE and UNICA

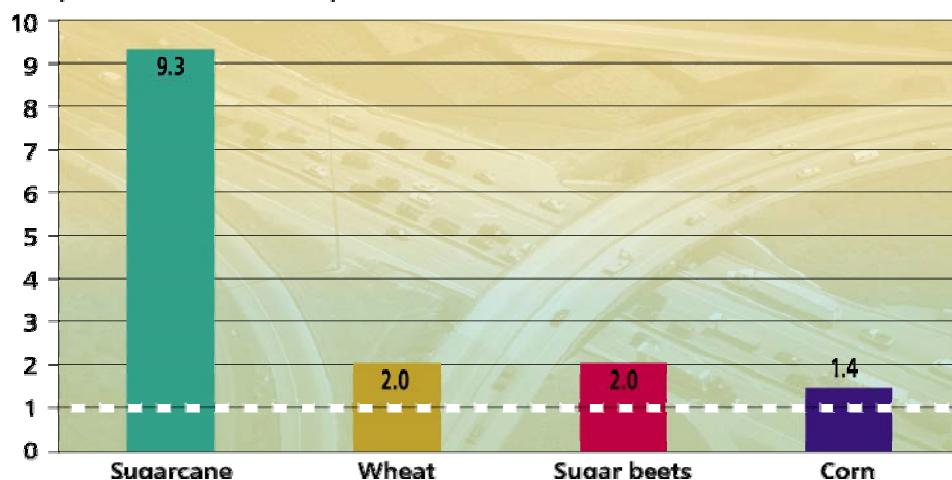
3 – *Reduce food import taxes and other import barriers and protections.* Food prices in some countries are artificially inflated due to import taxes and other kinds of protections. As an example, beef in the European Union costs four or five times higher than the same quality beef in an Argentinean or Brazilian store of the same European retailer. The argument mostly used is that lowering the protections will damage local agriculture of less developed countries. It must be assumed now that the new level of commodity prices may allow local agriculture to be competitive. Several other internal taxes on food can also be reduced by local Governments, reducing consumer prices. Additionally, the more than \$ 330 billion USD spent annually by OCDE members in agricultural subsidies put even more pressure in prices while undermining more cost efficient food production in naturally competitive countries.

4 – *Investment in international logistics in order to reduce food costs.* Part of grain producing countries has extremely poor logistics, like the case of Brazil. Governments should invest and society should work harder to change institutions in order to facilitate public private partnerships to privatize ports, roads, and other food distribution logistic equipments.

5 – *Reduce transaction costs,* since major international food chains are badly coordinated, have several redundancies, poor use of assets, corruption, opportunism and other inefficiencies that are largely responsible for losses, increase in costs, and maintenance of not adding value to companies, agents or others in the food chains, impacting food prices. Institutional reforms as proposed by Douglass North are the solution here. Also more efficient cooperatives, producer pools, and other collective actions should gain force to reduce redundancies and increase producer organization and bargaining power.

6 – *Use the best sources for biofuels,* in a totally sustainable way. The example of Brazil could be better analyzed, since ethanol is produced in 3.5 million hectares of cane, using only 1% of the country's arable land and supplying 50% of fuel transport

consumption, with no impact in food production. The growth of food production and biofuels together at the State of Sao Paulo in the last 10 years shows that it is possible to grow food and biofuels together. Crops for biofuels that have better yields and don't compete with food chains should be prioritized in global development of biofuels. Ultimately, the growth of biofuels in the world's energy matrix has a positive effect in inflation and food production for it reduces economic dependency in limited resources and eases climate changes that jeopardize agriculture (lately, unusual climate patterns have impacted wheat and meat production, for instance). The energy balance of Brazilian ethanol is 4.5 times better than that of ethanol produced from sugar beet or wheat, and almost seven times better than ethanol produced from corn.



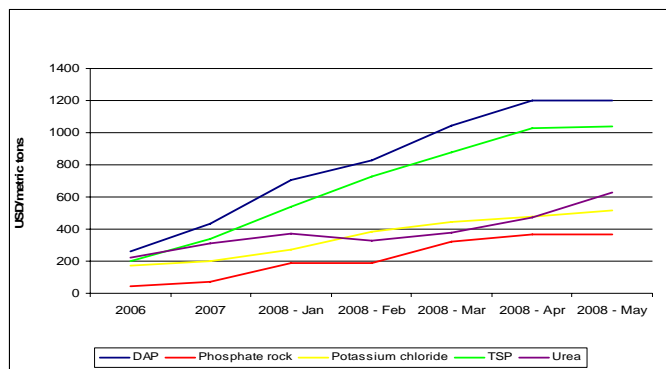
**Figure 1.** Energy Balance. Data represents the amount of energy contained in ethanol per unit of fossil fuel input

**Note:** estimated data

**Source:** World Watch Institute (2006) and Macedo et al (2008).

Data compiled by Icone and Unica

*7 - Invest in a new generation of fertilizers.* It is important to produce fertilizers from alternative sources, plants that can absorb more the energy of the sun, more recycling of by-products as sources of fertilizers to mitigate the huge risk and cost of fertilizers in the future. Fertilizers are among the most important and expensive inputs for agriculture, and in times in which yield must be improved, its importance grows even bigger. As an example, in Brazil fertilizers respond to around one third of total variable costs of a standard soy plantation. In the last three years farmers have been facing an astonishing increase in the prices of fertilizers. Compared to 2006, the DAP international prices averages for the first four months of 2008 rose more than 360%. Also during this same period, the prices of phosphate rock is 730% more expensive, TSP rose 414% and urea and potassium chloride rose 181% and 197% respectively (WORLD BANK, 2008).

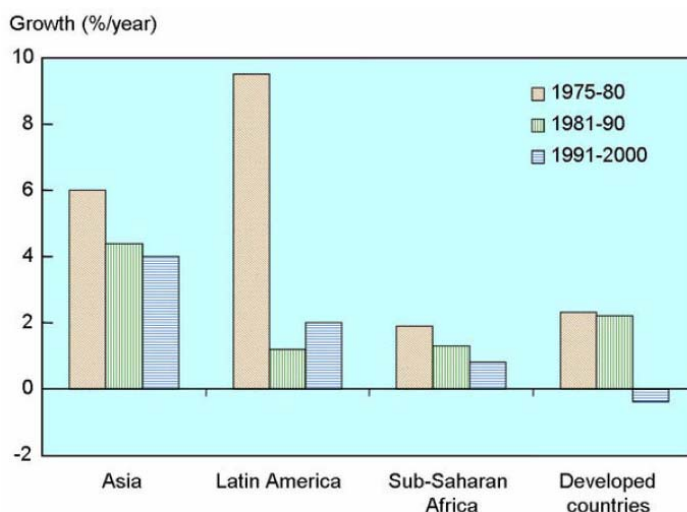


**Figure 2.** International Fertilizer Prices

Source: The World Bank

8 – *Work more towards sustainable supply contracts for farmers, with integrated sustainable investments and projects.* It is of fundamental importance that margins and income will be better distributed on food chains, reaching farmers all over the world. Price stimulus is the best economic incentive for growth in production with technology. It is well known and studied how concentration in several food industries and retailing retains margins that could be better distributed to farmers increasing economic development.

9 – *Stimulate research and investments in innovation from all possible sources, but mostly in genetics, in order to find new solutions for food and biofuels production and consumption.* In trying to solve the sustainability equation, seeds are a problem today, due to shortages. Public investments in agricultural research and development have decreased considerably in the past couple of decades, resulting in a yield-growth slowdown, disabling production and the ability to keep up with rising consumption. The following figure shows the decreasing investments in agriculture research and development:



**Figure 3.** Public investment in agricultural research and development

Source: D. Byerlee et al apud International Rice Research Institute, 2008

10 – *Slowly work to change consumption habits in both food and fuel.* Food is over consumed in several parts of the world, bringing with it obesity—a major health concern. Another area of inefficient consumption is fuel. Investments need to be made in resourceful public transportation. This is a major challenge in many countries. Barcelona has implemented a very nice public biking system which is an excellent example of a working solution.

My contribution is to organize and propose these 10 suggestions for use in this major debate. They are not new, and some are already being implemented with beautiful results. But, we've reached a turning point. We can either go back to trying to increase protectionism, less efficient ventures of self-sufficiency, ban biofuels, create food export taxes, or even threaten to turn private companies into public companies. Or society can move forward, and I certainly hope global interests will allow us to move forward with this positive agenda, the right avenue for global sustainability.

**Table 2.** Causes of Food Price Increases and Possible Solutions

<b>9 Causes of Food Prices Increase</b>	<b>10 Proposed Solutions</b>
Biofuels	Sustainable horizontal expansion towards new areas
Population growth	Vertical expansion with more technology
Income distribution and wealth in populated countries	Reduction in food taxes and other protections
Governmental programs for food distribution	Investments in international logistics platform
Urbanization of population and megacities	Use the best sources for biofuels production
Oil prices impact on production and transportation costs	Reduction in transaction costs in food chains
Production shortages due to adverse climate conditions	New generation fertilizers
Dollar devaluation	Sustainable supply contracts to farmers
Investment funds operating in commodities	Innovations (genetics and others)
	Consumption behavior for less energy consumption





*International Food and Agribusiness Management Review*  
*Volume 11, Issue 3, 2008*

## **Managing Global Climate Change** **An Executive Interview with David Lobell <sup>1</sup>**

H. Douglas Jose <sup>2</sup>

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### **Introduction**

Many of the world's poorest regions could face severe crop losses in the next two decades because of climate change, according to Dr. David Lobell, a Senior Research Scholar at Stanford University in the program on Food Security and Environment.

The average world temperature is increasing slightly says Lobell and a one-degree Celsius increase over time greatly impacts climatic growing conditions. Unfortunately, agriculture is also the human enterprise most vulnerable to changes in climate. Understanding where these climate threats will be is central to our efforts in fighting hunger and poverty over the coming decades. Dr. Lobell outlines some of the challenges that lie ahead and steps researchers are taking to combat the issues.

This televised interview can be seen with RealPlayer on IAMA's website at:  
[http://www.ifama.org/dispatch.asp?page=Executive Interviews 2008](http://www.ifama.org/dispatch.asp?page=Executive_Interviews_2008)

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<sup>1</sup>David Lobell is Senior Research Scholar, Program on Food Security and the Environment, Stanford University. His research and teaching interests include: food security, climate change, land use, remote sensing, and ecosystem modeling. David Lobell can be contacted at: [dlobell@stanford.edu](mailto:dlobell@stanford.edu)

<sup>2</sup>Doug Jose is a Professor and Extension Farm Management Specialist in the Department of Agricultural Economics at the University of Nebraska- Lincoln and host of the Market Journal, a weekly televised program on agriculture. This interview was conducted during the 18th Annual World Forum and Symposium in Monterey, California, June 18, 2008. Doug Jose can be contacted at: [hjose1@unl.edu](mailto:hjose1@unl.edu).

***David, there seems to be a lot of evidence that maybe we are having some global warming. What is the situation?***

**Lobell:** What you see from climate science is that global warming is definitely real - we're past the point of whether the trend is what we could expect just by chance. Certainly on the global scale and even for individual regions, we see warming that is nothing we could expect from just natural variability.

***The change in temperature has gone up but it seems small, only one or two degrees has significant impact?***

**Lobell:** That is right. The changes we have seen so far are less than a degree, about .7 degrees, is impacting many natural ecosystems and agricultural systems throughout the world. But it is not so much the impacts that have happened so far that we are worried about. It is this trend we are on. Looking into the future in 20-30 years we see implications that could be much, much worse than what we have seen already.

***So, if we look 20 years down the road and we did make major changes today, will those trends then turn around?***

**Lobell:** Climate trends don't really turn around until 30 or 40 years after you see the changes in terms of greenhouse gas emissions. The reason for this is that the climate system responds to is really the cumulative amount of greenhouse gas in the atmosphere and each change year-to-year is only a very small part of that cumulative amount. what we do on the energy or the greenhouse gas side of things will not affect climate for the next 30 to 40 years, climate change is really going be dictated by what we have done up to this point.

***There is going to be some significant changes then in crop response, what is going to happen there?***

**Lobell:** We certainly know that temperatures will rise and we also know that crops are fairly sensitive to temperatures. In most parts of the world what you see is that if the temperature raises the crops production goes down. For a one degree warming, you tend to see anywhere between from 5 to 10% losses in the fields.

So, looking ahead 20 or 30 years we do expect a degree warming, on a global average basis and expect some loss because of that warming. If you go to individual regions you would see possibly more or less than that amount.

***Are crops like corn, for example—which like some hot weather going to see impacts in production?***

**Lobell:** That's right, corn likes hot weather, so there are places like Canada right now which are not very suitable for corn, but will become more suitable. There are places certainly where the crop will become more comfortable in a warmer climate. But throughout most of the US corn-belt, including Nebraska, what we'll see is that a little bit of warming actually reduces the yields of corn. And if you go to places on the margin, like a lot of Africa where corn is grown, it is really quite sensitive to temperature increases.

*So, on a global basis what do you see then for changes in cropping patterns and are these going to change even in Nebraska the types of crops that might be grown?*

**Lobell:** I think what we'll gradually see are a couple of things. One is certainly a lot of effort is being put into adapting different varieties of corn to grow in warmer climates. It won't necessarily be a switch in the types of crops grown but a switch toward advanced breeds of these crops that can withstand higher temperatures. But certainly in many parts of the world you'll see a transition into different crops that are more tolerant of drought or heat and in some parts of the world you will see the warming open up new farm lands that were once too cold to be cultivated economically.

*That leads to a couple of other questions. First, the interaction with crop breeders, is this going to be significant?*

**Lobell:** Yes, it is certainly one of the major ways that we see of getting out of the worst of the impacts—is to try to breed new crops. The breeders and companies that work on this are really going to be a big part of the solution if we are going to breed the crops we need.

*In terms of water use, how does water enter into this?*

**Lobell:** Water use in many parts of the world will become increasingly important not only for climate change obviously, but because of the competition from other sectors. There will also be areas of the world where you will see potentially an increase in the amount of storminess and the flooding of fields and so one of the things, for example, in rice production, people are working on making varieties that are more resistant to flooding for a longer period of time without dying. So it is both on the side of being too dry in some places and too wet in others that we're looking at solving in the future.

*Carbon emissions provides the background for this discussion and it's important that we talk about it. As we look at controlling carbon emissions you say it's going to be a long haul before we see change?*

**Lobell:** One way to think about it is that our activities—the emissions of greenhouse gases are going to have a very big impact on our grandchildren's generation. But in terms of our generation and our children's generation we are really looking over the next 30 years at responding to the changes in the climate system which is the result of what we have already done.

So there are these twin challenges of trying to not emit so much that in 50 or more years we will see disastrous effects of climate change, but also trying to think about the next 10-20-30 years and how we deal with the smaller amount of change we expect from what we have already emitted.

***Within that 20-30 year period, are we still going to have wide fluctuations from year to year?***

**Lobell:** Yes, and this is one of the very difficult things about studying climate and noticing when you are in a new climate, the variations from year-to-year are always going to be larger than the average trend. So even if we see, for example, in the last 20 years about a one degree increase, over 20 years that is going to be hard to detect when each year you have swings of a degree. Managing agriculture for variability is always going to be important and the issue now is how we both manage for variability while at the same time managing for a future that is going to be on average warmer.

***What about the human aspect. Humans have essentially created this situation. How are humans going to get us over the problem?***

**Lobell:** Well that's the big question, I think. Once people really start to deal with this issue, and some are—in parts of the world, I hope we'll start to see a lot of innovative solutions to the problem. One of the big questions in measuring how this problem will impact us globally is by looking at how quickly economies develop and whether they continue to be on the brink of hunger or develop to a point where minor fluctuations in production are easier for them to cope with because they are at a richer baseline.

***So this is going to put more pressure on areas that are already struggling to feed themselves?***

**Lobell:** That's what we see. There is a correspondence— most of the poor of the world live in some of the hotter areas of the world. Those are the same areas where crops are already at their limits in terms of temperature thresholds. One of the ironies of climate change is that the communities which tend to be poorer and have the least to do with emissions are going to be on the front lines of dealing with impact of climate change.



*International Food and Agribusiness Management Review*  
*Volume 11, Issue 3, 2008*

## **Managing Global Climate Change An Executive Interview with Carole Brookins<sup>1</sup>**

H. Douglas Jose <sup>2</sup>

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### **Introduction**

Carole Brookins is an international consultant known for her work as a policy and trade strategist on issues concerning the global political economy and its effect on the food and agriculture sector. She currently serves on the board of several corporate and non-profit organizations concerned with global food system issues and is currently helping to develop solutions which can offset the effects of global climate change through the reduction and management of carbon emissions—an issue of increasing importance in future food marketing and world trade. Ms. Brookins served as U.S. Executive Director to The World Bank from 2001-2005 and has consistently advocated for partnering public and private sectors to develop infrastructure in countries, strengthen their investment climate, support agricultural productivity and improve the trade capacities of developing countries.

This televised interview can be seen with RealPlayer on IAMA's website at:  
[http://www.ifama.org/dispatch.asp?page=Executive Interviews 2008](http://www.ifama.org/dispatch.asp?page=Executive_Interviews_2008)

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<sup>1</sup>Carole Brookins is the Managing Director of Public Capital Advisors, LLC, a firm she co-founded in 2006 to provide financial advisory for emerging market municipal infrastructure development. Ms. Brookins can be contacted at: [brookinscarole@yahoo.com](mailto:brookinscarole@yahoo.com)

<sup>2</sup>Doug Jose is a Professor and Extension Farm Management Specialist in the Department of Agricultural Economics at the University of Nebraska- Lincoln and host of the Market Journal, a weekly televised program on agriculture. This interview was conducted during the 18th Annual World Forum and Symposium in Monterey, California, June 18, 2008. Doug Jose can be contacted at: [hjose1@unl.edu](mailto:hjose1@unl.edu).

***The environment is a concern which we all need to address. It is my pleasure to have as my guest, Carole Brookins who has been involved in trade, agriculture and now carbon emissions. Carole this is an issue that all agriculture is involved in.***

**Brookins:** Well, we're all involved in it. Anyone involved in agriculture, whether it's production agriculture or any aspect of upstream or downstream understand that we are stewards of our planet. Everyday farmers are dealing with the impacts of the planet from the condition of the soil; to rainfall; to temperatures and flooding. This whole issue of global warming, whether it's greenhouse gases or reducing your carbon foot-print are terms that farmers are going to have to learn and understand to manage the impact of climate change in the future. Farmers in our world are not only responsible for feeding the people on our planet but doing it in a way that is the most sustainable for their own land so they can pass it on to their children and so they will have a planet to pass on to their children.

***We do have a number of farmers in Nebraska who have been involved in the Carbon Exchange Market in Chicago. How do you see that developing in the future?***

**Brookins:** I am very excited about it. I am very privileged to be on the Board of the Chicago Climate Exchange (CCX) which is North America's only and the world's first greenhouse gas emission trading system where members have to reduce their carbon emissions; they register their carbon emissions; they are certified as registered and they are audited on their reductions and then they can trade them. Many farmers have received the opportunity to be part of this system because the Chicago Climate Exchange permits offsets from soil carbon management, from rangeland carbon management, agricultural methane management and forestry.

Farmers, for example, who through doing no-till and other conservation practices, dairy and livestock farmers who have developed anaerobic manure digestion technologies are able to trade those credits. Those farmers who capture the methane, the CO<sub>2</sub> emissions have emission offsets to sell and are paid for that benefit to our planet at CCX.

***We've talked specifically about farming but throughout the whole food chain people are going to becoming involved with this as well?***

**Brookins:** Absolutely, there is something called the *Carbon Disclosure Project* where many of the major retailers like Walmart and Tesco, or consumer and food product manufacturers like Unilever, Nestle and Proctor and Gamble are engaged. They are working to come up with a standardized measurement for the carbon foot print of products that are sold to consumers on supermarket shelves. Safeway, for example, is a member of CCX and is very interested in this idea of being able to sell products that give consumers a choice in knowing a product's carbon footprint. Does this mean if apples are shipped from New Zealand to the U.S. counter-seasonal that

they have a bigger carbon foot print due to transportation emissions than apples that are stored in Washington State or Oregon. Some analysis indicates that carbon emissions are greater for those products that are in refrigerated storage than those shipped across the Pacific. To those consumers who want to buy low Co2 products because they believe they are benefiting the environment, information will help them make these choices. Standardized measures with transparency will be necessary for honest and true marketing and labeling.

*There's two aspects here—a choice for consumers but also there is probably going to be some negotiation on a more global basis about some of these things we've talked about. Whether we in fact continue to transport food around the world.*

**Brookins:** Oh, I think we will. I've very concerned that the whole issue of trying to better improve our planet and deal with climate change is going to cause new kinds of trade barriers and trade fights. For example, some governments and groups will argue that they have the right under the WTO system to protect their domestic producers, claiming that an exporter isn't doing its fair share of reducing CO2 emissions in the world, and transportation emissions should be part of "dumping" considerations. We're going to have in the WTO and bilaterally a range of new issues, new rules that will have to be negotiated to create rules for the trading system. Otherwise, a range of potentially false trade barriers will proliferate-- just as we have to manage other agricultural trade barriers that aren't justified under the rules or based on sound science.

But I also see tremendous opportunities for agriculture in terms of beginning to develop a whole system globally in post-Kyoto Protocol climate negotiations. Agriculture will be part of the new system in terms of managing and measuring our carbon footprints. Agriculture will be a major contributor to solving the climate crisis—we are already stimulating a range of technologies and innovative production practices. Whether we are talking about biofuels, wind, solar or waste-to-energy, the use of our agricultural land, and innovation will be a winning combination. There is just an enormous amount of emerging technology where agriculture will be very much apart of the solution. And we are only just at the starting gate!

And more importantly, both presidential candidates in the United States, both Senator Obama and Senator McCain support US mandates to cap and reduce carbon emissions. The farmers who have been involved in these early-stage innovative offsets and very creative technological improvements to manage their emissions are going to have a real advantage as we move forward into a regulated market. This will contribute to farm incomes and rural economic opportunity—even as we are improving our planet for all.

***So as farmers look at their strategic planning in the next 5 - 10 years; what are the key points that they should be thinking about?***

**Brookins** I would think that every farm organization and commodity organization in addition to working on traditional agricultural policy and trade policy issues, food safety regulations, and environmental rules/soil conservation should also be focusing on policies that impact carbon management opportunities. Why? Because I think climate change policy will become of increasing importance to their members. Agriculture will be part of the U.S. system and post-Kyoto global climate negotiations. You can be assured that the U.S. will play a major role and farmers need to formulate and communicate their policy goals very clearly to their legislators and to the new presidential administration. This can be a win-win for agriculture, our country and the world.





## *Symposium Special Edition*

### **Best Paper and Student Case Competition Winners**

#### **Best Paper Award Winners**

##### **1st Place**

*The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry*

Dr. Yuliya Bolotova

Dr. Christopher S. McIntosh

Ms. Kalamani Muthusamy

Dr. Paul E. Patterson

*University of Idaho, USA*

##### **Innovation Award**

*Applying a Sectoral System of Innovation Approach to the Australian Red Meat Industry with Implications for Improving Innovation and Entrepreneurship in the Australian Food Industry*

Dr. Christine Pitt, Innovation Services

Dr. Susan Nelle, Australian Innovation Research Center Meat & Livestock Australia Limited

*North Sydney, Australia*

##### **Entrepreneurship Award**

*Entrepreneurial Opportunities in Agri-Food Supply Chains: Modeling the Dynamics of Discovery and Exploitation*

Dr. R. Brent Ross, Michigan State University, USA

*East Lansing, Michigan, USA*

Dr. Randall E. Westgren, University of Illinois at Urbana-Champaign

*Champaign, Illinois, USA*

##### **Communication Award**

*Market Orientation, Innovation and Entrepreneurship: An Empirical Examination of the Illinois Beef Industry*

Mr. Eric T. Micheels, University of Illinois at Urbana-Champaign

*Urbana, Illinois, USA*

Dr. Hamish R. Gow, Michigan State University

*East Lansing, Michigan*

## 2008 Student Case Competition Winners

### First Place: International Team

Ms. Kateryna Goychuk, *University of Tennessee, USA*

Ms. Ma. Mercedes Barilatti, *University of Buenos Aires*

Ms. Joy Mullady, *University of Florida, USA*

Ms. Fafanyo Asiseh, *University of Idaho, USA*

**Advisor:** Dr. Michael Gunderson, *University of Florida*

### Second Place: Santa Clara University

Ms. Lisa Stapleton

Mr. Abhihit Joshi

Mr. Meher Shah

**Advisor:** Dr. Andrew Starbird

### Third Place: New Mexico State University

Mr. Brandon Winchester

Mr. Ryan McConnaughey

Mr. Ben Wilson

Ms. Shawna McClain

**Advisors:** Dr. Jay Lilywhite & Dr. Bill Gorman



## 2008 Reviewers

IAMA would like to express gratitude and appreciation Mark Hansen, 2008 Symposium Chair and the following members who helped review Papers, Cases, Posters and Discussion Sessions, Student Case and Case Competition for the 18<sup>th</sup> Annual World Symposium as well as to those who assisted with the comprehensive Best Paper Award review process.

Luis Aguiar - *Brazil*  
Jay Akridge - *USA*  
Filippo Arfini - *Italy*  
Gregory Baker - *USA*  
Vera Bitsch - *USA*  
Yuliya Bolotova - *USA*  
Lindie Botha - *South Africa*  
Francesco Braga - *Canada*  
Harry Bremmers - *Netherlands*  
Stefanie Bröring - *Germany*  
Catherine Chan Halbrendt - *USA*  
Sylvain Charlebois - *Canada*  
Emma Coath - *Australia*  
Yvonne Colomer - *Spain*  
Dennis Conley - *USA*  
Matheus Consoli - *Brazil*  
Alejandro Cotes Torres - *Columbia*  
Elliot Currie - *Canada*  
Francis Declerck - *France*  
Josh Detre - *USA*  
Laura Donnet - *USA*  
Enefiok Ekanem - *USA*  
Ina Enting - *Netherlands*  
Dirk Esterhuizen - *South Africa*  
Christian Fischer - *New Zealand*  
Melanie Fritz - *Germany*  
Georges Giraud - *France*  
Amit Goel - *India*  
Hugo Goldsztein - *Argentina*  
Hamish Gow - *USA*  
Kay Grulich - *Canada*  
Mike Gunderson - *USA*  
Jon Hanf - *Germany*  
Wayne Howard - *USA*  
Andre Jooste - *South Africa*  
Jukka Kola - *Finland*  
Jim Krigbaum - *USA*  
Anjani Kumar - *India*

Debabrata Lahiri - *India*  
Michael Lau - *USA*  
Kobus Laubscher - *South Africa*  
Robert Lee - *USA*  
Wessel Lemmer - *South Africa*  
Nicole Leroux - *USA*  
Conrad Lyford - *USA*  
C. Maheshwar - *India*  
Woody Maijers - *Netherlands*  
Guilherme Malafaia - *Brazil*  
Allan McDermott - *New Zealand*  
Murray McGregor - *Australia*  
Michelle Louise Mendoza - *Belgium*  
Farhad Mirzaei - *India*  
Pal Molnar - *Hungary*  
Tracy Morrison - *USA*  
Rose Nyikal - *Kenya*  
Onno Omta - *Netherlands*  
Antonio Padula - *Brazil*  
Mickey Paggy  
Vadivelan Palaniappan - *India*  
Hernan Palau - *Argentina*  
Jon Phillips - *USA*  
Fabio Ribas Chaddad - *USA*  
Kerstin Röhrich - *Germany*  
Sebastian Senesi - *Argentina*  
Nicola Shadbolt - *New Zealand*  
Pieter Taljaard - *South Africa*  
Ludwig Theuvsen - *Germany*  
Mark Thompson - *USA*  
Jacques Trienekens - *Netherlands*  
Wendy Umberger - *Australia*  
Lucas Vokurka - *Netherlands*  
Cheryl Wachenheim - *USA*  
Mark Wade - *USA*  
Dave Weatherspoon - *USA*  
Lynn White - *USA*  
Fred Yamoah - *Ghana*

## **Best Paper Award Review Committee**

Luis Aguiar- *Brazil*  
Filipo Arfini- *Italy*  
José Vicente Caixeta-Filho- *Brazil*  
Francis Declerck- *France*  
Allan Gray- *USA*  
Catherine Chan-Halbrendt- *USA*  
Eluned Jones- *USA*  
Christopther Peterson- *USA*  
D. K. Nauriyal- *India*  
Desmond Ng- *USA*  
Hernan Palau- *Argentina*  
Jacques Trienekens- *Netherlands*  
Joao Martines-Filho- *Brazil*  
Jukka Kola- *Finland*  
Kerry Litzenberg- *USA*  
Kobus Laubscher- *South Africa*  
Ludwig Theuvsen- *Germany*  
Mark Hansen- *USA*  
Mary Shelman- *USA*  
Michael Gunderson- *USA*  
Nicola Shadbolt- *New Zealand*  
Onno Omta- *Netherlands*  
Pedro Marques- *Brazil*  
Peter Goldsmith- *USA*  
Carlos Steiger- *Argentina*  
Sylvain Charlebois- *Canada*  
Tadayoshi Masuda- *USA*  
Woody Maijers- *The Netherlands*  
Peter Zuurbier- *Brazil*



## Invited Symposium Papers, Posters, Discussion Sessions & Case Studies

### Discussion Session

**Moderator:** Dr. Dennis Conley, University of Nebraska-Lincoln, USA

*Court Debate of a Legal Case Involving Violation of Regulations in A Futures and Options Market (ID# 1003)* [paper](#) [powerpoint](#)

Dr. Dennis Conley, University of Nebraska-Lincoln, USA

Dr. Francis Declerck, ESSEC Business School, France

Dr. Francesco Braga, University of Guelph, Canada

### Case Conference Opening Session

**Moderator:** Dr. Gregory Baker, Santa Clara University, USA, Opening Remarks

**Case Conference Introduction “Developing a Teaching Case”** [powerpoint](#)

Ms. Mary L. Shelman, Harvard Business School, USA

### Paper Presentations

**Moderator:** Dr. Kobus Laubscher, University of the Free State, South Africa

*The State of Black Economic Empowerment in the Agribusiness Sector of South Africa (ID#1006)*

[paper](#) [powerpoint](#)

Dr. Dirk Esterhuizen, USDA, South Africa

Dr. Tobias Doyer, ABSA, South Africa

Dr. Johan Van Rooyen, SA Wine Council, South Africa

Ms. Lindie Botha, Agricultural Business Chamber, South Africa

*A Method for Integrated and Sustainable Agribusiness Projects (ID#1137)* [paper](#) [powerpoint](#)

Dr. Marcos Fava Neves, University of Sao Paulo, Brazil

Mr. Luciano Castro, University of Sao Paulo, Brazil

### Paper Presentations

**Moderator:** Dr. Yuliya Bolotova, University of Idaho, USA

*Evaluating Economic Performance of Food Manufacturing Industries: An Analysis of the US Pacific Northwest States (ID#1019)* [paper](#) [powerpoint](#)

Dr. Yuliya Bolotova, University of Idaho, USA

*Developments and challenges in the European pork sector (ID#1018)* [paper](#) [powerpoint](#)

Mr. Jacques Trienekens, Wageningen University, The Netherlands

Mr. Nel Wognum, Wageningen University, The Netherlands

Mrs. Rannia Nijhof-Savvaki, Wageningen University, The Netherlands

Mr. Mark Wever, Wageningen University, The Netherlands

## Paper Presentations

**Moderator:** Mr. Daniel Conforte, Massey University, New Zealand

***Distribution of costs and benefits from the commercial introduction of genetically modified crops: A case study on potato in Finland (ID#1076)*** [paper](#) [powerpoint](#)

Dr. Jyrki Niemi, MTT Agrifood Research, Finland

Mr. Jussi Tuomisto, MTT Agrifood Research, Finland

***Impact of New Chain Strategies on Entrepreneurship Development of Farmers (ID#1025)***

[paper](#) [powerpoint](#)

Mr. Woody Maijers, INHOLLAND Educational University, The Netherlands

***Be good and tell it: Meeting the challenge to re-establish the relationship between livestock industry and society (ID#1024)*** [paper](#) [powerpoint](#)

Dr. Ina Enting, Wageningen UR, The Netherlands

Mr. Onno Van Eijk, Wageningen UR, The Netherlands

Ms. Monique Mul, Wageningen UR, The Netherlands

Mr. Daniël De Jong, Wageningen UR, The Netherlands

## Paper Presentations

**Moderator:** Dr. Vera Bitsch, Michigan State University, USA

***Governance Structures in the Sheep Cheese Agribusiness (ID#1101)*** [paper](#) [powerpoint](#)

Ms. Evangelina Dulce, Food and Agribusiness Program, School of Agronomy -UBA, Argentina

Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina

Dr. Fernando Vilella, School of Agronomy – UBA, Argentina

***The Role of Price in Producers' Input Purchase Decisions (ID#1078)*** [paper](#) [powerpoint](#)

Dr. Allan Gray, Purdue University, USA

Mrs. Maud Roucan-Kane, Purdue University, USA

Dr. Jay Akridge, Purdue University, USA

## Discussion Session

**Moderator:** Dr. Kobus Laubscher, University of the Free State, South Africa

***The modern food supply chain: what role for government? What form for policy? (ID# 1014)***

Dr. Derek Baker, Institute of Food and Resource Economics, Denmark [powerpoint](#)

Mr. Karl Rich, International Livestock Research Institute, Kenya

Mr. Brent Ross, University of Illinois, USA [powerpoint](#)

Dr. Jacques Trienekens, Wageningen University, The Netherlands [powerpoint](#)

Mr. Doyle Baker, Food and Agriculture Organization of the United Nations, Italy [powerpoint](#)

## Case Conference

**Discussant:** Dr. Vera Bitsch, Michigan State University, USA

***Codornices Granja Rangel – Running a Family Business in Mexico (ID#1062)*** [case](#) [powerpoint](#)

Dr. Lisa House, Professor, University of Florida, USA

Dr. Carmen López-Reyna, Colegio de Postgraduados de Mexico, Mexico

Dr. Carlos Omar Trejo-Pech, Universidad Panamericana, Mexico

Mr. Dwayne Haynes, University of Florida, USA

***Negligent Hiring and Employee Rights: The Case of Southeast Aerial Spray Applicators (ID#1080)***

[paper](#) [powerpoint](#)

Dr. Mark Wade, Manager of Human Resources, Evans Properties Inc, USA

## Student Case Competition Preliminary Round (Group A)

### Judges:

Dr. Francesco Braga, Associate Professor, Department of Business, University of Guelph, Canada  
Ms. Erica Kuhlmann, Section and Head Manager, Food and Consumer Group, BMO Capital Markets, USA  
Dr. Hector Laurence, President & CEO, McLaren Holdings SA, Argentina

### Paper Presentations

**Moderator:** Dr. Ina Enting, Wageningen UR, The Netherlands

***Innovation in Food Products: Propagators and First-Mover Strategy (ID#1068)*** [paper](#) [powerpoint](#)  
**\*\*Best Paper Award Finalist\*\***

Dr. Thomas L. Sporleder, The Ohio State University, USA  
Dr. Stefanie Bröring, Bröring Group, Germany  
Dr. Neal Hooker, The Ohio State University, USA

***Flexible System Dynamic Models to Face Food System Challenges (ID#1094)*** [paper](#) [powerpoint](#)

Dr. Francis Declerck, ESSEC Business School Paris-Singapore, France  
Mr. L. Martin Cloutier, University of Quebec at Montreal, Canada

### Paper Presentations

**Moderator:** Prof. Vijay Paul Sharma, Indian Institute of Management, India

***South African Agribusinesses: Moving from “competing” to “winning” (ID#1001)*** [paper](#) [powerpoint](#)

Dr. Dirk Esterhuizen, USDA South Africa  
Dr. Johan Van Rooyen, SA Wine Council, South Africa  
Ms. Lindie Botha, Agricultural Business Chamber, South Africa  
Mr. Corwyn Botha, Kaap Agri, South Africa

***Biodiesel in Brazil: A Comparative Analysis of Competitiveness of some Vegetable Oils' Supply Chains (ID#1059)*** [paper](#) [powerpoint](#)

Mr. José Carlos de Lima Júnior, PENSA, University of São Paulo (FEA-RP/USP), Brazil  
Mr. Marco Antonio Conejero, PENSA, University of São Paulo (FEA-RP/USP), Brazil  
Dr. Marcos Fava Neves, PENSA, University of São Paulo (FEA-RP/USP), Brazil  
Mr. Luciano Thome e Castro, PENSA, University of São Paulo (FEA-RP/USP), Brazil

### Paper Presentations

**Moderator:** Mr. Woody Majers, INHOLLAND Educational University, The Netherlands

***An Assessment of University Agri-Entrepreneurship and Value Added Programs (ID#1093)***  
[paper](#) [powerpoint](#)

Dr. William Knudson, Michigan State University, USA  
Dr. H. Christopher Peterson, Michigan State University, USA

***Drivers of consolidation of major brewery groups - did their internationalisation strategies pay off? (ID#1013)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Semi-Finalist\*\***

Mr. Christian Fischer, Massey University, New Zealand

***Organizational Innovation and Collective Entrepreneurship: The Case of Renville (ID#1108)***  
[paper](#) [powerpoint](#)

Dr. Michael Cook, University of Missouri, USA  
Dr. Peter Klein, University of Missouri, USA  
Dr. Molly Burrell, University of Missouri, USA



## Discussion Session

**Moderator:** Dr. Mark Wade, Evans Properties Inc, USA; Dr. Paul Monaghan, University of South Florida, USA

*Ten years review of IAMA's management research: strengths, gaps, biases and future directions (ID# 1111)* [paper](#)

Mr. Daniel Conforte, Massey University, New Zealand

Dr. Dennis M. Conley, University of Nebraska – Lincoln, USA

Dr. Marcos Fava Neves, PENSA, Universidade de São Paulo, Brazil [powerpoint](#)

Dr. Allen Featherstone, Kansas State University, USA

Dr. Mark Hansen, Brigham Young University, USA

Dr. H. Christopher Peterson, Michigan State University, USA

Dr. Ralph Stablein, Massey University, New Zealand

Ms. Mary L. Shelman, Harvard Business School, USA

## Student Case Competition Preliminary Round (Group B)

### Paper Presentations

**Moderator:** Dr. Thomas L. Sporleder, The Ohio State University, USA

*Demand Driven Pricing: An Alternative Pricing Strategy for Direct Marketers of Beef (ID#1046)*  
[paper](#) [powerpoint](#)

Mr. Jared Burner, Virginia Tech, USA

Mr. Wen You, Virginia Tech, USA

Dr. Denise Mainville, Virginia Tech, USA

*Industry-Academic Partnerships – The View from the Corner Office (ID#1061)* [paper](#) [powerpoint](#)  
**\*\*Best Paper Award Finalist\*\***

Dr. Gregory Baker, Santa Clara University, USA

Dr. Al Wysocki, USA

Dr. Lisa House, University of Florida, USA

*Implications of agricultural trade liberalization on global and EU agricultural markets (ID#1075)*  
[paper](#) [powerpoint](#)

Dr. Jyrki Niemi, MTT Agrifood Research, Finland

Ms. Leena Kerkelä, Government Institute for Economic Research, Finland

Ms. Heikki Lhtonen, MTT Agrifood Research, Finland

### Paper Presentations

**Moderator:** Mr. Woody Majers, INHOLLAND Educational University, The Netherlands

*Consumer perceptions of fresh fruit and vegetables and the added value of antioxidants; differences between non, light and heavy organic food users (ID#1097)* [paper](#) [powerpoint](#)  
**\*\*Best Paper Award Semi-Finalist\*\***

Ms. Isabelle van den Berg, Wageningen UR - LEI, The Netherlands

Dr. Jos Bartels, Wageningen UR - LEI, The Netherlands

*Bioenergy, Food Security and Sustainable Development (ID#1109)* [paper](#) [powerpoint](#)  
**\*\*Best Paper Award Semi-Finalist\*\***

Dr. Bernardo Carvalho, University of Lisbon - UTL, Portugal

*Co-Innovating in the Argentine Rapeseed Chain. Networking and Social Capital “The Cazenave Case” (ID#1133)* [paper](#) [powerpoint](#)

Mr. Marcos Botta, Food and Agribusiness Program, School of Agronomy-UBA, Argentina

Mr. Jose Maria Mones Cazon, School of Agronomy-UBA, Argentina



Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina  
Mr. Marcos Daziano, School of Agronomy – UBA, Argentina

#### **Paper Presentations**

**Moderator:** Mr. Jacques Trienekens, Wageningen University, The Netherlands

***Heterogeneity in the Evaluation of Quality Assurance Systems: Taking the International Food Standard (IFS) in the European Agribusiness as an Example (ID#1096)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Semi-Finalist\*\***

Mr. Holger Schulze, University of Goettingen, Germany  
Ms. Friederike Albersmeier, University of Goettingen, Germany  
Ms. Jana-Christina Gawron, University of Goettingen, Germany  
Dr. Achim Spiller, University of Goettingen, Germany  
Dr. Ludwig Theuvsen, University of Goettingen, Germany

***Strategy Options for Angola's Agribusiness Sector after 27 Years of War: A Perception Based Study (ID#1118)*** [paper](#) [powerpoint](#)

Dr. Dave Weatherspoon, Michigan State University, USA  
Mr. Gomes Cambuta, Angola

#### **Case Conference**

**Discussant:** Dr. Yuliya Bolotova, University of Idaho, USA

***Dairy Industry Supply Control: Does It Work? (ID#1032)*** [case](#) [powerpoint](#)

Dr. Conrad Lyford, Texas Tech University, USA  
Dr. John Siebert, Texas A&M University, USA

***Market Coordination in the Sugar Industry, the Case of LSCPI (ID#1052)*** [case](#) [powerpoint](#)

Dr. Michael Gunderson, University of Florida, USA  
Dr. Aaron Johnson, University of Idaho, USA  
Dr. Michael Salassi, Louisiana State University, USA  
Dr. Cheryl DeVuyst, North Dakota State University, USA

#### **Paper Presentations**

**Moderator:** Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina

***Strategic Implications for the Future of the Texas Wine Industry (ID#1121)*** [paper](#) [powerpoint](#)

Mr. Michael Lau, Sam Houston State University, USA  
Dr. Roger Hanagriff, Sam Houston State University, USA

***Delivered Transportation Costs of Forest Residue for Cellulosic Ethanol Processing (ID#1112)*** [paper](#) [powerpoint](#)

Mr. Hayk Khachatryan, Washington State University, USA  
Dr. Eric Jessup, Washington State University, USA  
Dr. Ken Casavant, Washington State University, USA

***Community Attributes Influencing Growth of Food Manufacturing Industries in the United States (ID#1055)*** [paper](#) [powerpoint](#)

Ms. Fafanyo Asiseh, University of Idaho, USA  
Dr. Yuliya Bolotova, University of Idaho, USA

#### **Paper Presentations**

**Moderator:** Prof. Vijay Paul Sharma, Indian Institute of Management, India

***High-Value Markets for Agri-food Products: Analysis of the Potential for and Constraints to the Development of a Direct-Marketed Beef Industry in Virginia (ID#1044)*** [paper](#) [powerpoint](#)

Ms. Ashleigh Waddle, Virginia Tech, USA

Dr. Denise Mainville, Virginia Tech, USA

***Argentinean Specialty Crops Agribusiness: Governance Structures and Social Capital in International Trade (ID#1105)*** [paper](#) [powerpoint](#)

Ms. Mercedes Barilatti, Food and Agribusiness Program, School of Agronomy -UBA, Argentina

Mrs. Ana Maria Di Giulio School of Agronomy, UBA, Argentina

Mr. Hernan Palau, School of Agronomy, UBA, Argentina

Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina

Mr. Facundo Neyra, School of Agronomy – UBA, Argentina

**Paper Presentations:**

**Moderator:** Mr. Christian Fischer, Massey University, New Zealand

***Corporate Public Orientation in the German Agribusiness: Empirical findings (ID#1092)*** [paper](#) [powerpoint](#)

Ms. Friederike Albersmeier, University of Goettingen, Germany

Dr. Achim Spiller, University of Goettingen, Germany

***Restrictions to the Competitiveness of the Ecuadorian Shrimp Agribusiness (ID#1098)*** [paper](#) [powerpoint](#)

Mr. Pablo Aguirre Cueva, Food and Agribusiness Program School of Agronomy-UBA, Argentina

Mr. Hernan Palau, School of Agronomy-UBA, Argentina

Dr. Fernando Vilella, School of Agronomy – UBA, Argentina

***Analysing factors and attributes influencing beef consumption patterns and preferences on a municipal-level” The case of Bloemfontein South Africa (ID#1041)*** [paper](#) [powerpoint](#)

Ms. Philippus Christoffel Cloete, University of the Free State, South Africa

Mr. Pieter Rutger Taljaard, University of the Free State, South Africa

Dr. Andre Jooste, University of the Free State, South Africa

Ms. Ferdi Botha, University of the Free State, South Africa

**Paper Presentations**

**Moderator:** Mr. Daniel Conforte, Massey University, New Zealand

***An assessment of the characteristics of farmers in South Africa in order to identify best suited business structures to increase farmer's market power (ID#1043)*** [paper](#) [powerpoint](#)

Ms. Lizè Terblanche, University of the Free State, South Africa

Dr. Johan Willemse, University of the Free State, South Africa

***Entrepreneurial Opportunities in Agri-Food Supply Chains: Modeling the Dynamics of Discovery and Exploitation (ID#1079)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Winner\*\***

Dr. Brent Ross, University of Illinois at Urbana-Champaign, USA

Dr. Randall Westgren, University of Illinois at Urbana-Champaign, USA

***Drivers of Co-Innovation Success in Agro-Food Supply Chains (ID#1021)*** [paper](#) [powerpoint](#)

Dr. Paul Ingenbleek, Wageningen University, The Netherlands

Dr. Gé Backus, Agricultural Economics Research Institute, The Netherlands

**Case Conference**

**Discussant:** Dr. Mark Wade, Evans Properties Inc, USA

***AECOC and the launch of RFID Technology in the Food Sector (ID# 1010)*** [case powerpoint](#)

Mr. Jose Antonio Boccherini Bogert, Instituto Internacional San Telmo, Spain

Ms.Sofia Delclaux Real de Asua, Instituto Internacional San Telmo, Spain

***A New World of Opportunities in Food Safety: The Creekstone Case (ID#1050)*** [case](#)

Dr. Conrad Lyford, Texas Tech University, USA

Dr. Ken Harling, Wilfrid-Laurier University, Canada

**Paper Presentations**

**Moderator:** Mr. Christian Fischer, Massey University, New Zealand

***Complex contractual arrangements in the transaction of sugar cane to the industry: A case study in a sugar and ethanol mill in Brazil (ID#1063)*** [paper powerpoint](#)

Mr. Marco Antonio Conejero, PENSA, Univ. of São Paulo (FEA-RP/USP), Brazil

Dr. Marcos Fava Neves, PENSA, Univ. of São Paulo (FEA-RP/USP), Brazil

Mr. Luciano Thome e Castro, PENSA, Univ. of São Paulo (FEA-RP/USP), Brazil

Mr. Jose Carlos de Lima Junior, PENSA, Univ. of São Paulo (FEA-RP/USP), Brazil

Matheus Alberto Consoli, PENSA, Univ. of São Paulo (FEA-RP/USP), Brazil

***Food industry firms' strategies (ID#1015)*** [paper powerpoint](#)

Dr. Derek Baker, Institute of Food and Resource Economics, Denmark

Dr. Kim Lind, Institute of Food and Resource Economics, Denmark

***The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry (ID#1020)*** [paper powerpoint](#)

**\*\*Best Paper Award Winner\*\***

Dr. Yuliya Bolotova, University of Idaho, USA

Ms.Kalamani Muthusamy, USA

Dr. Christopher S. McIntosh, University of Idaho, USA

Dr. Paul E.,Patterson, University of Idaho, USA

**Paper Presentations**

**Moderator:** Mr. Machiel Reinders, Wageningen UR - LEI, The Netherlands

***Beyond Credence: Emerging trends in global consumer food preferences (ID#1005)*** [paper powerpoint](#)

**\*\*Best Paper Award Semi-Finalist\*\***

Ms.Nicki Marks, Victorian Department of Primary Industries, Australia

Ms.Bron Cuthbertson,Victorian Department of Primary Industries, Australia

***Is a Sustainable Agriculture Certification Business Design Possible in the Biofuel Agribusiness? (ID#1102)*** [paper powerpoint](#)

Mr. Sebastian Senesi, Food and Agribusiness Program, School of Agronomy -UBA, Argentina

Dr. Fernando Vilella, School of Agronomy – UBA, Argentina

Mr. Santiago Lorenzatti, AAPRESID, Argentina

***Out-Of-Home Trial and Consumers' Acceptance of New Food Products (ID#1033)*** [paper powerpoint](#)

**\*\*Best Paper Award Finalist\*\***

Mr. Machiel Reinders, Wageningen UR - LEI, The Netherlands

Mrs. Karin Zimmermann, Wageningen UR - LEI, The Netherlands

**Paper Presentations**

**Moderator:** Mr. Daniel Conforte, Massey University, New Zealand

***Applying a Sectoral System of Innovation (SSI) approach to the Australian Red Meat Industry with implications for improving innovation and entrepreneurship in the Australian Food industry (ID# 1136)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Winner\*\***

Dr. Christine Pitt, Meat & Livestock Australia Limited, Australia

Dr. Susan Nelle, Australian Innovation Research Centre, Australia

***Market Orientation, Entrepreneurship and Shared Vision: An Examination of the Illinois Beef Industry (ID#1079)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Winner\*\***

Mr. Eric Micheels, University of Illinois, USA

Dr. Hamish Gow, Michigan State University, USA

***Spirituality and Religion: Recent Developments in the Management Literature—Relevant to Agribusiness and Entrepreneurship? (ID#1009)*** [paper](#) [powerpoint](#)

Dr. Vera Bitsch, Michigan State University, USA

**Moderator:** Dr. Ina Enting, Wageningen UR, The Netherlands

***The Local Food Concept: Market Access through the Conventional Food Supply Chain (ID#1035)*** [paper](#) [powerpoint](#)

Dr. Getachew Abate, Michigan State University, USA

Dr. H. Christopher Peterson, Michigan State University, USA

***India's Agrarian Crisis and Smallholder Producers' Participation in Restructured Agri-food Chains (ID# 1131)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Finalist\*\***

Prof. Vijay Paul Sharma, Indian Institute of Management, India

#### **Student Case Competition Finals Round**

##### **Judges:**

Dr. Francesco Braga, Associate Professor, Department of Business, University of Guelph, Canada

Mr. Hans Johr, Corporate Head of Agriculture, Nestec Ltd, Switzerland

Dr. Hector Laurence, President & CEO, McLaren Holdings SA, Argentina

##### **Case Conference**

**Discussant:** Dr. Ina Enting, Wageningen UR, The Netherlands

***AGRO SEVILLA 2007 (ID#1007)*** [case](#) [powerpoint](#)

Dr. Miguel Angel Llano Irusta, Instituto Internacional San Telmo, Spain

Presentor: Gloria Ocana-Derqui, Instituto Internacional San Telmo, Spain

#### **Paper Presentations**

**Moderator:** Dr. Mark Wade, Evans Properties Inc, USA

***U.S. Ethanol Production, Corn Supply and Disappearance, and the Marketing of Corn in the U.S (ID#1002)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Finalist\*\***

Dr. Dennis Conley, University of Nebraska-Lincoln, USA

Mr. Adam George, University of Nebraska - Lincoln, USA

***Bridging Challenges in Value-Added Food Marketing Through Product Management and Consumer Studies (ID#1026)*** [paper](#) [powerpoint](#)

Dr. Wuyang Hu, University of Kentucky, USA

Dr. Linda Cox, University of Hawaii at Manoa, USA

***Evolution and performance of co-operatives in Bulgaria, New Zealand and Uruguay (ID#1095)***

[paper](#) [powerpoint](#)

Dr. Elena Garnevska, Massey University, New Zealand

Mr. Daniel Conforte, Massey University, New Zealand

Ms. Nicola Shadbolt, Massey University, New Zealand

**Paper Presentations**

**Moderator:** Mr. Jacques Trienekens, Wageningen University, The Netherlands

***Consumer's perception on fruits and vegetables packaging in India (ID#1004)*** [paper](#) [powerpoint](#)

Dr. Jabir Ali, Indian Institute of Management Lucknow, India

Dr. Sanjeev Kapoor, Indian Institute of Management Lucknow, India

***Quality perception using signals on food labels: an analysis on Italian consumers (ID#1049)***

[paper](#) [powerpoint](#)

Dr. Maria Carmela Aprile, University "Parthenope", Italy

Dr. Flavio Boccia University "Parthenope", Italy

Dr. Giuseppe Gallina, University "Parthenope", Italy

***An Evaluation of Cross-Market Effects of Generic Dairy Promotion Programs (ID#1083)*** [paper](#)

[powerpoint](#)

Dr. Joseph V. Balagtas, Purdue University, USA

Mr. Metin Cakir, Purdue University, USA

Dr. Harry M. Kaiser, Cornell University, USA

**Paper Presentations**

**Moderator:** Dr. Derek Baker, Institute of Food and Resource Economics, Denmark

***Increasing Domestic Consumption of South African Wines: Exploring the market potential of the "Black Diamonds" (ID#1089)*** [paper](#) [powerpoint](#)

Ms. Leah Ndanga, University of Pretoria, South Africa

Dr. Andre Louw, University of Pretoria, South Africa

***Evaluating Transaction Costs faced by producers in milk Marketing: Marketing Board versus Contracts (ID#1120)*** [paper](#) [powerpoint](#)

Ms. Annie Royer, ATOM, France

***Innovation and Uncertainty: Application of Option and Portfolio Concepts to Strategy Development (ID#1065)*** [paper](#) [powerpoint](#)

Mrs. Maud Roucan-Kane, Purdue University, USA

Dr. Mike Boehlje, Purdue University, USA

Dr. Allan Gray, Purdue University, USA

**Paper Presentations**

**Moderator:** Mr. Woody Maijers, INHOLLAND Educational University, The Netherlands

***Bio-fuel and Animal Production Agribusiness in Argentina: Innovativeness, Entrepreneurship and Leadership (ID#1103)*** [paper](#) [powerpoint](#)

**\*\*Best Paper Award Semi-Finalist\*\***

Mr. Marcos Daziano, School of Agronomy-UBA, Argentina

Mr. Facundo Neyra, School of Agronomy - UBA, Argentina

Mr. Sebastian Senesi, School of Agronomy-UBA, Argentina

Dr. Fernando Vilella, School of Agronomy - UBA, Argentina

***Organizations in Agrifood Chains and their Strategies for Sector Competitiveness: The Colombian Coffee Model (ID#1099)*** [paper](#) [powerpoint](#)

Mrs. Luz Ayala, Food and Agribusiness Program, School of Agronomy-UBA, Argentina  
Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina  
Mr. Hernan Palau, School of Agronomy-UBA, Argentina  
Dr. Fernando Vilella, School of Agronomy – UBA, Argentina

***Lobby Processes in Agribusiness Chains. Two Argentine Cases (ID#1104)*** [paper](#) [powerpoint](#)

Mr. Facundo Neyra, Food and Agribusiness Program, School of Agronomy -UBA, Argentina  
Mr. Marcos Daziano, School of Agronomy – UBA, Argentina  
Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina

**POSTERS**

***Nutrition Information on Packaged Food in the Context of Increasing Obesity in the U.S. (ID#1040)*** [poster](#)

Dr. Sayed Saghaian, University of Kentucky, USA  
Dr. Sushil Kumar, Indian Institute of Management - Lucknow, India

***Export Potential and Product Space for South African Agricultural Products (ID#1051)*** [poster](#)

Mr. Olubukola Oyewumi, National Agricultural Marketing Council, South Africa  
Dr. Andre Jooste, National Agricultural Marketing Council, South Africa  
Dr. Ron Sandrey, Trade Law Centre for Southern Africa, South Africa

***Re-engineering the Goat Sector in Namibia with a Focus on Entrepreneurial Development (ID#1054)*** [poster](#)

Dr. Kobus Laubscher, University of the Free State, South Africa  
Mr. Ernst Idsardi, University of the Free State, South Africa  
Mr. Salomo Mbai

***Reducing Eye Injuries in Seasonal Farm Workers Harvesting Florida Citrus (ID#1081)*** [poster](#)

Dr. Mark Wade, Evans Properties Inc, USA  
Dr. Paul Monaghan, University of South Florida, USA

***Management of Agribusiness Services: Precision Service Offerings and Profitability of Retail Crop Input Dealers (ID#1085)*** [poster](#)

Mr. David Ubilava, Purdue University, USA  
Dr. Jay Akridge, Purdue University, USA

***Analysis of the Price Impacts of Federal Fruits and Vegetables Commodity Procurements (ID#1031)*** [poster](#)

Ms. Amanda Sceiford, Virginia Tech, USA  
Dr. Denise Mainville, Virginia Tech, USA

***Agricultural Nanotechnologies and Implications on Policy and Consumer Acceptance (ID#1038)*** [poster](#)

Mr. David Marshall, University of Kentucky, USA  
Dr. Wuyang Hu, University of Kentucky, USA

***Introducing New High Value Crops in Jordan: The Case of Sweet Onions (ID#1140)*** [poster](#)

Dr. Jay Lillywhite, New Mexico State University, USA  
Mr. Ayman Ghumain, New Mexico State University, USA



***Integrating Production and Marketing of Asian Vegetables: A Case Study of a Central American Firm's Strategy to Export into the North American Market (ID#1124) [poster](#)***

Dr. John Westra, Louisiana State University, USA  
Dr. Roger Hinson, Louisiana State University, USA  
Dr. Carl Motsenbocker, Louisiana State University, USA  
Dr. Wess Harrison, Louisiana State University, USA

***Strategic Marketing Planning and Management for Traceability in the Argentine Honey Sector (ID#1107) [poster](#)***

Mr. Fernando Mogni, Food and Agribusiness Program, School of Agronomy -UBA, Argentina  
Mr. Hernan Palau, School of Agronomy -UBA, Argentina  
Ms. Cecilia Tresoldi, School of Agronomy -UBA, Argentina  
Mr. Sebastian Senesi, School of Agronomy -UBA, Argentina  
Dr. Fernando Vilella, School of Agronomy – UBA, Argentina

***Designing Appropriate Market Linkage Programs for Small Farmers: Are Cooperatives and Private Firms Complements or Substitutes? (ID#1110) [poster](#)***

Mr. Aleksan Shanoyan, Michigan State University, USA  
Dr. Hamish Gow, Michigan State University, USA

***Internationalisation and the challenges it creates to agribusiness executive education (ID#1113) [poster](#)***

Ms. Nicola Shadbolt, Massey University, New Zealand  
Dr. Gregory Baker, Santa Clara University, USA  
Dr. Jay Akridge, Purdue University, USA

***Consumer's Trust Attitudes and Actions Following a Food Safety Event (ID#1116) [poster](#)***

Mr. Jonathan Shepherd, University of Kentucky, USA  
Dr. Sayed Saghaian, University of Kentucky, USA

***Meeting Food System Challenges through Contract Farming in India: Opportunities and Challenges (ID #1114) [poster](#)***

Mr. Gurulingappa G. Koppa, Institute of Rural Management, India  
Mr. Pradip Kumar Mishra, Institute of Rural Management, India