NORTH DAKOTA GRAIN FACILITY
SUPPLY CHAIN QUALITY ASSURANCE PROJECT

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ABSTRACT

The competitive position of grain producers is continually influenced by the environment, agronomics, markets, and policy. The objective of this project is to provide an overview of the quality assurance (QA) programs commonly utilized by the grain and food industry. The information is a resource for N.D. grain facilities as they seek new opportunities to market North Dakota producers' grain. The QA programs may be used by firms to broadly exhibit that they are compliant with quality standards monitored through a third-party auditing system. The system may be developed to fit the goals of individual grain facilities. As described here, a variety of alternatives may be adopted based on individual business competencies, products, and goals.

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1. INTRODUCTION

North Dakota produces more than 500 million bushels of grain each year that is marketed to domestic and foreign customers. These transactions are typically completed via contracts that ensure the desired quality and service attributes. While many product standards are unique to the commodity, such as protein levels and oil content, other product or process standards may be cross-cutting. One cross-cutting standard is quality assurance through a quality management system (QMS). Quality assurance may be used as an internal system for managing processes through explicit and consistent operational functions. These functions may be internal or in relationship to outside suppliers and customers. Quality assurance is a marketing tool that ensures nationally or internationally recognized standards through a transparent set of standards and protocol.

Many businesses integrate quality assurance programs into their policy manuals. The parameters of these programs vary widely from sporadic in-house assessment of equipment, personnel, and operations to periodic third-party audits of the business. These quality assurance programs may have been borne in-house for efficiency goals or have developed from requirements from outside demands related to customer demands or regulatory requirements. QMS benefits have been estimated at $1.50 to $2.00 for each $1 invested (Hurley, 2003).

The standards and their applications are wide ranging in the manufacturing and food industries and several quality standards programs were identified in a scan of business practices and applications. The most commonly recognized plans in export marketing and agriculture are the International Standards Organization (ISO), American Institute of Baking, United States Department of Agriculture's Process Verified Program (PVP), and Hazard Analysis and Critical Control Points (HACCP). The objective here is to create a resource guide for North Dakota grain facilities to use in assessing and adopting quality management systems. First, an introduction to recognized quality management systems is provided. The next section offers a review of the existing literature and applications. Case study analysis is then used to understand the decision and implementation processes for North Dakota grain terminals through consideration and pursuit of the QMS programs. The conclusion summarizes findings and provides suggestions for future activities.

A successful case study experiment will provide wide-ranging benefits. North Dakota businesses will have an opportunity to assess and implement quality assurance programs for their own businesses based on local industry experience. The program review and case study work will enable grain facilities and producers to cost-effectively assess and adopt recognized quality assurance programs. Existing and potential N.D. grain customers will be provided with an assurance for ongoing product quality protocols and assessment that enhance products in the eyes of domestic and international buyers.

Quality is an essential ingredient in building successful businesses and marketing. Not only do products and services need to be of high quality, but potential customers also need to have assurance that the products will be of high quality. Consumers and retailers are having a greater impact on grain producers, processors and distributors than ever before as product availability drives global markets. Retailers exert a strong and growing influence. They demand assurances that the food they sell is safe and that it meets increasingly stringent standards for food safety and quality.

Global and domestic retailers have only a general understanding about North Dakota's grain safety and quality assurance systems. If North Dakota grain suppliers are to achieve and maintain market access, they must demonstrate that North Dakotan grain —and its underlying grain safety and quality assurance systems—meet or exceed major buyers' criteria.

1.2 Quality Management System Programs

As mentioned, a wide range of quality management systems can be identified in a scan of business literature and individual companies' public media. The decision to systemize a third-party quality management system depends on many factors such as internal resources, business partner valuation, and market strategies. This section provides a "10,000-foot" view of some commonly recognized QMS programs. It is not intended to allow implementation, but rather convey key aspects of programs that are most relevant to businesses in North Dakota's bulk grain marketing industry.

1.2.1 International Organization for Standardization

The International Standards, which International Organization for Standardization (ISO) develops are employed by a range of industrial and business organizations, including governments, private industry, and nongovernmental entities. While technology and globalization have done much to overcome language barriers in business relationships during the knowledge age, the ISO certification has long been recognized worldwide as an indicator of quality assurance among business partners.

The majority of ISO standards are highly specific to a particular product, material, or process but some more general and food-based applications are very relevant to the grain industry. The ISO 9000 and ISO 14000 families are among most widely known standards, considering ISO and other QMS programs. The ISO 9000 and 14000 protocols are in use by some 887,770 organizations in 161 countries. ISO 9000 is a generic guarantee of business quality through management ideals that have existed for decades. The ISO 9000 series of management systems is focused on quality management to meet customer expectations. The ISO 14000 series deals with environmental sustainability. Another series relevant to the grain industry is the newly introduced 22000 series that is centered on food safety.

ISO 9000 does not specify requirements for the goods or services, but rather leaves that definition to customers. The ISO 9000 series of systems can be applied to virtually any process or industry, and is attainable for any individual business regardless of size. Eight quality management principles underlie this system for improved performance through quality management: (1) customer focus, (2) leadership, (3) involvement of people, (4) process approach, (5) systems approach to management, (6) continual improvement, (7) factual approach to decision making, and (8) mutually beneficial supplier relationships (International Organization for Standardization, 2006a).

ISO 9000 provides a set of requirements for an organization's QMS that provide businesses with confidence that partners can consistently provide goods and services that meet needs and expectations and comply with applicable regulations. For this reason, sometimes suppliers refer to being "ISO 9000 certified, or having an "ISO 9000-compliant QMS." The requirements cover a wide range of topics, including supplier's top management commitment to quality, its customer focus, adequacy of its resources, employee competence, process management, quality planning, product design, review of incoming orders, purchasing, monitoring and measurement of its processes and products, calibration of measuring equipment, processes to resolve customer complaints, corrective/preventive actions and a requirement to drive continual improvement of the QMS. Last, there is a requirement for suppliers to monitor customer perceptions about the quality of the goods and services provided. QMS requirements can be validated through several means such as supplier's declaration of conformity' or second party assessment and third party assessment or certification or registration. The method is dependant on the potential for supply chain feedback and alternate ISO series requirements. Many companies use each of the internal, customer, and third-party assessments in various processes and time lines.

To follow ISO 9000, a company's management team decides quality assurance policies and objectives. Next, the company or an external consultant formally writes down the company's policies and requirements and how the staff can implement the quality assurance system. Once this guideline is in place and the quality assurance procedures are implemented, an outside assessor examines the company's quality assurance system to make sure it complies with ISO 9000. A detailed report describes the parts of the standard the company missed, and the company agrees to correct any problems within a specific time. Once the problems are corrected, the company is certified as in conformance with the standard. Time for implementing this system has been estimated at 1 to 2 years. An estimated price of $10,000 to $25,000 for a small company includes the cost for consultants and auditors (Sparling et al., 2001).

1.2.2 Process Verified Program

The USDA Process Verified Program (PVP) provides agricultural suppliers the opportunity to assure customers of their ability to provide products and services of consistent quality. Business processes, not otherwise certified through regulatory processes in production, manufacturing or services delivery, can be verified through independent, third party audits. USDA Process Verified suppliers are able to make marketing claims - such as production and manufacturing practices or service provision - and market themselves as "USDA Process Verified".

The USDA Process Verified Program does rely on the International Organization for Standardization's ISO 9000 series standards for documented quality management systems as a format for evaluating program documentation to ensure consistent auditing practices and promote international recognition of audit results (U.S. Department of Agriculture, 2006). Under the PVP, the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA) provides independent, third-party certification of the written quality practices and production processes used to provide consistent-quality products. Individuals and organizations, e.g., farmers, handlers and processors, not GIPSA, develop and implement quality management systems based on internationally recognized standards and value-adding processes that satisfy their customers' expectations. Prior to granting certification, GIPSA performs a desk audit to evaluate conformance to all quality management requirements. The agency then confirms what is written about the quality management system and manufacturing processes through an onsite audit. Additional periodic, announced and unannounced audits, including document reviews, major system audits, and surveillance audits, will be performed to verify continuing conformance. Through this program, GIPSA verifies the processes used to ensure quality, not the quality of the final product (U.S. Department of Agriculture, 2005).

The PVP provides a less costly alternative to ISO to ensure product quality, and to reduce risk and associated costs. The PVP also provides businesses with much of the framework needed to pursue ISO certification. As with all third-party quality assurance programs, businesses acknowledge internal and competitive gains from being proactive in consistently providing customers with desired products and services by managing of the entire production and handling system rather than by simply testing the end product or operating in reactionary mode.

In their assessment, Sanden, et al (2004) caution businesses that that achieving PVP is not a simple task. Businesses should be prepared to spend more time on paperwork and record-keeping, to increase production costs related to development, implementation, and auditing. Development can be very expensive if a consultant is hired to write the quality manual. Implementation cost can be high or low depending on the content of the quality manual. Audits can also become expensive as they need to occur each year. Cost of the initial audit for the group that Kansas State Research and Extension worked with was $5,000.

1.2.3 American Institute of Baking

The American Institute of Baking (AIB) also offers quality certification based on a set of food quality and safety standards. AIB offers a compendium of alternative certifications centered on food safety. Its Food Safety Audit Program includes Food Safety Audits, HACCP Accreditation, Quality Systems Evaluation, Production Quality, Occupational Safety, Certification Schemes, and an Integrated Quality System Certification Program (American Institute of Baking, 2006).

The Food Safety Audit is conducted by a trained staff of food safety auditors. Food processors who participate in the in-plant audit program receive a complete examination and technical assistance in all areas that affect product integrity, regulatory exposure, and pesticide use. The Quality Systems Evaluation is a comprehensive audit developed by AIB to thoroughly evaluate a supplier's quality system. Starting with raw materials, the audit evaluates their handling, testing, storage and use. The audit then covers processing, including control and verification, finished product acceptability, shipping and storage, and analytical calculation. Finally, plant programs (HACCP, metal detector, chemical contact, recall, etc.) are also evaluated in the comprehensive evaluation. Plants not ready for ISO 9000 registration have found the Supplier Quality Evaluation an excellent verification of their quality system.

The Production Quality Audit program examines the criteria that allow conformity to production efficiency and customer product specifications. The criteria are grouped as: control of incoming ingredients; product handling; packaging and storage; and control of non-conforming products. Audits can be customized to fit needs. At the conclusion of the audit, recommendations are given for improvement and cost savings.

The Integrated Quality System is offered to the food industry through the Gold Standard Certification Program. The Gold Standard Certification program is designed to provide continuous improvement in supplying the facility with the values of confidence, security and prosperity through full integration of sanitation, safety and the process quality. The elements of the Gold Standard Program include: Good Manufacturing Practice Audit Qualification; HACCP Validation and Verification; and Quality Systems Evaluation. Recertification is required annually.

A form of the AIB Integrated Quality System (IQS) has been adopted by an elevator in Iowa. Neither benefits nor costs for this elevator adaptation were specified in sources identified in this study.

1.2.4 Hazard Analysis and Critical Control Points

Food safety is increasingly an issue for growers and handlers of agricultural products because of consumer concerns related to globalization and terrorist threats. The risks associated with food production and delivery have increased dramatically over recent years. Among the oldest national quality management systems is the Hazard Analysis and Critical Control Points **(**HACCP) that was developed by the United States space program. Planners were aware of a need to ensure the astronauts didn't get sick from their food supply and thus developed protocol for ensuring product integrity for its food supply. After success in space, the system was introduced into the food industry in the U.S. In the 1970s and 1980s, HACCP was used only for low-acid foods. In 1985, its use broadened to encompass other categories. Over the past decade, HACCP has gained acceptance as the food safety system of choice worldwide.

HACCP is a system of risk management that addresses food safety through the analysis and control of hazards in all steps of the food in production, storage, distribution and preparation. HACCP has become the food safety system of choice for many reasons. Perhaps the most compelling reason is that HACCP

puts an emphasis on prevention. By identifying and monitoring critical control points, a producer stops problems before they start. HACCP systems must be built upon a firm foundation of compliance with current Good Manufacturing Practices (GMPs) and acceptable sanitation standard operating procedures (SSOPs), both of which are considered prerequisite programs to HACCP.

Seven principles of HACCP Recognized by Food and Drug Administration (FDA) & the National Advisory Committee on Microbiological Criteria for Foods (NACMCF) are: 1) carry out a hazard analysis, 2) identify the critical control points (CCPs), 3) establish the critical limits for each CCP, 4) establish a procedure to monitoring each CCP, 5) establish procedures for corrective action, 6) establish documentation and a system for keeping records, and 7) identify procedures for HACCP compliance (Food and Drug Administration, 1997).

The U.S. Department of Agriculture requires meat, poultry and seafood producers to have HACCP-based procedures in their operations. Growers and produce handlers are not required by regulation but many are realizing the need for HACCP, especially those producing high-risk fruits and vegetables (U.S. Department of Agriculture, 1999). An approved HACCP plan identifies 'Critical Control Points' and specifies methods, measurements, frequency, and accountability for monitoring and corrective action.

Developing a HACCP program begins with a proper risk assessment. Each product must be evaluated through a process from raw materials to finished product to determine monitoring activities and action plans for each critical control point. Prerequisite programs for attaining a safe food process must be in place before a proper HACCP plan can be implemented.

The primary factor in the implementation of HACCP is a shift toward reliance on systems rather than individual defect. Taking a systems approach involves looking at all parts of the food handling and preparation process, step by logical step. It is a preventive maintenance plan rather than a fix-it-when-it-breaks attitude. Food Safety and Inspection Service (FSIS) and most HACCP experts believe that a company will do a better job of HACCP plan development if it takes some preliminary steps before it attempts to apply the seven principles and write a plan. FSIS recommends that a company should take the following steps to get started: 1) assemble a HACCP qualified team, 2) detail the food method of production, distribution, and end-use, 3) develop a process flow diagram, and 4) group products based on like processes.

Once a plan has been established, an Internal Audit of the HACCP system must be carried out periodically. This examination and assessment of the system should be completed by senior management and will identify any problems or failures in the system. Once a HACCP plan is in place, it should be verified by a qualified third party on an annual basis. The benefits of the third party HACCP plan validation/reassessment are immeasurable. An unbiased perspective identifies deficiencies and opportunities for improvement. It also reinforces the importance of the food safety process to all employees. Last, third party validation adds credibility to the process and makes it easier to change and improve the system.

The cost to develop and implement a HACCP system varies widely as discussion below. The nature of products and processes in the food industry are determined by many factors, including product perishability, regulatory requirements, and manufacturing/packaging requirements. The estimates identified for HACCP application in agriculture range from less than $5,000 to more than $80,000.

2. LITERATURE AND APPLICATIONS

Because of the relatively new interest in applying quality management systems to bulk grain handling facilities, little literature was found regarding processes, expenses, and benefits. A brief overview of existing literature does provide some insight regarding the resource requirements and expected benefits. In addition, case study information of some other production agriculture applications is offered as context for understanding how these systems are currently utilized.

Quality assurance in grain products is not a unique idea, but the full-scale implementation of well-recognized programs by local grain facilities is rare. One example of existing grain facility adherence with broadly recognized quality assurance programs is the Topflight Grain Cooperative in Illinois. Topflight uses its ISO 9001:2000 certification to communicate “a guarantee to the buyer that the company followed certain procedures and safety measures in production, handling or transportation of that product or creation of the service” (Wright, 2004). This QMS assures the supply chain process conforms to a set of specified requirements that can be certified by an external agency. In addition, the certification of the grain facility has been used in a platform for Illinois producer partners to adopt quality assurance programs to allow traceability and standards guarantees beginning at the field. Other grain facilities that were identified as offering the 9000 series of quality assurance include Cargill Incorporated Terminal 22 in Balcarres, SK, with ISO 9000 certification; Port of Louisiana-Jefferson in Jefferson, IN, with ISO 9002 certification; and Colusa Elevator Company, Dallas City, IL, with ISO 9000 certification (International Standards Organization, 2006a). Another example of quality assurance in field crop production and marketing are those associated with organic agriculture and specialty commodities such as sugar beets and potatoes. While the quality assurance programs used in other areas of field crop production are not directly applicable to grain production, valuable knowledge may be gained by understanding the parameters, practices, and implementation.

In general terms, studies suggest that incentives for ISO 9000 adoption differ depending on firm size. Seddon et al. (1993) found that large firms tend to adopt ISO 9000 for internal reasons such as cost reduction and internal operations efficiencies, while small firms tend to adopt ISO 9000 for external reasons such as to meet customer requirements and to improve market share. Larger firms tended to cite cost reduction as one of the benefits more so than small firms. In contrast, the smaller firms tended to cite an external motivation, such as improved market share, as an ISO 9000 benefit.

Quality assurance systems have the potential to reduce many types of transaction costs by serving as the seller's guarantee of safety and/or quality, thereby increasing the competitiveness of a national food production and processing system (Holleran et al., 1999). Quality assurance systems can also improve operational efficiency by reducing product failure rates. Quality assurance systems can directly affect a firm's costs, profits, and market access, all of which may serve as an incentive for adopting a particular quality system.

Starting at the level of the grain handler, members of the grain supply chain have successfully used quality assurance. Producers delivering high-value, identity preserved crops have become interested in implementing these quality management systems at the farm level. Karaca (2006) conducted a cost-benefit analysis that shows that quality assurance programs may be profitable for producers, depending on their farm size and equipment management strategy.

Grain quality assurance projects or programs currently tested in the United Staets are company/ organization-based. Quality management systems are being introduced at the local level via two routes: 1).through normal grain markets (often producer-owned), and 2). through producer-held companies

created to develop markets and coordinate very specialized production **(Hurburgh, 2003). Two systems implement processes and the final employs a third-party audit:**

a) Grain handler driven. Firms that have an audited quality management system are good candidates for direct marketing arrangements – producer to end-user. Transportation and logistics have often prevented direct sales of bulk products; the firms creating source verification are becoming large enough that coordination of source verified bulk shipments is much more feasible than in the past. In the grain industry program, source verification was divided into nine general areas, and specific procedures/controls were created for each.
   - Raw materials
   - Process control
   - Process verification (eg. Statistics)
   - Finish product acceptability
   - Storage and shipping
   - Instrument accuracy and calibration
   - Personnel training
   - Plant programs (eg. safety)
   - Quality policies (eg. management commitment)

   Logically grain handlers will extend the QMS process back to the producer in measured steps working backward from the scale ticket (receipt document of delivery). A gradual progression of activities moving back from delivery will allow certification of producers without imposing major work that would add little tangible value. QMS are essentially people training and interaction activities, such as:
   - Identifying wagons and trucks, and recording container, time and date of deliveries. This would extend traceability to a field or bin if needed.
   - Determining if predelivery sampling and control of delivery timing could improve off-harvest merchandizing potential and minimize inventories of off-grade grain.
   - Utilizing agronomy sales departments to create interaction with producers about data management, possible economies, and actual data collection in cases where the grain company is the primary input supplier.
   - Documenting completely the use of company supplied inputs by producers.
   - Develop an in-company standard data management/documentation protocol to be applied (and trained to) when and if there is a market need requiring QMS and traceability.
   - When premium opportunities exist, always attaching some QMS activity requirements to the premium. For a bulk handler, premiums are likely to be incremental at first.
   - Recognizing that incremental value traits (such as feed ingredient modifications or bulk non-GM) are best suited to grain handler organized QMS.

b) Producer supply network. Producers organized to form supply network companies have some advantages in the initial stages of specialty grain production and QMS establishment. Members' investment in these companies makes the creation of a full QMS system easier to achieve. Time investments are made to support the financial commitments. Investors in these companies, while targeting high-value premium grains, are more likely to also recognize operating efficiencies that present themselves in the course of creating a full system QMS. The intangible time-based learning activities are more easily accepted in the investor-owner format. Owner-operators can also benefit from promoting the idea "dealing with the grower."

Producer networks lack distribution and logistics capabilities. The capital required for marketing to sophisticated users may be hard to obtain. Traits of smaller incremental value will be difficult to

administer in this format. Therefore it will be very important for producer networks to understand their strengths and target products carefully.

c) Third Party Audit. All source verification systems require audit by disinterested third parties. Auditing services are being created. USDA is now deciding whether it should become a quality management system auditor, most likely to the ISO 9000-2000 standards.

States themselves are not grain growing boundaries but they can be centers of thought and creativity. Source verification and customer service are people issues, not geography issues, meaning that choice of purchase sources can and will provide benefits. Sparling et al. conducted a case study analysis to understand the cost for a Canadian grain firm to adopt a QMS (2001). Murgo Farms Inc. is a grain farm with elevator facilities in Canada. Murgo had sales of $1.2 million and profits in the six-figure range in 1998, employing total assets worth $4 million. Its principal activity was grain farming.

Three management systems were considered: HACCP, ISO 9000, and Both ISO 9000 and ISO 14000. Murgo estimated that implementing each of the three systems would cost at least $20,000 in consulting and registration fees to implement and the entire process would take approximately a year to complete. The nature of HACCP made it likely that additional expenditures could be as high as $50,000.

Sparling had only found few instances where elevator or farming companies had adopted these systems. The Hensall District Co-op., the largest farmer owned co-operative in Ontario, had implemented ISO 9002after determining that it was the best quality management system to serve the international markets where it sold its commodities. W.G. Thompson Inc., one of the largest commercial elevator operators in Ontario, has implemented HACCP at four of its grain elevators. The company took this route primarily to avoid food safety problems and because some of its processing customers were HACCP certified. At the time, no agriculture companies or farms in the area were ISO 14000 certified.

The HACCP system is more common, especially in the consumer-market food products. In the initial stages of developing the producer-oriented quality assurance plan, the California poultry industry explored whether a rigid HACCP program could be fully adopted on the farm. With the available technology and the design of today's modern poultry buildings, it was determined that a strict HACCP plan is not workable. However, hazard analysis concepts can be adapted to husbandry practices to meet the overall goal of reducing risks of bacterial and chemical contamination (California Department of Food and Agriculture, 2006).

In a study on costs of HACCP system in Brazil, Buchweitz and Salay (2003) analyzed the costs associated with implementation of HACCP. Three food service establishments provided information about the costs of adoption and maintenance of the HACCP system. One was a self-managed industry restaurant serving up to 10,000 meals, and two were food contractors, one with meal production of between 50,000 and a 100,000 and the other serving more than 100,000 meals. The time necessary to implement the HACCP system varied from 3 to 24 months. As was found in others studies, costs associated with the implementation of HACCP system of the companies are not separated from general expenses, so the results here have been based on estimates.

For the food contractors, the process of implementation implied the hiring of a consultant and the investment of part of the time of a manager. These costs totaled some $37,926 to $67,229 per unit administered for implementation. The cost of training also varied quite a bit, with values varying from $1,192 to 11,075 per unit administered for the two food contractors. The investment in materials to initiate the HACCP (thermometers, educational materials, etc.) was much more similar for the two contractors: $615.00 and 713.05/ unit administered. The self-managed restaurant hired a consulting firm to implement the HACCP system. This consulting firm developed the plan and trained the employees,

also providing follow-up services for maintenance of the system. In this case, the costs were about $3,540 for implementation. Moreover, the company spent approximately $944 for materials. Of the three cases analyzed, the lowest implementation cost reported was 60 cents per meal-day.

The process of maintenance involved disparate investments: from $445 to $4,306 per month. While one company invested relatively little in training and personnel, it faced additional expenditures in relation to laboratory analyses and cleaning supplies. Another had relatively high costs for personnel, training and monitoring, but did not invest in laboratory analyses. When a consulting firm was involved, $1,062.00 per month was spent for the maintenance of the system (laboratory analyses, registration analysis, review of the HACCP and training). The ratio of maintenance costs/meal-day was noticeably greater for the smaller self-managed restaurant (33 cents per meal-day).

In a study of HACCP-regulation impacts in the Mississippi catfish industry, three catfish processors were categorized by size and by level of complexity (Herrera, et al. 1999). Cost categories included training, record-keeping, receiving, metal detection, food-contact surfaces, hand sanitizing, and adulteration prevention. Results showed that the large processor incurred the highest total cost. By size, maximum processing capabilities were 150,000, 70,000, and 25,000 pounds per day and total costs were $413,475, $73,340, and $11,538, respectively. Costs per unit of capacity were higher for larger firms in these particular cases.

The oyster-processing industry study offers another estimate for the implementation and operating costs of HACCP systems. Four small to medium-sized firms were studied and the cost per pound of implementing HACCP systems were found to be 3.7 to 11.6 cents (Hinson and Whitney, 2003). In other sectors of this industry, HACCP costs were found to be 0.7, 1.87, and 1.32 percent of industry sales for broilers, pork, and beef industry, respectively (Goodwin, et al. 2002).

Several other food quality assurance systems were found in the literature scan. A quality assurance program model used by Australian deer industry is designed to provide customers with a quality assurance for the animal health and welfare (Deer Industry Quality Assurance Board 2006). Government-accredited farmers are accountable for all aspects of their production system, maintaining a system of records that cover for production, transport, and disposal systems. Accredited farmers and transporters have routine and spot checks at least every two years.

Australia has taken an industry approach to quality assurance by investing producer checkoff funds and processor contributions to develop tools and make them available to all Australian supply chains for beef. The quality assurance system in Australia is voluntary and is led by national government agencies and a single industry entity, Meat and Livestock Australia. Different quality assurance programs require different levels of documentation, depending on market needs. For example, the Australian Lot Feeders' Accreditation (ALFA) program is a significant element of the overall program.

The quality assurance programs in New Zealand are led primarily by processors and based on private entity participation. Firms are encouraged to develop and implement quality assurance programs with their producers and suppliers to meet market demand. Government inspectors inspect plants to assure safety and wholesomeness but do not appear to be heavily involved in quality assurance program development or research. These agricultural-industry QA program offer a variety of attributes for ideas in other applications.

3. WHEAT CUSTOMER COMMENTS ON QMS

To better understand the potential for external gains from a quality management system in bulk grains, the N.D. Wheat Commission conducted an informal survey of its contacts at domestic mills and the international field offices for U.S. Wheat who deal with U.S. wheat customers across the world (2007). Responses to the inquiry suggest that future demand will likely increase from the European Union, Japan, and Korea. Traceability knowledge demands from international wheat customers extend from the field through the entire supply chain and may become more critical to sales, as an import requirement, because of to consumer food safety demands and offerings from competitor systems.

It is expected that there will be more demand for traceability in the future, for example, right now no UK flour mill will buy domestic wheat from a farmer who does not participation their quality assurance program. The program is a certification that best farming practices have been employed in both production and storage and verifies that records have been kept.

With regard to more regionalized comments on the international wheat market quality management systems, many spring wheat buyers in Central and South America, with the exception of those in Mexico, do not buy directly from country elevators and they would be very interested in a quality systems approach. A quality assurance program could possibly make ND spring wheat more competitive than Canadian CWRS in Mexico as Mexico sometimes has issues with the quality of US wheat. Quality management systems could also play a larger role in the future depending on how the GMO issue develops.

The benefits of a QMS in European and North African countries depend on how widely it is adopted. If the QMS is geared towards improved quality-based segregation, it could make a major contribution as more quality segregation is desired. The two major suppliers of HRS and HD in Europe already exercise significant care in origination and segregation of wheat. They have a record of providing specific varieties, offering rheological performance, and meeting low tolerances of deoxynivalenol (DON), more commonly known as vomitoxin.

North African buyers are mainly concerned about reliability and price. Quality is a secondary concern. The exception are durum buyers in Morocco. They are among the most demanding buyers in the world, but are unlikely to be impressed with a QMS, unless it is directly related to guaranteeing a wheat-quality result. The mills in North Africa have spent considerable effort in getting ISO certifications and place importance on using it to promote their products. The benefit of implementing QMS at US elevators is entirely dependant upon the programs' ability to better meet customer requirements

In the Philippines, QMS would probably be most beneficial if it were implemented at the export elevator level. In the future QMS programs could become a base standard for doing business, as HACCP and ISO certifications have increased around the world and traceability is becoming more of an issue. Implementation of QMS at the wheat-based manufacturing level in the Philippines has been at a slower pace than more developed countries, however, interest is HACCP and ISO programs is growing due to increased demand at the consumer level for quality assurance. Buyers in the Philippines already view the United States as having some of the highest wheat quality standards in the world so QMS at the country elevator level may not be as important in this market.

3.1 Quality Management System Case Study

AG Processing Inc. (AGP) is a farmer-owned cooperative involved in the marketing and transportation of agricultural products. AGP incorporates nearly 200 local cooperatives in the Midwest representing 250,000 farmers and five regional American and Canadian cooperatives.

The AGP Minneapolis office and AGP Duluth Port expressed interest in taking additional steps in becoming an ISO facility. Novecta, a joint venture company of the Iowa and Illinois Corn Growers Associations specializing in ISO certification for agriculture, was invited by AGP and North Dakota State University's (NDSU) Upper Great Plains Transportation Institute (UGPTI) to tour and make recommendations for AGP-Duluth becoming an ISO 9001 registered facility.

The AGP Duluth elevator is already an approved Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP) certified facility. The standards and processes adopted to fulfill these program requirements create an excellent foundation for moving to the next level in quality assurance – ISO certification, which, as previously described, may include various components selected to meet a firm's ultimate goals for institutionalizing product, systems, and service quality. The AGP-Duluth facility handles wheat, peas, barley, corn, and soybeans throughout the course of its marketing year. Other grains may be handled at the facility but were not discussed during the site visit.

The elevator tour was conducted by Kim Tullgren, elevator supervisor, for Gary DeLong of Novecta and attended by Doug Benson from the UGPTI. The professional staff of the Duluth Port and Michael Kylmala, the Elevator Superintendent, assisted with the site visit. The elevator was receiving wheat by rail and truck while loading out wheat into a vessel during the tour, illustrating the tasks and responsibilities of the elevator personnel.

3.2 Site Tour Observations

The site tour was conducted as an initial stage in assessing the business activities and culture with respect to potential for implementing ISO standards. Several important observations were drawn from the AGP Duluth elevator site. For instance, it is evident that AGP-Duluth places great importance on product traceability. One demonstration of this priority is in its use of new technology called "Bin Site" software. The process and software were developed by John Deere Agri-Services. The Bin Site software allows the facility to track the kernel from field through the market to final destination through a computer log of kernel activities.

In addition, product quality control priorities are evident. The elevator employs a complete board system that inventories and categorizes incoming grain by lots which are defined by its quality (protein, test weight, moisture, etc.). These numbers are verified by bin measurements daily and Daily Position Reports (DPR).

Although AGP-Duluth is a large export facility, it places priority on identity preservation based on customer contract specifications. Incoming grain is stored by known customer requirements. Grain is continually monitored to maintain quality characteristics and is cleaned to APG-required standards before loading out-bound grain. Prior to the initial unloading and final loadout, all grains are probed and inspected by a third-party firm. Completed inspection forms are faxed to a control room before the grain is unloaded or shipped. Received grains are stored in well-marked designated bins.

Although elevator infrastructure was built starting in the early 1900's, it had been modernized through an ongoing process of investments in technology and facility assets. A focus in all business investments and

activities is maintaining equipment and processes for a variety of products, while prioritizing employee safety. The facility has safety and housekeeping standards which appeared to be effectively established and institutionalized, even during the busy activity of receiving and loading grain that may take place up to12 hours per day.

Discharge of specific grains was communicated through the use of a paper trail, allowing for receiving staff, load out personnel and dock personnel to communicate proper loading. AGP personnel take extra steps to inspect and prevent nonconforming grain from entering the system. This procedure allowed an employee to stop loading anytime any problems were noticed. UDSA personnel were on site as well, monitoring and inspecting the grain and loading process. The communication between the AGP and the UDSA appeared to be well-established.

AGP office personnel were helpful and knowledgeable about the processes they were using to get information to the Minneapolis Merchandising office and Omaha Corporate office. The HACCP quality manual (QM) was in use and was offered for review. The manual was briefly reviewed and, as expected, found to be well-written.

3.3 AGP Duluth Elevator ISO-HACCP/GMP Comparative Analysis

The AGP Duluth elevator site visit identified several points of comparison and difference between the HACCP and GMP systems in use at the elevator versus the ISO 9001:2000 quality system. It must be noted, however, that an ISO system would not be a separate system but would include and complement the HACCP and GMP's already established at AGP Duluth. The following items were identified and will need to be addressed as steps to become ISO 9001 registered.

These items are not in order of importance or inclusive:

- The scope of the ISO program will need to be defined. Figures 1-3 illustrate potential ISO program scopes. The possible scopes are defined as:

    - Option 1: the AGP Duluth port would become ISO 9001 only.

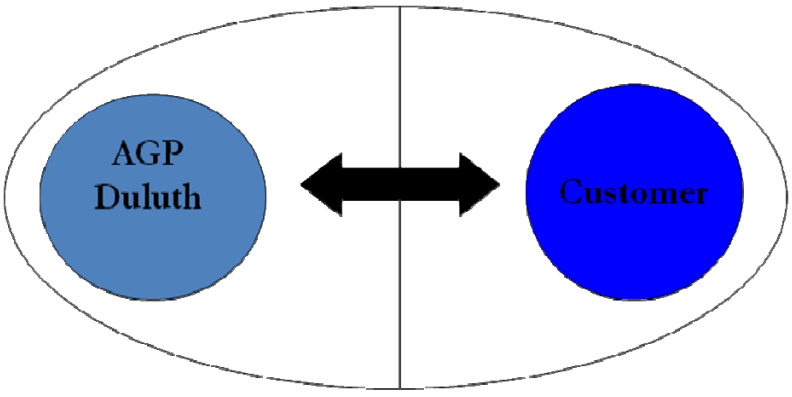

Figure 1 AGP Duluth Port Elevator ISO 9001

- Option 2: the AGP Duluth and AGP elevators would be ISO 9001 registered as a group.

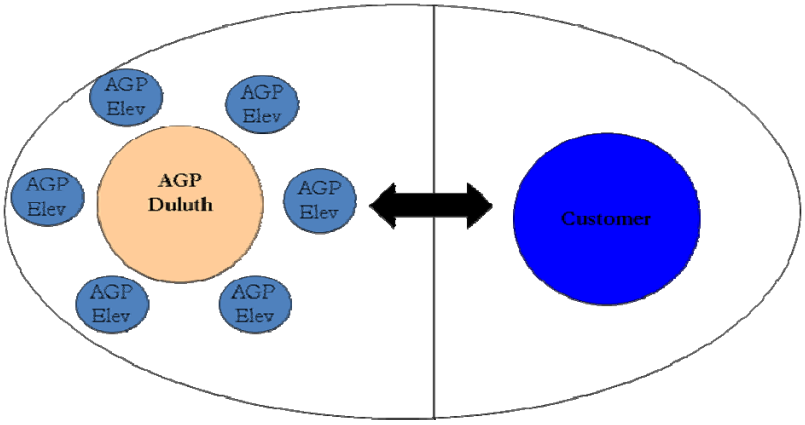

Figure 2 Duluth Port Elevator and AGP Elevators ISO 9001

- Option 3: the AGP Duluth would become ISO 9001 as in Option 1 but would define elevators as suppliers requiring internal auditable quality standards to be met. Farmers may also have quality standards to compliment AGP ISO standards.

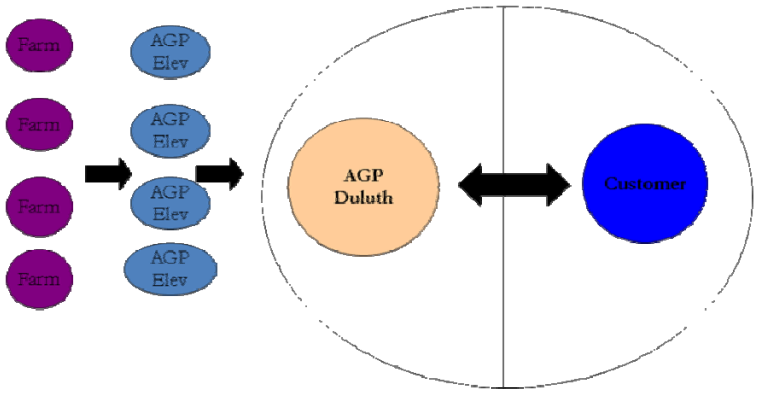

Figure 3 AGP-Duluth Port Elevator and Required AGP Elevators with Farmers' Complimentary in ISO Standards

AGP-Duluth internally considered the three alternatives for scope as presented above. In addition, an initial set of action items that can be targeted and monitored in developing the plan achieve the certification was formed. The list included:

- A QM vision that reflects the additional ISO 9001 requirements.
- A quality policy and objective(s) that are ISO compliant
  - Current quality policy is okay
  - Measured objectives to compliment policy
- Defined Documented Quality System Procedures required:
  - Control Of Documents
  - Control of Records
  - Internal Audits
  - Control of Non-conforming Product

    - Corrective Action
    - Preventative Action
- Management review meeting(s) that are ISO compliant
    - Input and outputs annually recorded
- A named quality management representative (QMR)
- A training program that is ISO compliant
    - Program and records
- Customer communication compliant
    - Customer owned property
    - Customer satisfaction measurement
- Purchasing
    - Requirements of suppliers
    - Can conduct supplier audits
- Analysis of data
- Continual Improvement

These items would be areas that an ISO certification process and/or consultant, such as Novecta, would address individually during the implementation process. Some of these items may already be in place and were simply not reviewed during the site visit. Further discussion and prioritization would be part of a contract for implementation.

3.4 Potential Benefits of AGP Duluth Elevator ISO Certification

As aforementioned, AGP-Duluth as already exhibited a quality culture in its business processes and relationships. Implementing the ISO standards and certification would further elevate the quality focus, and offer of evidence of the continuing commitment with regard to standards especially for international customers given the well-recognized and highly-regarded ISO standards. Identified below are some of the possible benefits of the ISO 9001 standard to AGP at the Duluth Port. This list is not inclusive:

- Typically, more market access to new or existing customer base (this would need to be verified by the merchandisers)
- Additional cost savings in additional efficiencies.
    - Continuous improvement
    - Communication
    - Training
    - Relationships with:
        - Suppliers
        - Customers
- An “upstream” quality system to the supply elevators and possibly farmers.
- Provide a solid QMS that can mature into an overall system including all auditable quality and regulatory standards.
- Provide a base system that could lead and establish ISO implementation throughout the AGP System

4. SUMMARY

Quality assurance may be institutionalized and promoted through a wide scope of activities and varying degrees of stringency. The staff and established processes at AGP-Duluth were found to be very complimentary to an ISO 9001 system. AGP-Duluth has a commitment to its current QMS programs and is focused on the end-use customer. These traits are very important and recognizable as a critical beginning for an ISO implementation process. With the Duluth Port already having HACCP and GMP certification, the basic steps for becoming ISO 9001 are in place with some of the additional steps and differences outlined above.

The identification of the scope of the ISO certification process and any involvement by an ISO certification consultant, such as Novecta and/or North Dakota State University, would be a necessary and required initial step. These items will directly impact the cost of the implementation process.

Following the site visit, AGP-Duluth completed an internal business assessment of going forward with one of the proposed ISO scope implementations. The third, and most comprehensive implementation, was identified as the preferred alternative. Unfortunately, it was ultimately determined that the time and monetary resources needed to bring that farm-to-market system into ISO compliance was unviable at this time.

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