White Paper

Thoughts and Findings Emerging From:

“New Frontiers in Grain Quality Technology and Informatics: a National Roundtable”

April 13-15, 2005
Hotel Intercontinental
New Orleans

Hosted by the University of Illinois

White Paper Editorial Committee:
Peter Goldsmith, U of Illinois
Tom Redick, United Soybean Board
Fred Roth, Agris
Paul Smolen, Bunge
Michael Sweat, Food Origins
Amy Bantham, Food Origins
Michael Masterovsky, SJH
Bill Jorgenson, SJH

Executive Summary

The following is a White Paper on grain quality measurement and informatics. The White Paper has two objectives: 1) to summarize the activities of a new conference http://www.grainqualitytechnology.org/ on grain quality and informatics held in New Orleans in April, 2005; and 2) to provide recommendations and action steps for the industry for creating and capturing value from grain attributes.

Additional sections of the White Paper include:

I. Introduction
II. Conference Summary
III. What Was Said
IV. What It All Means
V. Where Do We Go From Here

Key industry observations:

- Grain attribute opportunities are essentially driven by four forces:
    1. Redesigned delivery systems to more effectively serve customers
    2. Technology to measure, track, & manage attributes
    3. Low cost per unit for information and transaction costs
    4. Grain buyers procure characteristics not attributes
- Buyers think about characteristics and properties (i.e., consistency), sellers seem to focus only on individual attributes
- 70% of quality for buyers is determined post-genetics
- Suppliers need tools to more effectively assess value
- For farmers to realize more value they will have to measure and manage what end-users find strategic
- Many of the attributes being created already exist in the industrial or commodity channels
- Low cost/low labor, high speed/high volume measurement and informatics is key because the underlying good is low valued/high volume
- Automated, high speed, high volume data retrieval involving sensors, nano, RFID, genetic testing, and GPS will be important components
- GMOs offer great potential for end-use value creation, but will require measurement technology to minimize commingling
- Government needs to rethink its role in differentiated grain markets because transactions are more dynamic, heterogeneous, and complex
- One Forward-One Back will initiate search by firms to create private value from quality management to reduce the cost burden of traceback

I. Introduction

Overview

A three-day industry conference (Tech I) was held in New Orleans at the Hotel Intercontinental. The subject was grain quality technology and informatics. This conference (http://www.grainqualitytechnology.org/) was the first of its kind and was hosted by the University of Illinois. There were 138 participants from the US, Europe, and South America, representing 85 different businesses and organizations. 74% of the attendees were from business, 15% from academia, and 11% from government. Twelve sponsors provided monetary or in-kind support, and 13 firms displayed their technology. The conference involved panel discussions, case studies, breakout sessions, and industry tours, all focused on the subject of grain quality technology and informatics. Panelists and attendees represented all perspectives along the marketing channel including government regulators and market promoters.

Background

In recent years, tremendous advances have been made in grain quality testing and management. From the detection of genetically modified organisms to rapid assessment of starches and amino acids, the ability to test is more available than ever. Information abounds. The ability to manage attribute-related information, grain quality informatics, is also improving rapidly. New systems have emerged that allow the combination of greater service and value creation for end-users by the grain supply system. Quality testing equipment can now be integrated into a variety of types of production, harvesting, storage, and grain handling equipment. Sellers of grain from seed to processing can now know what they are selling.

High starch for ethanol production, protein quality and quantity for soy-based isolates, genetically modified-free ingredients, nutritionally dense feeds, zero trans fatty acid foods, and pharmaceutical applications; are some of the examples of the new and dynamic arena of grain and oilseed procurement. Suppliers from around the world now operate in a hyper competitive environment to access these new demand opportunities.

Delivering feed and food stuffs within safe and secure supply chains now is part of the bundle buyers are demanding from their suppliers. Being able to traceback, participate in fast and efficient recalls, and provide surety to buyers, are key for competitive advantage.

A final element is cost. Grains, such as corn and soybeans, are produced in large quantities around the globe and have numerous industrial as well as organic substitutes. Many of the next stage uses of corn and soybeans are in low-valued bulk products, such as corn syrup, ethanol, and soybean meal. As a result, premiums for quality are small and tend to decay rapidly. Commodities still offer buyers superior features of procurement flexibility, low transaction costs, and opportunities for risk management. In the end, there are few opportunities for end-users to pay significantly more for a quality-based offer versus a commodity offer. Therefore, cost discipline will be critical for quality-based grain models to be successful.

Roundtable Objectives

There are numerous models, concepts, and new businesses exploring the frontier of grain quality informatics. As with all formative stages of changing environments, many new concepts will fail and some will succeed. Who knows where the bold entrepreneurs and innovators of the new paradigm will take us.

With this in mind the University of Illinois and the National Soybean Research Laboratory in collaboration with the Illinois Soybean Checkoff Board facilitated a 3-day Roundtable. The goal of the Roundtable was to serve as an industry catalyst bringing together leading industry and academic thinkers to explore the frontiers of grain quality informatics and new business models. The Roundtable had three main objectives:

1. To learn about frontier technologies, applications, business models, and end-user needs,
2. To interact and hear from a broad spectrum of industry players, and
3. To contribute to a white paper that outlines directions for research, development, programming, and policy supporting the proliferation of quality-based business models.

II. Conference Summary

Introduction

The first purpose of the White Paper is to summarize the activities and highlights of Tech I. The second purpose is to synthesize the various presentations and comments to provide guidance to the industry about creating and capturing value from grain differentiation.

The White Paper has been written by a committee of eight[1]. The White Paper, key audio clips[2], photos, articles, reprints, and presentations will appear on the conference website: http://www.grainqualitytechnology.org/ or may be purchased as a "Full Proceedings" including the conference binder for $30.00.

Tech I was designed to bring all perspectives along the marketing channel together to better understand the nuances of value creation and capture from grain differentiation. All speakers were managers and government officials directly involved in differentiated grain markets, technology, or informatics. A list of speakers, sponsors, and displaying companies can be found on the web site.

[1] White Paper Committee: Peter Goldsmith, University of Illinois; Mike Sweat, Food Origins; Amy Bantham, Food Origins; Bill Jorgenson, Food Origins; Mike Masterovsky, SJH Consulting; Paul Smolen, Bunge; Tom Redick, United Soybean Board, Fred Roth, Agris Corp.

[2] All sessions were recorded for analysis purposes. No direct citations will be made.

Tech I focused on the technologies and business models associated with positive attributes[3] associated with corn, soybeans, and wheat differentiation. This subject area was selected to give the conference focus. Being a new event, focus and clarity were critical. Subsequent technology and informatics conferences might very likely focus on other types of technologies and attribute classes within other product/commodity contexts.

Program Summary

Panels - The panelists were industry managers and government specialists.

Panel 1-- Grain buyers/users were asked about their needs with respect to grain attributes.

Panel 2-- Handlers and producers were asked to discuss their interest, abilities, technologies, and experiences producing and delivering differentiated grains.

Panel 3-- Life science companies were asked to discuss differentiation from two perspectives; the underlying measurement technology and informatics used in breeding and selection, and their view of opportunities and challenges marketing enhanced grains.

Panel 4-- Technology and informatic firms were asked to discuss both the underlying technologies supporting grain differentiation and business models (actual or conceptual) for creating and capturing value from grain attributes.

Panel 5—Government representatives were asked to discuss the role of government in differentiated grain markets both domestically and for facilitating international trade.

Keynotes

There were two keynote speeches, one to open the conference and one to cconclude. Dr. Kathleen Eisenhardt, strategy specialist from Stanford University provided a framework for action for firms dealing with acute technological change and opportunity. Jimmy Woodward, CFO Flowers Foods, and Ken Parnell, VP (retired) of Wal-Mart provided a view of the future where technology and informatics are critical to supplier-buyer relationship optimization within the agri-food chain.

Industry Tours

Two half-day industry tours were held concurrently. Those that were interested in grounding themselves in grain transport were given an inside tour of some of the largest grain port facilities in the world, ADM-Ama; Bunge-Destrehan; and Total Transportation, Inc. Those interested in grounding themselves in commercial scale grain quality measurement technologies visited, GeneScan, USDA Federal Grain Inspection Service, and ADM-Destrehan.

[3] Positive attributes are those product features where generally more is preferred than less. High oil and high extractable starch are examples of positive attributes. Negative attributes are where one is trying to remove a "negative" attribute from a product, such as molds and GMOs. Products such as low linolenic soybeans don't conform exactly to the definition, but would be considered a positive attribute.

Breakouts - Four breakout sessions were convened on the last day. A cross-section of stakeholders was lead through a semi-structured discussion of key strategic questions (Appendix 2) on four topics:

1) **Grain Supply Chain R&D**
2) **The Role of Government in the Grain Supply Chain**
3) **Grain Supply Chain Technology**
4) **Strategies in Attribute Management**

Industry Displays

Agris, **a John Deere Company** - an informatics company
Cognis - a measurement equipment company
FOSS - a measurement equipment company
GeneScan - a testing, measurement, and verification company
USDA GIPSA - government agency responsible for grain inspection
NC-213 - a national academic research group focused on grain quality
Zeltex - a measurement equipment company
Strategic Diagnostics - a testing, measurement, and verification company
RailRunner - a transportation and logistics company
Cert ID - a testing, measurement, and verification company
EnviroLogix - a testing, measurement, and verification company
Perten Instruments - a measurement equipment company
Pioneer Hi-Bred - a seed company

Management Articles

The proceedings included two management articles, one from the *Harvard Business Review* on strategy and technology and the second from the *Journal on Chain and Network Science* on value creation and identity preservation.

1. "Strategy as Simple Rules." Eisenhardt and Sull, 2001.
2. "Ten Conversations about Identity Preservation." Goldsmith and Bender, 2004.

III. What Was Said[4]

Keynote #1

Kathleen Eisenhardt, Professor of Management, Stanford University

The key point that Dr. Eisenhardt made was about the importance of "playing the game." Strategy development in chaotic environments is emergent and experiential. So it is critical for firms to not over commit in new areas where uncertainty abounds but make sure they are invested and engaged with new technologies as the future unfolds in real time. Firms should be constantly probing new models and new technologies.

[4] All presentations are posted on the website or can be found in the hard-copy proceedings.

Panel #1: End-Users

Will Duensing, Director, Quality Assurance and Technical Services, Bunge Milling
Will outlined 21 corn attributes preferred by food processors. He also pointed out two important realities: the relatively small size of the food corn market, compared to the feed and energy markets, and the potential conflict between the 21 preferred user attributes and the 6 attributes favored by farmers. The corn market breaks down as follow: (1) Feed / Residual = 55.5 % (2) Food Seed Ethanol = 35.4 (Ethanol % increasing rapidly in this sector) (3) Exports = 19.1%. In the food category, corn meal is very specialized for snack foods. Dry milling uses 1.5% of supply, about 10% relative to Wet Milling.

David Bossman, Executive Director (retired), American Feed Industry Association
David made three points, that 80% of corn and over 90% of soybeans are used for feed. Second, feeders can procure attributes from a variety of sources, including industrial; so there is competition. Third, the key need is for consistency. Codex Alimentarius --- on Animal Feeding – has "traceability" code, worldwide GMPs. (One step forward, one step back traceability). Since grain traders can incur liabilities from traceback systems, grain shippers should "Circle your wagon and reduce your liability – you've got to find where you bought that grain from" (in reference to the new Codex standard demanding traceability in animal feed). Growers will find grain shippers tracing back for more than just biotech genetic events. The technology for detecting traces of mycotoxins has improved, while the medical evidence implicating mycotoxins in various health problems is building.

Jeff Norman, Corn Procurement Manager, Tate & Lyle
Jeff talked about the importance of contracting, coordination, and full traceability in their business model to be the leading renewable ingredients company. Rapid pace of genetic modification poses challenges – need identity preservation to maintain market share in certain markets. The Starlink™ was a "nightmare for our business" and there may be more identity preservation failures to come (e.g., U.S. corn exports are being tested for traces of Syngenta's Bt. 10, which has zero tolerance).

Eduardo de la Fuente, Director of Quality Control, Maseca
Eduardo provided a detailed overview of 11 key grain characteristics Maseca likes to see and how they impact manufacturing plant yield, efficiency and product quality. Maseca's traceability for food safety began after the Starlink™ corn recall to perfect a system for more traceability, right back to the seed and each farmer's field. GIS maps are use to plot coordinates of the field and identify pollen barriers visible to GIS. Training for farmers at facility helps to ensure tracing from farm to fork. The data is maintained on a computer which can run a traceability report in 15 minutes – which silo was served by which farmers, all contracts in system as well. In 20 minutes we can tell you what seed was planted by that farmer in a particular field.

Panel #2: Grain Handlers and Producers

Lynn Clarkson, President, Clarkson Grain Company, Inc.
Lynn talked about the role technology and supply chain coordination play as they meet the needs of their very discriminating clients from around the globe. He reported a 35% increase in organic markets worldwide. Standard setting could prove challenging, as some vendors seek a 0.1% or 0.5% tolerance for GM content depending on regulatory status of the biotech crop, while the US is more process-dependent. This leads buyers to "cherry pick" loads based on genetic testing, and reject those that fail the test. The bottom line for markets is more contract production. General Mills saw 30% increase in efficiency when it went to contract production, since it could dictate the region where crops would be grown and specify use of their optimum variety. Farmers must meet these criteria: (1) attitude (2) Info-tech infrastructure (including precision farming with GPS etc.), (3) post-harvest management (see Argentina's "Ag Bags" for low cost segregation of harvest) (4) third party verification. While growers may collect organic corn premiums of $6.50/bu compared to $2.50/bu for conventional, there is overseas competition that may take this market.

Dale Crawford, Farmer, Illinois Soybean Association
As an Illinois soybean grower, Dale told about his personal experienced with a new initiative called the "Soybean Quality Rewards Program" where producers are paid a premium for protein. He also addressed was how measurement occurred, the perspective of farmers towards the program, and suggestions how the program might be expanded. There is little risk to the producer, compared to some specialty crops (i.e., no worries about biotech crop pollen drift) and growers can collect up to 6 cents per bushel, with lower premiums for lower protein counts.

Chuck Cawley, Farmer, Illinois Farm Bureau
Chuck provided insights into the complex issue of seed purity, measurement technology, and producer liability. What are the critical control points as producers and handlers attempt to deliver on contracts with ever narrower specifications. Traceability and identity preservation are the key to premium markets. Premiums paid on specialty crops, however, do not always cover the costs associated with testing, identity preservation (e.g., separate planter, combine, storage, transport etc.). With seed purity at 95%, growers may assume the risk of failure to meet buyer standards, even if the grower performs without error (since the seed may prove to be the source of the lost sale). Illinois Farm Bureau's "Tech Advisory Group" (see their website) has a wealth of knowledge about the identity preservation challenges facing growers.

Larry Groce, Sales and Marketing Advisor, Premium Ag Products, LLC
Larry, who works with a producer group in Shelbyville, Missouri, involved in identity preservation, describes five key challenges for groups attempting to create and capture value. There are challenges that specialty contracts bring, like the "buyers call" clause that can create a cash flow crunch for growers who have to hold the crops, not just deliver

a commodity to an elevator upon harvest. "Grower Groups" could be the key to controlling the costs of identity preservation, and like Wayne Gretzky anticipating where the puck will be, growers need to anticipate buyer demand and be ready to deliver.

Panel #3: Seed Companies

Pradip Das, Director, Crop Analytics and Susan McIsaac, Monsanto Co.
Pradip and Susan discussed two key points. The first was how NIR technology was having huge impacts on the speed and precision when developing differentiated grains. The second point of discussion was the state of Monsanto's innovation pipeline with respect to grain attributes, which is creating high yield hybrid for ethanol production. "Process preferred" corn provide high fermentation options for ethanol, with 28 dry mill ethanol plants participating in Monsanto's Fuel Your Profits℠ initiative along with over 70 supporting elevators across nine states using over 350 million bushels of corn from 2.5 million acres in 2004." http://www.monsanto.com/monsanto/layout/media/04/03-04-04.asp

Peter Coaldrake, Director, Grain and Nutritional Sciences, Maize Development, Pioneer Hi-Bred Int'l, Inc., A DuPont Company
Peter made the connection between the rise of new technologies available to life science companies and their new capability to increase the specificity of their breeding and shift from input to output traits. Identity preservation systems are needed for coming waves of specialty output traits. Biotech tools expand the range of genetic resources that can be brought into play, improving food qualities and enhancing traits to "fine-tune" animal feed. Detection of traits will move at a rapid pace too, with rapid (i.e., high-throughput) screening of traits at elevators and processing centers. Planners will determine before marketing seed whether the premium for higher yield and agronomic qualities will cover the costs of identity preservation.

John A. Schillinger, President, Schillinger Seed & CEO, Heartland Fields, LLC
John talked about their businesses of integrated supply chain alliances. Through these alliances they are able to leverage their expertise in soybean germplasm to deliver superior product performance to their food manufacturing customers. The 6 cent premium for soy protein is one example of successful delivery of a higher value soybean product. Non-GMO soy is another example of a steadily expanding market for specialized production, with non-GM soybean seed in demand for producers serving consumer markets (soymilk, tofu, Japan's unique preferences, etc.). Growers should expect overseas customers, particularly Japan, to pay a personal visit to inspect the facilities for production.

Thomas P. Redick, Attorney, United Soybean Board
Tom linked the policy and legal developments with respect to GMOs that could threaten the rate of innovation in enhanced grains. He also made a compelling case for the role of measurement and informatics to help address liability and indemnification issues

associated with greater differentiation and the associated risks of contamination/commingling. The Cartagena Protocol on Biosafety will enact global regulation of commodities in the coming year, which will drive more identity preserved production in corn, soybeans, cottonseed and canola to serve overseas markets for food and feed. The European Union's traceability and labeling directives took effect in April, 2004, providing a taste of the documentation demands that the Biosafety Protocol will impose. Growers who rely on USDA for guidance on pollen drift should take care, since the USDA struggled to set suitable standards for pollen drift from corn. A government standard for pollen drift is a mere minimum that may not prevent liability from pollen drift from biotech crops that cannot commingle with food or feed.

Panel #4: Testing Equipment and Informatics

Jan-Ake Persson, Global Grains Manager, FOSS

Jan-Ake outlined the numerous opportunities for attributes to add value all along the marketing channel from seed to fork. FOSS provides dedicated, rapid and accurate analytical solutions that allow growers to market quality grains. FOSS worked to develop a test for wet gluten measurement which worked, to the surprise of their milling industry clientele. For many of the opportunities to be realized the numerous obstacles related to reference methods, segregation, and measurement need to be addressed. Try to use existing instruments to avoid capital investment, since segregation of quality in chain of commerce can be costly and exceed premiums to be paid. FOSS NIR grain analysis devices are used in various exciting applications. See, e.g, Charles Hurburgh, Near-Infrared Grain Spectroscopy, Iowa St. Univ. Grain Quality Lab, http://www.extension.iastate.edu/grainlab/research/nirprojects9_03.pdf

Jerry Halterman, Managing Director, GeoVeritas

Jerry described their geospatial information management system that links genetics, the environment, and management practices into actionable business intelligence for those involved in grain channels. He provides relational databases for agribusiness and rural markets -- producer and consumer records -- allows precision market analysis -- including processor attributes via GEM grains. (Genetic, Env, Mgt)

Ching-Hui Tseng, QTA Technical Manager, Cognis

Ching-Hui described QTA® (Quality Trait Analysis) which is an internet-enabled FT-NIR analysis service that characterizes value-added traits, establishes traceability of crop products along the supply chain and provides a unique centralized database tool for grain management. He provides server storage and Internet access for quality traits (isoflavone, specific sugars, etc.). QTA owns the instruments -- you run it.

Ron Leiker, CEO and Fred Roth, Director of Business Development, Agris Corp

Ron described their ERP software product and web-based on-line retrieval system that allows the collection, management, analysis, dissemination, and sharing of grain attribute

data associated with a firm's grain inventory. "Bin Sight" -- commodity segregation, storage and blending -- Traceability for stored grain (including farm stored). Allows segregation for whatever can be tested. Traceability reporting for stored grain includes an online display of relevant grower information.

Dave Crompton, President, OPIsystems, Inc.
Dave described their automated sensing system that allows remote monitoring and data management of the quality of the grain inventory. Stormax monitoring systems – picks up insects and reports to server. OPOGIMA – automated monitoring and alarms. Has a wireless option with 20 mile range.

Richard Dempster, Director, Product and Technological Development, American Institute of Baking
Rick reported on research that looked at the relationship in wheat flour between the various growing environment and genetic variables and a set of baking/bread quality measures. 30% of the end-use experience was a function of genetics and 70% the growing environment.

Panel #5: Facilitating International Trade
Steve Tanner, Director of Technical Services, GIPSA, FGIS, USDA Technical Center
Steve shared the government's perspective on quality markets: to enhance transparency by providing rapid testing in order to differentiate functional qualities that meet specific end-user needs. Biotech genetic events are info needed by overseas importers. While testing can be avoided through verified processes, there is a need for process validation by testing that adheres to uniform standards. We will be weeding out the labs who don't meet genetic testing standards. We may see online licensing to grade grain sometime in the future.

Kent Sisson, Assistant Deputy Administrator for Marketing, FAS, USDA
Kent described the role of FAS in the marketing of differentiated products overseas. Cooperator Program – funding levels started out with boat commodities, evolved to other groups including groups developing consumer-oriented promotions. Focus used to be on building markets for products, not much attention to changing the product to meet the specific needs of customers. Today, FAS adapts to the needs of overseas markets.

Dennis Thompson, CEO, Illinois Crop Improvement Association, Inc.
Dennis announced a new strategic alliance with GeneScan to service extended marketing channels with third party verification and oversight. Key features of their philosophy are that perception is reality, take a procurement perspective, cover the entire channel, be practical, be fair, and be flexible.

Dave Shipman, Deputy Administrator, GIPSA, FGIS, USDA, given by Steve Tanner
Dave provided an overview of the direction of FGIS with respect to grain differentiation. Their goal is to provide a USDA reference set for those measuring grain attributes.

Juan Carlos Batista, Agrifood Quality Director, Agrifood Health and Quality National Service, Secretariat of Agriculture, Livestock, Fishery and Food, Argentina
Juan provided an overview of the Argentinean grain trade and perspective on traceability and contaminants.

Three Case Studies: Views from the Frontlines: New IP Models in Action
Dan Kallestad, CEO, Cerys Systems, Inc.
Dan presented a case study of a new system that utilizes a web-platform to remotely monitor, control, and manage attributes of grain lots, from on-farm bins to commercial silos. The system allows grain aggregators to customize a product to a buyer's precise specifications utilizing disparate sources of grain.

Wade Ostrander, Field Agent, North Kansas City Missouri, National Starch and Chemical Company
Wade shared the experiences of National Starch's new farmer program designed to elevate and reduce the variability of starch levels supplied by producers. Working backward from the plant's operations Wade was able to document the benefits of changing the starch profile and translate that into a viable farmer program.

Paul Smolen, Bunge
Paul shared the challenges faced by suppliers attempting to capture added value for higher quality or higher attribute content soybeans and soybean meal into mainstream markets. Key findings highlighted the critical importance of using new measurement techniques along the supply chain from grower to feeder. Doing so would recognize the present attribute variability in soybeans and soymeal as a first step to identifying differences that matter enough to influence purchasing behavior.

Keynote #2
Jimmy Woodward, CFO & Senior VP, Flowers Foods, and
Ken Parnell, Vice-President Meat, Seafood and Deli, Wal-Mart (retired)

Ken's comments had two themes: 1) that markets and needs are dynamic and that all firms constantly need to strive to add value and innovate; and 2) that many innovative ideas that have improved the consumer product supply chain were initially thought of as impossible. Enhanced agricultural quality management and full traceability as new initiatives may seem like burdens now but will be the norm in the near future.

Jimmy described the practical application of Ken's thinking as suppliers to Wal-Mart. They have embraced the need to provide enhanced quality control and full traceability. He described the incremental process of how they are achieving their objectives through measurement, technology, and constant improvement.

Breakouts - The following are the five key observations made in each breakout session.

Grain Supply Chain R&D

1. Need for automated cheap/rugged sensors -don't need the Cadillac- a 1st mile (farm/elevator) problem - to lower per-unit measurement costs look to leverage technology and applications from other sectors (horticulture) and other industries (emissions testing)
2. Need to focus on how to protect and prevent change in the product's specs as it passes through the supply chain
3. Key is data integration and automation - hence sensors, wireless transmission (RFID), smart technologies, self-configuration
4. Need to identify the critical control points for measurement and BMPs for grain management in order to reduce the repetition of,or need for, measurement. Compare and contrast the situations of tomatoes and soybeans: 30% of cost due to transportation so opportunities to use technology to get product more efficiently to market
5. 70% of quality variation comes from the environment

The Role of Government in the Grain Supply Chain

1. Government regulations change the way industry operates and can have unintended consequences: huge costs for compliance with, for example, the FDA Bioterrorism Record-keeping Rule and Sarbanes-Oxley; unreasonable amounts of documentation and paperwork; restrictions on international research.
2. Industry tends to fight government regulation, finding it costly and burdensome, but if it can change its practices to result in higher quality and greater value, it can find a business reason to do what is required.
3. The role of government in an attribute world is: to partner with industry to harmonize and standardize test methodologies, with the intended effect of measuring consistently and reliably to add value throughout the supply chain; to provide internationally-recognized credibility and to protect that credibility by basing standards on sound science.
4. At the same time, there is no "one size fits all;" complexity must be allowed in the system to provide customers with choices and meet customer expectations up and down the chain.
6. There needs to be transparency and trust between government and industry and because there is credibility, the government generally takes a "trust but verify" approach to industry; the government has become more open to the needs of industry as it sees that the needs are changing.

Industry Tours

The following are five key observations made at each of the stops on the industry tours.

Industry Tour #2: ADM(Ama)-Bunge(Destrahan)-Total Transportation

1. Increasing fragmentation of buyer demands; whereas as over 70% of all ships used to be loaded with the same commodity in each hold, now only 50% are that way. Buyers are requesting that suppliers be able to load different commodities in each hold.
2. Because the cost of landing and keeping a ship berthed are so high there are increasing opportunities for suppliers to service all the needs of a buyer –"1-stop shopping," e.g., corn, soybean meal, and wheat.
3. Who holds the inventory upriver? Timing and coordination of ships with the various barge companies and the supply chain back to the origin is non-trivial.
4. Port facilities don't make money on storage, the facilities are operating at or near capacity, there is active investment in automation and speed, and the volume they have to move is staggering.
5. The volume levels of grain demanded require tremendous speed in handling. For the large volume purchasers there will be a tradeoff between speed and cost as product specifications narrow.

IV. What It All Means

*Compare the presentations of the life science companies with those of the end-users

See: **Das/McIsaac; Coaldrake; and Duensing; Bossman; Norman; La Fuente**
There is dissonance between the two. Life Science following the pharma model focuses on targeted attributes while end-users talk about characteristics like "consistency" that is a complex function of the genetics, the environment, and handling.

*Might the challenges in delivering such an "offer", i.e., consistency at a very low cost be hindering the development of output trait markets.

*****Low cost of information per unit of the underlying grain is critical. So sensors, automation, data integration, and wireless transmission will be necessary.

See: **Crompton; Kallestad; Leiker; Halterman; Tseng**

*****Dedicated supply chains can work for buyers but the key is measurement

See: **Ostrander; Schillinger; Smolen**

*****The key for successful differentiated grain business models is efficient measurement. Get the technology up-chain in then hands of farmers and handlers.

See: **Smolen; Persson; Dempster**

*The key for successful differentiated grain business models is client service

See: **Clarkson; Schillinger**

*Producer creation and capture of value is not obvious. Where and how do they fit in?

See: **Cawley; Groce; Ostrander; Crawford; Schillinger; Clarkson**

*****There exists a debate with respect to calibration and industry reference standards. Are differentiated grain markets like commodity markets in that transparency and meta-(government) standards are necessary conditions for efficient markets? Or are differentiated grain markets different in that meta standards are not necessary; replaced by the idiosyncratic trade specifications and terms agreed upon by the bilateral trading partners? The implication is that with the former a gold standard is needed for calibration, while with the later a bronze or no standard will do.

See: **Tanner; Shipman; and Thompson; Smolen; and Ostrander**

*****A debate exists as to where and how end-user needs can best be met; through genetic or environmental attributes. If both, what is the proper balance? And if both how can supply chains be constructed to incorporate both appropriately?

See: **Das/MacIsaac; Coaldrake; Schillinger; Clarkson and Halterman; Dempster**

*Corn and Soybeans are essentially feed and energy inputs therefore need to focus value creation on servicing feed and energy clients.

See: **Bossman, Duensing**

***Dennis Thompson** links **Kathleen Eisenhardt's** concept of strategic thinking --- with the successful ag entrepreneur in 21st century who will pick up on end user's perceptions of quality and be able to deliver real value. This could be biotech specialty, non-GMO speciality, non-myco-pesticide, or particular qualities customers want for food use. (**Tanner and Persson** noted that technology has to adapt tools to detect such qualities, where customers really want to know).

*IT supplies tools for reaching the market and minimizing risk, including contractual liability risk. **Redick, Thompson and Cawley** all raised the issue of fairness in contracts that give a grower the premium, but may allocate to the grower too much risk and uncertainty. In particular, managing for the absence of certain genetic events poses a difficult issue for a farmer or intermediary to manage.

***Juan Batista** noted the same phenomenon of grower risk for emerging issues involving mycotoxin and pesticide residues, which the grower may have limited tools to manage at very low levels.

***Kent Sisson** from the Foreign Agricultural Service (FAS) provided the historical setting for the increased attention given to specialized demands of overseas customers. Traceability is emerging in various sectors of the food industry. FAS has a Market Access Program that encourages comprehensive 3-5 year industry strategy plans, taking into account domestic issues and constraints that implicate export. He suggests industry be more inclusive in developing plans, so that the farmers are involved. Also consider alliances with other crop program participants where they share common opportunities and challenges.

V. Where Do We Go From Here

The following suggestions come from the Breakout (B) Sessions and from the White (W) Paper Committee members -

A. The Next Conference (Tech II)
   1) Yes need a next conference (B)
   2) Technology focus key (B)
   3) Case studies are beneficial (B)
   4) International mix was/is a good thing (B)
   5) Bring in experiences from other industries e.g. steel or textiles (B)
   6) Involve more downstream processors and manufacturers (B)
   7) Use grad students to clean cases up for dissemination (B)
   8) Make sure foreign and domestic customers are present (B)

9) Industry displays/demos of technology key (B)
10) Cross-pollination across supply chain key for the proper perspective (B)
11) Get end-users engaged (B)
12) Bring in large growers (B)
13) Wal-Mart and similar firms key --- push upfront in the conference (B)
14) Hold the next roundtable in Fall 2006 (W)
15) Collaborate with NC-213 (national academic research group) http://www.oardc.ohio-state.edu/nc213/ to create 2.5 days of an academic program and 2.5 days of a industry/technology conference (W)
16) Interact with other national organizations such as National Grain and Feed Association (NGFA) http://www.ngfa.org/, American Institute of Baking (AIB) http://www.aibonline.org/, Grain and Elevator Processing Society (GEAPS) http://www.geaps.com to determine their perceived needs and priorities and align delivered pilots/solutions activity around their perceived needs. This gains visibility and implementation leverage for identified solutions. (W)

B. R&D
1) Link technologies with logistic applications (B)
2) Explore upstream vs. downstream testing (B)
3) Craft specific value hypotheses and design pilot studies to measure a) whether or not value hypothesis is correct, and b) economically deliverable. (W)
4) Try to bring some understanding to the value of "bundled" services (example: grain attribute visibility combined with JIT delivery/logistics efficiencies. (W)
5) Government policy makers should utilize industry representatives from across the entire channel in an advisory capacity (W)
6) Reduce costs/unit and broaden the set of applications for measurement and informatics technology
7) Adapt the technologies to farmer and 1st handler settings (e.g., http://www.zeltex.com/)