Conceptual Design of Fully Traceable Supply Chain for Bulk Agricultural Commodities

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Outline

- Traceability
- Chain Traceability
- Traceability System Requirements
- Internal Traceability
- Conceptual Traceability Model
  - Entity-Relationship Model
  - Sequential Interaction Model
- Concluding Thoughts
Traceability

Under European Union Law,

“Traceability” means the ability to track any food, feed, food-producing animal or substance that will be used for consumption, through all the stages of production, processing and distribution.

Traceability is a risk-management tool which allows food business operators or authorities to withdraw or recall products which have been identified as unsafe.

Require that each company know who their immediate supplier is and to whom the product is being sent, on the principle of **one up, one down**

One weak link in the **supply chain** can result in unsafe food, which can present a serious danger to consumers and have costly repercussions for suppliers

Food safety is therefore the joint **responsibility of all the actors** involved
Bulk Grain Supply Chain

Seed Production

Farming

Handling

Processing

Distribution
Traceability System Requirements

- Seed Company
- Farmer
- Grain Handler
- Processor
- Distributor
- Retailer
- Consumer

Grain Traceability System

- Comply with Food Safety Regulations
- Authenticate Claims
- Protect Integrity of Brand Name
- Record Breeding Practices
- Record Farming Practices
- Record Handling/Storage Practices
- Record Processing Practices
- Document Chain of Custody
- Meet Consumer Preferences
Internal Traceability

Every actor in the supply chain is responsible for maintaining records that link the inputs with the outputs.

**Internal processes:**
- Movement
- Storage
- Aggregation
- Segregation
- Transformation
- Destruction
Internal Traceability: Entity-Relationship Models

**SEED COMPANY**
- **PK** Company_ID
  - Address
  - Contact_Person
  - Contact_Phone

**SEEDS**
- **PK** Seed_ID
  - Seed_Variety
  - Seed_Type

**BREEDING**
- **PK,FK1** Company_ID
  - Seed_ID
  - Time
  - Date

**GROWING**
- **PK,FK1** Company_ID
  - Seed_ID
  - Time
  - Date

**SALE**
- **PK,FK1** Company_ID
  - Seed_ID
  - Time
  - Date

**WHOLESALER**
- **PK** Wholesaler_ID
  - Name
  - Address

**RETAILER**
- **PK** Retailer_ID
  - Name
  - Address

**FARMER**
- **PK** Farmer_ID
  - Name
  - Address

**FIELD**
- **PK** Field_ID

**LOT**
- **PK** Lot_ID

**PLANTING**
- **PK,FK1** Farmer_ID
  - Crop_ID
  - Field_ID
  - Date
  - Time

**HARVESTING**
- **PK,FK1** Farmer_ID
  - Crop_ID
  - Field_ID
  - Date
  - Time

**FERTILIZER**
- **PK,FK1** Farmer_ID
  - Crop_ID
  - Field_ID
  - Date
  - Time

**ELEVATOR**
- **PK** Elevator_ID
  - El_Name
  - El_Address
  - Record_ID

**CROP**
- **PK** Crop_ID
  - Field_ID
  - Crop_Name
  - Farmer_ID
  - Fertilizer_App
  - Lot_ID

**SALE**
- **PK** Record_ID
  - Elevator_ID

**buys**

**sells_to**
Internal Traceability: Entity-Relationship Models
UML Sequence Diagram

Suspect Product

Farming
Send Crop Data
Request Additional Information for Suspect Grain
Return Necessary Information for Suspect Grain

Handling
Send Grain Data

Processing
Send Product Data
Request Additional Information for Suspect Products
Return Necessary Information for Suspect Products

Distribution
Send Product Data
Request Additional Information for Suspect Products
Return Necessary Information for Suspect Products

Retail
Request Additional Information

Top Package::User
Return Requested Information
IDEF0: Traceability System Development

Develop Traceability System A0

Regulatory Compliance

Chain-of-custody Documentation
- Production Practices Documentation
- Claims Authentication
- Safety & Quality Assurance
- Customer Satisfaction
- Validation Certificates

Regulatory Need
Business Need
Customer Preference

Industry Standards Personnel Procedures

Control

Process Name
Input Output

Mechanism
Traceability System Development

1. Determine Traceability Plan
2. Implement Traceability Plan
3. Evaluate System Performance
4. System Validation
5. System Maintenance

Regulatory Compliance
Procedure Manual
Implementation Report
Performance Report

Regulatory Need
Business Need
Customer Preference
Industry Standards
Personnel
Procedures

System Validation Certificates
Production Practices Documentation
Claims Authentication
Safety & Quality Assurance
Customer Satisfaction Validation Certificates

Chain-of-custody Documentation

Performance Report
Grain Elevator Model
(Handling Specialty Grain)

1. Determine Traceability Plan
2. Implement Traceability Plan
3. Evaluate System Performance
4. System Validation
5. System Maintenance

- Regulatory Compliance (ISO)
- ISO Certification (Regulatory Need)
- Segregate different crops (Business Need)
- Speciality grains (Consumer Demand)
- Industry Standards
- Personnel
- Procedures
- Traceability System Manual
- Implementation Report
- Performance Report (QMS reports)
- Audit reports
- Production Practices Documentation
- Quality Management System Documentation
- ISO Certification
- Customer Satisfaction
- Validation Certificates

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Concluding Thoughts

- Traceability systems should meet business and regulatory requirements while providing product information.
- All actors in the supply chain must maintain internal and external traceability systems.
- Businesses should share relevant information with other partners.
- A request for traceability data should be responded to as soon as possible (comply with regulations).
- Failure at one point in the chain will result in the system failure. A chain is only as good as its weakest link.
Thank you

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