

QUALITY MANAGEMENT SYSTEMS FOR AGRICULTURE: PRINCIPLES AND CASE STUDIES^{1/}

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Quality management systems, with their associated statistical process controls and product tracking, are not new to world industry, but the concept is a radical departure from the generic commodity mindset that has typified agriculture. Trading undifferentiated commodities at constantly eroding margins provides little incentive for quality beyond that needed for minimal acceptance. A number of powerful and wide-ranging forces are converging to create a climate of change.

- Biotechnology is creating plant and animal products with value that cannot be captured without process control from production to consumption.
- Consumers in affluent nations have increasing ability to include environmental and social values in purchasing decisions, leading to pressures on production processes as well as measurable quality of outputs.
- Precise analytical and production practices have greatly increased expectations of what should and should not be included in food. Measurements in the part per trillion range, or even of individual DNA molecules, enable near zero specifications regardless of their validity in any risk analysis.
- Fewer people are involved in direct food production which has shortened the adoption time for new technologies
- World concepts of quality assurance are in the mainstream of all markets including those of the USA. Requirements for labeling of biotech products are forcing policy decisions in retail chains.
- Reduced margins are forcing a reexamination of operating efficiencies.
- Food safety and terrorist fears have greatly increased the willingness of food marketers to implement tracking systems for security reasons.

Some attributes cannot be measured by either visual inspection (e.g., natural beef) or by chemical analysis (e.g., BST in milk). In other cases, measurement is possible but cost prohibitive. For some consumers it is the process (how it was produced or by whom) that creates value, i.e., organic, animal welfare practices, locally grown, not the grade. Process control and more importantly source verification is necessary to capture the value of the trait. Finally, increased world security concerns are causing more scrutiny of all products intended for food – either commodity or specialty.

^{1/} Prepared for the 2002 Integrated Crop Management Conference, Iowa State University, December 4-5, 2002.

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What is Source Verification?

Source verification is the ability to trace products from their initial components (for example, from seed) through a production and distribution system to the end user. Other terms have been used for source verification – tracability, product tracking, process verification and others. Source verification automatically applies to identity preserved products – those that are physically isolated throughout the market – but also increasingly refers to documentation in bulk commodity markets as well. Some examples of soybean products that are or could be source verified are:

- Individual varieties grown by individual farmers (e.g. Vinton 81 soybeans)
- Specialized bulk products, such as nonGM or large seeded soybeans
- Totally contract controlled products such as health foods, organics, or pharmaceuticals
- General commodity soybeans if some risk factor is present (for example an unapproved GM event)

Source verification is a process. Testing for specific traits and special handling are part but not all of the process. Source verification requires a documentation chain from start to finish, in addition to whatever actual confirmation testing can be done. Source verification functions even when testing is not possible, or when the value of the product is in consumer perception rather than physical attributes. As long as the integrity of the documentation is maintained, the source verification and protection will be intact.

Quality Management Systems

Source verification requires a certified (third party audited) quality management system (QMS). Quality management systems are formalized procedures for requiring discipline and reproducibility in a production process. Discipline and documentation have not been mainstays of traditionally independent minded agriculture. Quality management systems force operators to document what and how processes are done, then prove through records and audit that the process, however described, is consistent. QMS do not require specific or high quality standards, just that desired standards are met. QMS are also a convenient framework under which to introduce environmental and/or safety standards.

The worldwide framework for quality management systems has been the ISO 9000 series of standards. Many manufacturing industries have customized a “front end” for the ISO standards to make them more user friendly for specific situations. This is also happening in agriculture, as in for example the American Institute of Baking Quality Systems Evaluation (QSE) program for flourmills and bakeries. Custom programs can also incorporate other elements such as food safety or environmental protection not addressed by ISO 9000.

All successful quality management systems incorporate the eight guiding principles of ISO.

1. Customer focus
2. Leadership
3. Involvement of people
4. Process approach
5. System approach to management
6. Continual improvement
7. Factual approach to decision making
8. Mutually beneficial supplier relationships

For the producer and the user alike, quality management systems have immediate benefits:

- Operating efficiency and cost savings are created through the detailed study of operations required for QMS. Industrial firms have averaged around \$1.50 - \$2.00 of cost/efficiency gains for every \$1 invested. If a QMS costs \$5000 for a 1000 acre farm, meeting this benchmark would mean \$10/acre in gains. Typically corn grosses about \$300/acre; \$10 is only 3%.
- The chain-of-custody documentation that is required for a comprehensive QMS will be a major benefit in marketing sensitive or narrowly focused products, such as genetically transformed pharmaceutical/industrial grains, or specifically fed specialty animals. Some of these products are genuine concerns to general users, and often are very hard to test/validate in the traditional inspect and pay scheme of commodity markets.
- The exhaustive analysis and procedural controls is well suited to reduction in security threats, such as addition of toxic agents or production limiting diseases. For example, white mineral oil is applied for dust control to nearly all grain handled at elevators, and the number of suppliers is very limited. The stringent validation and audit requirements of a QMS, which normally are imposed on suppliers to QMS firms, greatly reduces the chance that a terror agent could be distributed in this way.

For users, buying from QMS producers/handlers is an automatic method of predelivery tracking. The producer and first handler must be involved in source verification if any meaningful tracking and/or quality improvements are to be made. Source verification and audited quality management systems are opening direct market channels that require openness and transparency.

Getting Started

QMS will change the work culture of an organization. Culture changes are hard to make, and therefore entering with a system that has the fewest stumbling blocks and the clearest terminology for the industry is quite important. The world standard ISO system was essentially developed around manufacturing industries and thus there are many trainers and application templates for ISO in industry. ISO adheres to the fundamental principle that the training and registration functions must be separate to prevent conflict of interest.

Food systems have some unique characteristics, notably that they are involved with a biological product that spoils and is eaten by people, both of which cause food safety issues not directly

addressed by ISO to be of great concern. Food systems also have traditionally started with commodity (undifferentiated) products, transforming them into more specific goods. At the commodity marketing level, it has been hard to interest operators in providing services or products that exceeded the minimum requirements.

Agricultural firms can enter QMS with either a privately created or an ISO system. The private systems have the advantage of relating better to the culture of agriculture. They have the disadvantage of generally being both trainer and auditor. Some criteria for choosing the method of entry are:

- Know that the provider can train to your people, level of knowledge and that the trained is familiar with the industry.
- Choose integrity above all else, because if training and audit functions are to be combined, absolute integrity and dedication to purpose are needed, even if at times business relationships and corporate goals are strained.
- Determine that the documentation templates, procedure formats, and other materials are understandable by operating personnel, not just management.
- Identify immediately several sources of clear benefit that can be captured even before the entire QMS is in place, because this process is long and at times ponderous. There has to be some immediate realization of benefit in order for the cultural change to happen.
- Have a committed internal leader at the operations level.

Quality Management Systems for Grain Markets

There are two routes by which QMS are being introduced to grain production –through normal grain markets and through producer-held companies created to develop markets and coordinate very specialized production.

Development Process – Grain Handler Driven

Several grain companies are developing internal quality management systems. There are examples of ISO certification – Colusa Elevator Company, Consolidated Grain and Barge, Inc., and of other systems such as AIB QSE – Farmers Cooperative Elevator Company, Farmland Industries.

Many examples have occurred in Iowa, because State government and Universities recognized the need for source verification somewhat before the general market did. 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 one grain industry program, that of Farmers Cooperative Company, Farnhamville, Iowa, source verification was divided into nine general areas, and specific procedures/controls were created for each.

- Raw Materials
- Process Control
- Process Verification (Statistics)
- Finished Product Acceptability
- Storage and Shipping
- Instrument Accuracy and Calibration
- Personnel Training
- Plant Programs (Safety, etc)
- Quality Policies (Management Commitment)

The Tables 1 and 2 show some of the documentation and statistical control charts developed as part of the QMS. These are comparison charts kept to document constant improvements in accuracy of grain analysis.

Part of grain handling source verification is tracking of product from receipt to resale or use. This is important if a special trait is involved, and even more so if some consumer health or safety issue is involved. 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 bring producers to the level for certification without impressing major work with little tangible to offer in exchange. Some possibilities are:

1. Identify wagons and trucks, and record container, time and date of deliveries. This would extend product trackers to a field or bin if needed.
2. Determine if predelivery sampling and control of delivery timing could improve off harvest merchandizing potential and minimize inventories of off grade grain.
3. Utilize agronomy sales departments to create interaction with producers about data management, possible economies for them, and actual data collection in cases where the grain company is the primary input supplier.
4. Document completely the use of company supplied inputs by producers.
5. 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.
6. When premium opportunities exist, always attach some QMS activity requirements to the premium. For a bulk handler, premiums are likely to be incremental at first.
7. Incremental value traits (such as feed ingredient modifications or bulk nonGM) are best suited to grain handler organized QMS.

Development Process – Producer Supply Network

Producers organizing to form supply network corporations 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”. An example is Innovative Growers, LLC, stimulates by Iowa State University.

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.

1. Producer networks will likely target higher value products, and those needing field research to commercialize.
2. There are opportunities to identify cost savings in commodity operations, as well as specialty products.
3. Initially there may be excess documentation, until confidence is established.
4. Purity will be a major concern for the products of producer networks; operations affecting purity will be controlled even in commodity grain.
5. Producer networks will maintain their individually strategic plans, but will utilize standard formats, templates and study guides for their certification programs, each applying each those elements most relevant to the particular product involved.
6. Technical expertise will be needed; any network must have at least one skilled person on staff.
7. There will be opportunities with smaller incremental premiums where the high value skills/procedures of a producer network connect with grain handler programs (such as sale of non biotech soybeans).

This concept is essentially an extension of the organic and container markets now operating for premium soybeans. The addition of increasing food safety and consumer concerns will impress more rigorous documentation and structure, such as is offered by QMS, but these markets will readily adapt to source verified QMS. The key addition will be third party audit and verification.

There are several groups from Iowa that are organizing themselves in this way, or are upgrading their already successful organizations to more formal source verification. An example of the quality management system flow for a grain producer is shown in Figure 3.

Quality Management Systems in the Livestock Industry

QMS application in the livestock industry appeared primarily as a result of European consumer uncertainty of meat quality. First on the scene to address this issue was the Australian and New Zealand beef industry. With nearly 60 per cent of their beef production exported, these two countries developed a quality assurance program to protect their diverse customer base and differentiate their beef in the global market as a safe and consistent product. “Aus-Meat” their nationwide QMS was developed in partnership with the Australian government and the beef industry. This collaborative effort includes to identification, grading, and quality assurance through the entire supply chain from producer and through processors and suppliers to the consumer.

More recently in the United States the USDA-AMS has developed a voluntary testing and process verification program in anticipation of a growing domestic demands. The new USDA program “USDA-Process Verify”, was designed to assure customers of safety and consistency of products and to help differentiate products for specific niche markets.

USDA-Process Verify programs are based on the ISO-9000 format and provide an auditable platform for business management practices. However, unique production requirements are self-imposed for each business. These self-imposed requirements are the “traits” that are verified through an audit system. These may range from production methods, breed, diet, to handling techniques. They may be as simple as controlling the origin of the animal. It is important to note that QMS systems are not the same as other USDA grading programs in the livestock industry that focus primarily on the end product or carcass traits.

These documented management systems and audit verification procedures allow claims about production processes and products differentiation based on specific traits. The label of “USDA Process Verified” can be used

The USDA program has been implemented by several businesses that are using the certification process to target specific markets or to strengthen labeling or branding programs. Examples of early adopters include:

- Excel Corporation
- Farmland Industries
- America’s Best Pork
- PM Beef Group LLC
- Pederson's Natural Farms
- Premium Standard Farms
- Red Angus Feeder Calf Certification Program

As for grain, there is a mix of livestock buyers and producer groups driving the introduction of quality management systems.

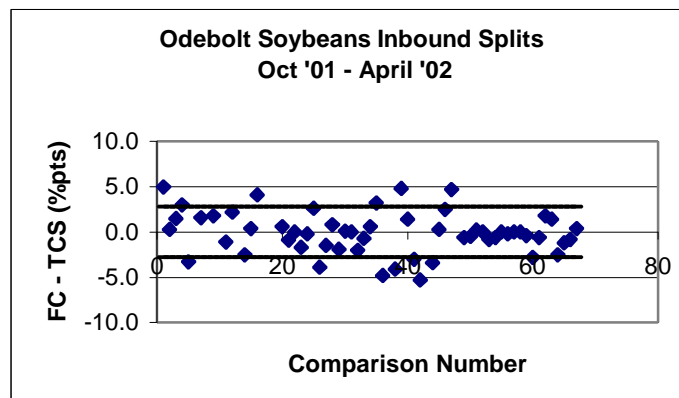
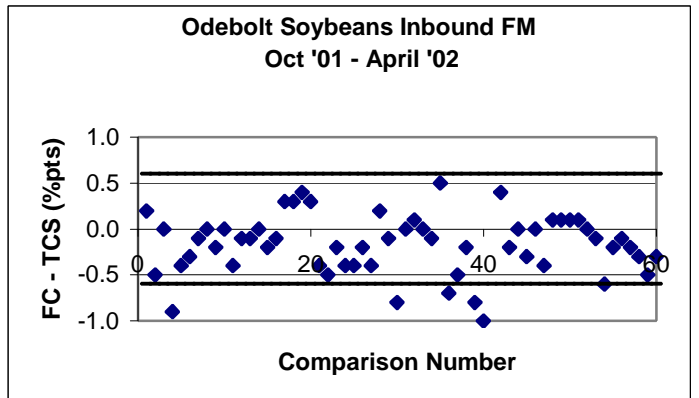
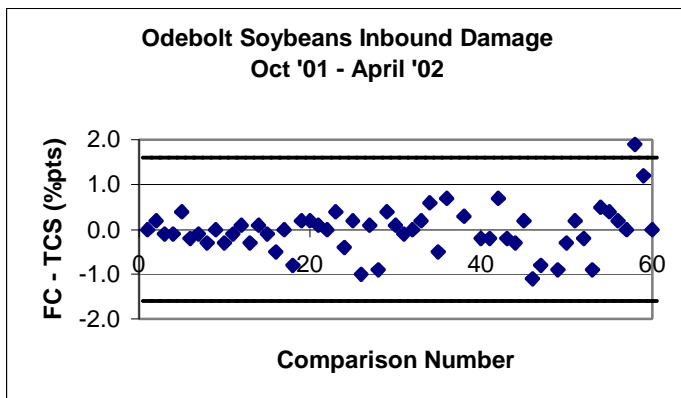
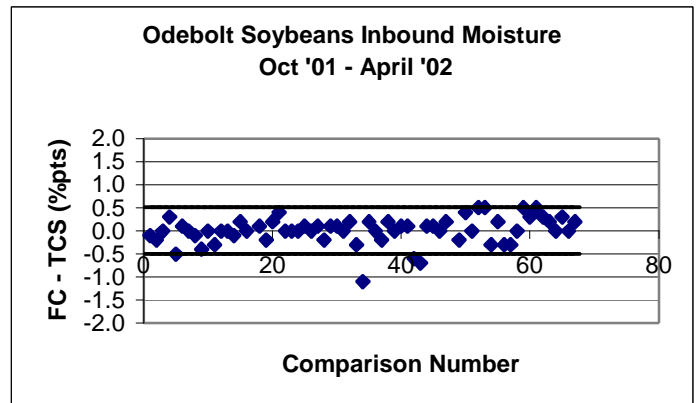
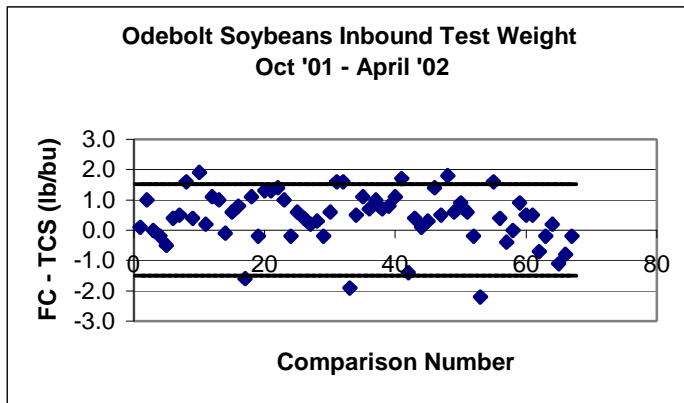
Third Party Audit

All source verification systems require audit by disinterested third parties. Auditing services are being created. For example, USDA is now deciding whether it should become a more universal quality management system auditor, most likely to the ISO 9000-2000 standards. USDA will be asking for public comment in January; it will be important to hear from all segments of agriculture whether this would be a useful service. Auditing is a high skill occupation, because auditors must understand both process control statistics and the industry being audited. The auditor must judge the degree to which the applicant has met the various criteria of the system. Auditing is very often quite subjective.

Summary

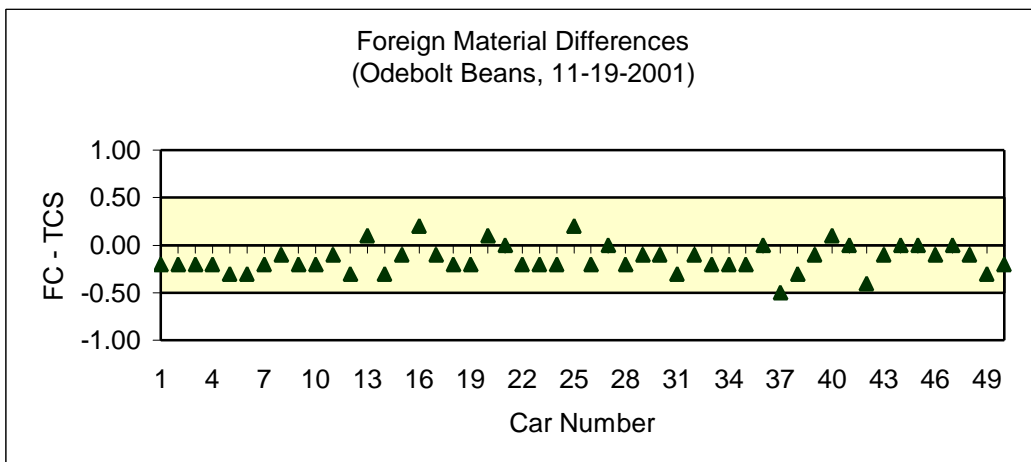
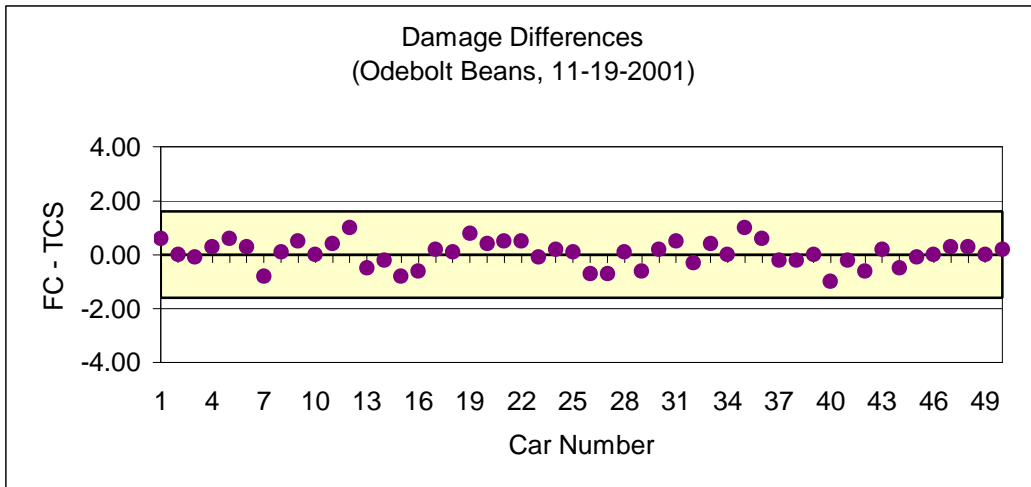
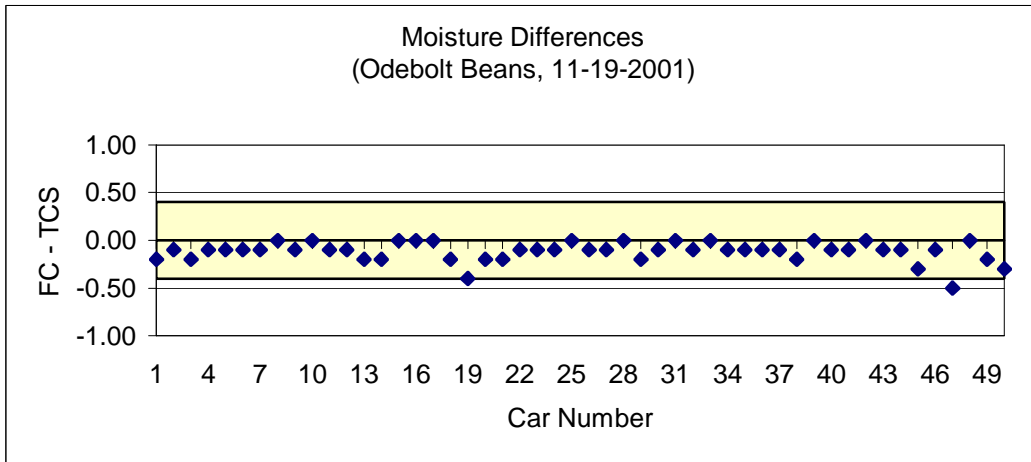
Source verification is becoming understood as a method of connecting producers to consumers, and of providing increased security around food supplies. Source verification requires that market participants have documented quality management systems, preferably audited by a disinterested third party. As more complex traits and increased needs for security arise, quality management systems will become common in plant and animal agriculture. There are several formats for quality management systems, but all generally include the principles of the international standard ISO 9000. Early examples in the grain and meat industries show that quality management systems reduce costs and increase profits, which makes the transition from generic commodities to source verified products more feasible.

Figure 1. Example of Control Charts for Grading Inbound Soybeans at a Country Elevator



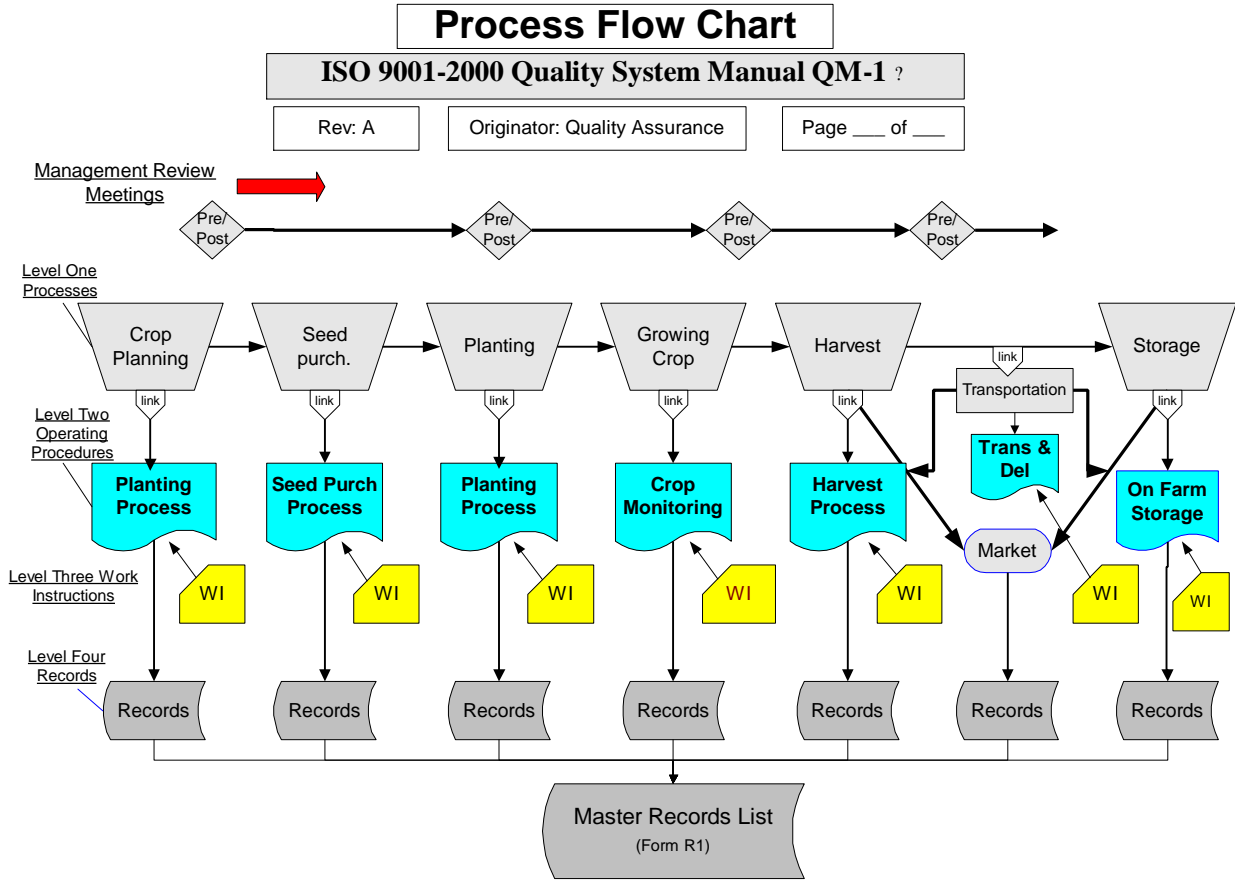
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Figure 2. Example of Control Chart for Rail Soybean Grades



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Figure 3. Typical process flow for a farm-based quality management system



Source: Center for Industrial Research and Service, Iowa State University