The Andersons Research Grant Program

Project Title: Implementing and Evaluating Traceability Technology in Wheat Storage and Handling

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Beginning: November 1, 2009       Ending: October 31, 2011

Amount Requested:

Year 1: $24,981      Year 2: $24,468
Problem

Several authors (see, for example, Kennett et al.; Thakur and Hurburgh; Golan et al.) have persuasively argued that tracking flows of individual lots of grain through the grain marketing system can provide benefits similar to those achieved through improved supply chain management for industrial and consumer products. Golan et al. suggest that firms have three primary purposes in using traceability systems:

1) improved supply management
2) improve food safety and quality through traceback capability, and
3) differentiate and market foods with varying quality attributes

Each of these purposes is relevant for elevators in wheat producing areas of the country. First, improved supply management in wheat marketing would increase profitability in several different ways. Better information about storage conditions could reduce inventory loss or spoilage. More accurate and timely information about inventories and their size and quality could improve response to market opportunities. Better information about qualities, quantities, and location of each type of inventory helps a manager operate an elevator more efficiently through better tracking of inventories, more efficient use of grain-moving equipment and storage facilities, and through appropriate insect control based on weather conditions and bin history.

Second, food supply chain security is a strong motivator for designing and implementing traceability systems. Much research and several state initiatives have focused on the development of these traceability systems. The US Public Health Security and Bioterrorism Preparedness and Response Act of 2002 requires that all companies involved with the food and feed industry self-register with the Food and Drug Administration and maintain records that provide a measure of traceability (US Food and Drug Administration, 2002). The ISO 22005 Food Traceability Standard requires that each company record their immediate supplier and to whom the product is being sent (International Organization for Standardization, 2007).

Food safety is directly affected by the quality of information utilized in the food supply chain. Information integrity is paramount to optimal decision making: incorrect information can, for example, result in poor choice of insect control methods, including pesticides, or sale of unsafe food products. Homeland Security Presidential Directive HSPD-7 for Critical Infrastructure Identification, Prioritization, and Protection (2003) – hereafter referred to as Critical Infrastructure Protection (CIP) – identifies agriculture and food as one of the eleven sectors requiring attention. Providing accurate data free from manipulation is critical to our nation’s food supply.

While RFID has been proven to be successful in other critical sectors (i.e. utilities, transportation, etc.) and other parts of the food industry such as retail inventory

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1 Smyth and Phillips suggest that the three terms identity preserved production and marketing (IPPM), segregation, and traceability actually describe three different roles that are often termed “traceability.” Since the technology we are proposing to implement and evaluate here has all three components, we use the term traceability here to include all three.
management, it has yet to be employed in their earlier stages of food processing. Just as in other CIP sectors, data integrity is of significant importance, and is a central tenet of information security. This not only includes the deterrence of outside threats (i.e. hackers, etc) from outside dangers, but includes preserving integrity from mechanical and human error in austere environments. RFID offers a capability to rapidly collect critical grain data in real time, but the technology must be tested in the field to ensure it is operationally feasible and the data collected can be protected from a myriad of threats.

Finally, the opportunity to market grain with particular characteristics is an important motivator for adopting traceability as part of a supply chain management information system (SCIMS). These characteristics may be common to a particular grain production geographical area, and may include protein content, seed variety, and certain grain handling practices (Thakur and Hurburgh, 2009). These characteristics may be determined by climatic conditions during a growing season or by management practices specific to the area around a local grain elevator system.

Using geographic information systems (GIS) and product traceability methods, “grain sheds” based on quality characteristics can be established much like the idea of “watersheds” in the water resource management industry. Grain produced from a particular grain shed would have similar marketing quality characteristics and could be marketed to a particular buyer or industry based on these common characteristics.

By tracking individual loads, a manager may be able to segregate grain by its characteristics to obtain optimal value, compared to the value of that grain sold at an average quality level. For example, a manager can use information on protein level to take advantage of market premiums for protein. Individual buyers may even pay a premium for wheat whose protein measures reliably within one half percentage point of the desired level, compared to wheat with the same average protein level but with a wider variance.

Although a SCIMS has potential to provide substantial benefits in wheat marketing, it has not been effectively implemented in a first-handler wheat elevator. Several factors may explain this failure. Elevators typically have small operating margins, leaving little incentive for costly investments of uncertain payoff. Moreover, managers have seen few, if any, examples of successful adoption of such technologies, and have more pressing needs for their investment. They may find data collection and processing too expensive with limited, untrained personnel.

The goal of the research proposed here is to increase quality of wheat delivered to end users while improving profitability of wheat marketing, biosecurity, and environmental quality. As such, this goal addresses all three NC-213 objectives.