Electronic Management and Exchange of Laboratory Analysis Information
INTRODUCTION
Managing food safety – the need for an electronic standard

• Increased laboratory demand driven by:
  – Increased concern of food safety
  – Closer control by business partners, importers, retailers and the public authority
  – Need for faster supply chains to avoid wastage
  – Exchange of laboratory analysis results is one of the major data flows in the agrifood supply chain

• Industry inefficiencies
  – Many custom made solutions (between cooperatives, traders, packers and retailers
  – Exchange of information between agrifood stakeholders difficult and inefficient
  – Need for an electronic standard to exchange laboratory analysis data.
  – Exchange of laboratory analysis one of major data flows in the agrifood supply chain

Why eLAB matters

In the global agrifood industry, the proof of product compliance with legislation and market standards is becoming ever more important. As demands from retailers, food trade partners, quality control agencies and government authorities grow for detailed reports on residue observation in agricultural products, the standardisation of laboratory reporting has become more important than ever to complement and drive efficiencies in the agrifood chain. This realisation has fuelled the conception and initial implementation of eLAB in the Netherlands and France. The pilot projects have already seen early improvements both in the laboratory and in the agrifood supply chain and promise to be the foundation for implementing eLAB around the world.
• Standardising the exchange of information across heterogeneous systems nationally and globally

• Harmonization of laboratory analysis data exchange including:
  – The harmonization of technical data
  – The development of a consensual data dictionary for laboratory observation reporting
  – The development of a standardized laboratory observation reporting message (LOR)
  – The implementation of an electronic laboratory observation report message

• Informing stakeholders such as producers, growers, quality control agencies and authorities earlier, more efficiently and in a shorter timeline

• Improving quality controls and food safety
The exchange of information – development of an eLAB standard

- Transmission of messages to exchange information between the laboratories, farmers, advisory services, food producers and cooperatives.

  - Partly pushed by private sector
    - To improve the interoperability in the agrifood sector
    - Focus on integrating business processes to exchange data using XML messaging & web service protocol.

  - The UN/CEFACT eLAB standard
    - Developed by the agricultural expert group of UN/CEFACT
    - Business Requirements Specification (BRS) which explain the business processes that are supported by eLAB including the eLAB business and entity references
    - Requirements Specification mapping (RSM)
    - The UN/CEFACT standardised schema for business processes, a technical file called (XML Schema Definition)
    - UN/CEFACT standardised data components (Core Component Library)
    - Working closely with GS1 on standards for fresh fruits and vegetables
An Observation Independent Approach for the fresh produce supply chain

Flow of Goods & Information

Base Material Supplier
Crop Protection Product Supplier
Packaging Supplier
Grower
Packer/Repacker
Distributor/Trader
Food Service Operator
Retail Store

Third Party Logistics Services Provider (forward and reverse logistical)
Benefits of an eLAB standard information exchange

- Allows farmers and cooperatives to integrate this information in farm management systems
- Cooperatives use this information then to despatch better advice to farmers
- Farmers use it to manage their production in function of the analysis results for:
  - Which fertilizer to use
  - What quantities
  - In which season
  - What crop/animal feed to use
  - Determine the health status of living animals
  - Identifying chemical residues in products for export licence approval
Differences in paper-based and electronic messaging systems

### Paper-based logging
- No guarantee a report is accurate
- Difficult to consolidate
- More scope for irregular behaviour

### Electronic logging
- Electronically secured log reports
- Cross-checking in real time
- Central database to register messages

### Integrity
- Difficult to maintain and update in different data formats
- Slower processing time
- No automated validation

### Efficiency
- Faster processing
- Single view of all relevant information
- Simple maintenance of forms

### Security
- Higher risk of forgery and manipulation
- More difficult to identify patterns of fraud/misuse

### Security
- Very difficult to forge
- Online verification
- Searchable database with all logged data

### Time
- More time to prepare
- Longer time to deliver
- More time to process

### Time
- Computer-assisted application preparation
- Better informed decision making
- Faster management through real time status
HOW ELAB WORKS
Sample workflow of eLAB

1. Request for Observation
2. Sampler Person
3. Physical Sample and Observation Contract
4. Sample Received Report
5. Intake and process sample
6. Perform observations
7. Prepare report observations and conclusions
8. E-Lab Observation Report
9. Observation Report Incl. Conclusions
10. Invoice
The laboratory acknowledges the request for analysis, takes in the sample, identifies it and characterises it for later traceability.

The laboratory specifies the actions taken on the sample, such as infection with fungi or bacteria for the purpose of observation and details the storage conditions.

The laboratory then performs the requested observations, specifying the analysis method(s) used.

The laboratory proceeds to compile an eLAB observation report:
- Contains the result of the observations with commentary: can contain pictures, documents and other (binary) files.

The eLAB observation report is sent to the receiving party (which in many cases coincides with the requesting party).

The laboratory can then issue an invoice to the party detailed in the observation contract.

The roles of requesting party, laboratory and receiving party can be represented by different stakeholders.
Different eLAB stakeholders

• Requesting party
  – Farmers delivering electronic or paper requests for analysis to be performed on their products
  – Farmer cooperatives having jointly built an eLAB standard messaging system, submit electronic requests on the behalf of farmers to laboratories
  – Exporters or importers
  – Government agencies, e.g. as part of the export or import certification process

• Laboratory
  – Commercial laboratories with working relationships with farmers or cooperatives
  – Commercial laboratories with working relationships with importers or exporters
  – State laboratories performing standard analysis e.g. on export goods reporting then to the Competent Authority

• Receiving party
  – Cooperatives accept electronic receipts and observation reports on behalf of their members and then distribute the observation report to interested stakeholders such as scientific bodies and importers/exporters.
  – Competent Authority as part of a quality management system or a certification scheme (such as phyto-sanitary certification)
• Global Location Number (GLN)

• Global Trade Item Number (GTIN)
  – Barcode EAN-13 = GTIN-13
  – Barcode GTIN-14

• Global Product Classification (GPC)
  – Food and Non-food: Masterdata retail
The GS1 Identification Key used to identify **physical locations or legal entities**.

- The key is comprised of a GS1 Company Prefix, Location Reference, and Check Digit

- A GLN is a 13 digit number composed of a GS1 Company Prefix, a Location Reference number and a Check Digit

- GS1 Company Prefix: A globally unique number assigned to a GS1 member
- Location Reference number: number assigned by the company to the location
- Check Digit: A modulo-10 number calculated ensure data integrity
The GS1 Identification Key used to **identify trade items**. The key is comprised of a GS1 Company Prefix followed by an Item Reference Number and a Check Digit.

<table>
<thead>
<tr>
<th>Type</th>
<th>Global Trade Item Number (GTIN)</th>
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<tr>
<td>GTIN-14</td>
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Example retail: GTIN-13 in an EAN-13 bar code

![Example retail: GTIN-13 in an EAN-13 bar code](image)

Items not intended for retail sale (cases and pallets of product), may use the above or alternatively may use GTIN-14 and may be encoded in ITF-14, GS1-128, GS1DataBar, or GS1 DataMatrix bar codes, and EPC RFID tags.
• The GS1 Global Product Classification (GPC) standard helps global trading partners to group products in the same way, everywhere in the world.

• The building block of GPC is a product code known as a brick.
  – There are bricks for everything from a car to a bottle of milk.
  – The highest level of the classification is a segment, which is defined as a particular industry.
  – The lowest level of the classification system is called a brick attribute which is defined as a particular product detail.

• A GTIN can be assigned to exactly one brick
eLAB system management modules

**Laboratory**

**Receive**
- Receive Request
- Take sample
- Intake sample
- Characterise sample

**Process**
- Perform agreed observations
- Traceability of sample and observation methods
- Compile report

**Report**
- Send eLAB observation report
- Send invoice

**Farm/Cooperative management system**

**Competent Authority**

**Farm/Cooperative advisory system**
• Receive Module
  – Accepts electronic (or manual) observation requests in form of an eLab message from requesting parties such as farmers or cooperatives
  – The module will have the ability to enter such requests via a web interface by registered parties
    • Which include laboratory personnel entering requests on behalf of requesting parties
    • In addition to accepting – typically via a web service – submission from another system.
  – Support the registration of samples, their identification and characterisation
  – Allow storage of information about sample packaging and storage.
eLAB system management modules

• Process Module
  – Support the laboratory personnel in their work on samples
  – Should feature a sample queue for organisation of the laboratory work
    • A queue system should allow for priorities to process urgent samples faster
  – For each sample, laboratory workers shall be shown the type and details of analysis requested
    • Should provide links to analysis methods and allow the necessary data to be recorded
    • Should also continue to support the traceability of processed samples (recording when the sample was last used, where it is stored and under what conditions)
  – Shall record the observation report
    • Can consist of a simple upload tool for a report written by a text processing system
    • Could also include an online report compilation tool with pre-configured snippets
  – Should support review and sign-off by a responsible laboratory manager

• Report Module
  – Allows for the sending of the eLAB observation report to stakeholders such as the Competent Authority for official analysis or the farmer/cooperative for commercial analysis
  – eLAB observation report can be used in a Quality Management system of either a company, a cooperative or even a country
THE IMPLEMENTATION PROCESS
eLAB pilot project
• **Efficiency driven project:**
  - Project LEIDRAAD was initiated by the Dutch government and standardization organizations to develop consistent standards for the agrifood supply chain
  - The key organizations involved in the setup of this project were AgroConnect, Floricode (Florecom), EDI-Bulb, Frug I Com
  - Pilot Projects
    - Initial projects focused on
      - Residue analysis in fruit and vegetables
      - Soil and crop analysis

• **Initial results**
  - Standardised messages sped up the analysis turnaround by 90 minutes per analysis with a 15 minute/sample saving at the laboratory Time between reception of an analysis sample to return of the results
  - French Ministry of agriculture initiated pilot study of eLAB to replace its current messaging system
  - Other nations have shown interest such as China, New Zealand and the US
• eLAB designed using highly developed farms/cooperatives

• Improved efficiency and reduce costs
  – On average 90 minutes less timed between receiving the sample and issuance of the observation report
  – In total, 15 minutes gained per sample on productivity
  – For 3,000 samples (750 hours and labour cost 30€ p/h) = €22,500 yearly

• Improved transparency and quality control for better food safety
  – Observation report is mostly needed in 48 hours
• Feasibility of implementation for private sector farmers, cooperatives and laboratories has to be considered
  – Lack of technical capability
  – Information management systems on farm or in laboratory not wide spread

• eLAB messaging system between state laboratories and the Competent Authority
  – Implement simplified and standardised procedures
  – Strengthen official analysis and official quality management processes (e.g. issuance of phyto-sanitary certificates)
  – Control of outsourced analysis
  – Reduce fraud
  – Transmit analysis results to (the Competent Authority of) trade partners
  – Collect statistics on essential issues like pesticide residues, heavy metal contamination, mycotoxins etc
• eLAB for state laboratories
  – Implementation 3 modules: Receive, Process and Report
  – Ability to receive analysis requests from the requesting parties
  – The system should have a web interface to enter such requests directly (ideally also via mobile devices)
  – Needs to feature manual entry of laboratory personnel on behalf of the requesting party and electronic reception – e.g. directly from the Competent Authority for official analyses
  – Integration with a central database and consensual data dictionaries to be used for all laboratory observation reports in the agricultural domain

• eLAB for competent authorities
  – Ability to issue Laboratory Analysis Requests for official analyses
  – Ability to integrate Laboratory Observation Reports into their database of records on official processes (such as the issuance of a phytosanitary certificate)
  – Capability of drawing geolocalised statistics on relevant issues (e.g. pesticide residues, mycotoxins, soil qualities, illnesses etc.)
  – Ability to share specific and aggregate data with (the Competent Authority) of trade partners.
Accredited laboratory

**Electronic Logging**
- Electronic input of paper observation request
- Electronic scheduling of sample collection
- Electronic issuance of laboratory results

**Key Benefits**
- Better control of food imports/exports
- No paper work
- Greater control of food industry activities
- Consistent and real-time collection of information
- Central registry of agricultural data
- No duplication of paper work
- Real-time report processing

**Electronic Reporting**
- Integration with quality control processes and systems
- Integration with quality/safety certificates

**Key Benefits**
- Greater processing efficiency
- High quality data exchange
- Report standardisation
- Quick communication channel to stakeholders
- Better export controls
- Less fraud

**Central Data Repository**
- Development of consensual data dictionaries
- Data exchange with relevant authorities

**Key Benefits**
- Provable integrity of observations/certificates
- Cost savings
- Central Repository
- Greater processing efficiency
- Less paper
- Non-repudiation of data
- Improved auditability
- Better scientific advice

Data exchange with importing/exporting country

**Electronic Logging**
- Electronic issuance of lab observation requests
- Electronic receipt of sample collection receipt
- Electronic acceptance of laboratory observation reports
- Integration with certificate management processes

**Key Benefits**
- Better control of food imports/exports
- No paper work
- Consistent and real-time collection of information
- Real-time observation result processing
- No duplication of paper work
- Central registry of agricultural data

**Electronic Reporting**
- Integration with quality control processes and systems
- Integration with quality/safety certificates

**Key Benefits**
- Greater processing efficiency
- High quality data exchange
- Report standardisation
- Quick communication channel to imports/exports
- Better import/export controls
- Less potential fraud

**Central Data Repository**
- Data exchange with Broder control
- Data exchange with importing nations

**Key Benefits**
- Provable integrity of observations/certificates
- Cost savings
- Central Repository
- Greater processing efficiency
- Less paper
- Non-repudiation of data
- Improved auditability
- Better scientific advice

Intergovernmental discussions

Laboratory buy-in
CONTRIBUTION TO THE NATIONAL ECONOMY
Typical results chain - eLAB

**Input**
- Feasibility
  - Stakeholder buy-in
  - Funding
  - Specification
- Legal/infrastructure
  - Security infrastructure
  - Electr. lab management systems
- Training
  - National awareness
  - Training laboratories and officials

**Process**
- eLAB messaging
  - Implementation
  - Piloting
  - Rollout
- eLAB in Laboratory
  - Industry buy-in
  - Implementation
- eLAB Exchange
  - Bilateral agreement
  - Implementation
  - Piloting
  - Rollout

**Output**
- eLAB messaging
  - Request message
  - LOR report
- eLAB in Food
  - Better monitoring
  - Better reporting
  - Improved science
- eLAB Exchange
  - Bilateral data exchange
  - Non-repudiation

**Outcome**
- also called Purpose
- Control im/exports
  - Better food safety, plant or animal health monitoring
- Increased efficiency
  - Faster turnaround
  - Cost savings
  - Better productivity
- Statistics
  - Better planning
  - Better resource management

**Impact**
- also called Goal

- Safer food, healthier plants and animals
  - Greater trust in trading nations
  - Better public health
  - Less diseases
Costs and funding

• Cost variants
  – Current state of existing eLAB system
  – Local costing of implementing an eLAB system
  – Integration with existing legacy systems

• Indicative cost figure
  – Without existing infrastructure: 30,000 EUR to set up
  – Resourcing costs: 120,000€
  – IT infrastructure already set up, eLAB messaging can be cheaper to implement.
  – Using the B2B connector of the eFoodChain project, cost for simple transmission of messages can be further reduced

• Software support
  – No off-the-shelf software solution for an eLAB-based system
  – Required to develop their own IT infrastructure to support the eLAB messaging standard or adapt an existing legacy system to be able to support eLAB messaging
  – eFoodChain has released a B2B connector into the public domain that manages the secure exchange of eLAB messages

• Funding
  – Funding can come from fees applied for an eLAB observation report
  – Potentially arrangements may be made with the private sector to contribute to funding of eLAB implementation and operation
SWOT Analysis

**Strengths**
- Uniform messaging system
- Productivity gains
- Improved quality controls
- Timeline efficiencies
- Compliance to laws/treaties
- Development of consensual data dictionaries

**Weaknesses**
- Additional cost for IT infrastructure
- Requires electronic laboratory management systems
- Requires right code lists for target markets
- Full benefits only if requesting and receiving parties have electronic systems

**Opportunities**
- Improved efficiencies
- Better information sharing
- Cost reduction of information gathering
- Better food prices due to better quality

**Threats**
- In absence of general eInfrastructure, business case might not be strong enough
- IT security
- Technical capabilities of laboratories
- Technical capabilities of farmers
- Funding for development and operation
More information

• YouTube: eLAB
  – https://www.youtube.com/watch?v=OwR8cuzOO7Q

• eFoodChain:
  – http://www.efoodchain.eu/

• Standards:
  – UN/CEFACT Modelling Methodology User Guide (CEFACT/TMG/N093)
  – UN/CEFACT Business Requirement Specification Document Template (CEFACT/ICG/005)

• Business requirements specifications:
  – UN/CEFACT E-CERT BRS
  – UN/CEFACT E-DAPLOS BRS
  – UN/CEFACT CRIE cattle registration and information exchange BRS
  – UN/CEFACT agricultural observations BRS
ROUNDTABLE DISCUSSION
• Divide the room into three groups:
  – Agribusiness
  – Laboratory
  – Cooperative

• Q1: When would you use the eLAB standard?

• Q2: A new requirement for comprehensive mycotoxin testing for export goods is to be implemented. How?
Thank you for your attention!

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