The ISO Strategic Advisory Group for Smart Farming

R. Andres Ferreyra, PhD, Syngenta Digital
The ISO SAG-SF Report

IMPORTANT: Most of the material contained in this presentation is either contained in, or refers to, the Final Report of the ISO Strategic Advisory Group on Smart Farming. Please find it here:

https://bit.ly/3olkd8x
When you find yourself in a hole, stop digging


- The global agrifood sector finds itself in a predicament: our standards are insufficient to support the data-driven, principled decision-making required to solve 21st century problems such as enabling a circular bioeconomy.

- This results from the bottom-up growth of both the industry and its standardization efforts.

- ISO realized this and chartered a group (joined by 21 national standards bodies) to develop a strategic roadmap to guide hybrid top-down, bottom-up action.

- The proposed Technical Committee described in this presentation is a key part of that strategy.
A working definition of Smart Farming

**Data-driven, principled decision-making** in **agricultural value chains** occurring as the optimization of multiple, often conflicting objectives in the context of **global**

- **Volatility**
- **Uncertainty**
- **Complexity**
- **Ambiguity**

**Examples of objectives to maximize**
- Profitability
- Sustainability
- Compliance (e.g., regulatory)
- Other values-driven goals such as efficiency and labor productivity*

**Examples of scope**
- Crops, Livestock, aquaculture, pollinators, genetic improvement, Food processing, input mfg., etc.

**Causes or manifestations**
- Climate change
- Input price volatility
- Harvested commodity price volatility
- Supply chain interruptions
- Logistics challenges
- Decreasing resource base (land, water, etc.)
- Regulatory context

* These are geopolitical-context-dependent and may not be applicable in some contexts.
Agrifood systems are data-exchange-intensive

(How do they fit in? They produce ~46% of the world’s food!)

A circular bioeconomy requires many additional data flows at scale
ISO and how it works

- International Organization for Standardization (ISO)
  - Member countries → National standards bodies (NSBs)
    - American National Standards Institute (ANSI) for US
    - Technical committees & subcommittees (TCs/SCs)
  - ISO develops standards within the TCs and SCs
    - NSBs propose them, designate experts to develop them
    - TC/SC members (designated by the NSBs) vote to approve
      - The vote for each NSB/country is typically managed by a domain-specific national standards organization designated by the NSB
        - ISO/TC 23 (Agricultural machinery): the US rep is ASABE (Am. Soc. Agric. & Biol. Engineers)
        - ISO/TC 44 (Welding and Allied Processes): the US rep is AWS (American Welding Society)
        - TC 154 (Processes, data elements and documents in commerce, industry and administration): US rep is OAGi (Open Applications Group, Inc.)
  - When a new TC or SC is created
    - Each participating NSB will designate an organization to represent it.
    - That organization (ASABE in the US for most agricultural work) will hold the TAG (technical advisory group) and determine the country’s positions regarding standards in that TC/SC
    - Operating the TC/SC requires money on an ongoing basis
      - Fees to ANSI (e.g., $8000/yr for a TC)
      - Operating costs (e.g., secretariat, travel to plenaries, etc.)
More ISO Context

• ISO: 24000+ standards, 250+ committees, 168 members (1/country).
• ISO committees and subcommittees tend to have narrow scopes.
• This typically leads to great results within narrowly-scoped domains.
• Smart farming, however, requires interoperability across domains.
• There lies the challenge, and ultimately the motivation to make a strategic coordination effort.
• ISO is aware of this and chartered its Strategic Advisory Group on Smart Farming (SAG-SF) as a result.
The ISO Strategic Advisory Group on Smart Farming and its Roadmap
ISO and its Goals for the Roadmap on SF

• **Describe the standardization landscape** around Smart Farming across the entire food value chain in the context of the Sustainable Development Goals (SDGs).

• **Identify gaps** where standardization is needed.

• **Recommend actions and priorities** for standardization activities.

• **Publish the results** (i.e., the roadmap document).
**Critical first steps**

1. **Internal Coord.** (Partnerships)
   - Rec. 3.1.4, 3.1.7: ISO SF Coordinating Committee, Coordinate with existing TCs
   - Rec. 3.2.1: TC on data-driven agrifood systems
   - Rec. 3.1.6: New committees
   - Rec. 3.1.5: Joint Smart Farming Landscape Group

2. **External Coord.** (Partnerships)
   - Rec. 3.4.10, 3.4.11: Reference Architecture, Data Model

3. Build upon on horizon 2 projects

**HORIZON 1**
- 6 months to 1 Year
- Key steps:
  - Rec. 3.1.4, 3.1.7: ISO SF Coordinating Committee, Coordinate with existing TCs
  - Rec. 3.2.1: TC on data-driven agrifood systems
  - Rec. 3.1.6: New committees
  - Rec. 3.1.5: Joint Smart Farming Landscape Group

**HORIZON 2**
- 1 to 3 years
- Key steps:
  - Rec. 3.1.9: Standards interoperability
  - Rec. 3.1.8: New committees
  - Rec. 3.4.10, 3.4.11: Reference Architecture, Data Model

**HORIZON 3**
- 3 to 6 years
- Key steps:
  - Build upon on horizon 2 projects
  - Long-term SF projects
**HORIZON 1**

6 months to 1 Year

- Rec 3.2.2: Agrisemantics WG
- Rec 3.1.3: Publish SF report, create Communication Plan
- Rec 3.1.1: Promote SF report

**HORIZON 2**

1 to 3 years

- Rec 3.4.2 – 3.4.8: High-priority Agrisemantics standards, Data type registry system / infra
- Rec 3.1.8: New standards + fill gaps in existing standards
- Rec 3.1.10: Interoperability testing principles
- Rec 3.4.1: FAIR Data Principles
- Interoperability testing framework
- Refine interoperability testing

**HORIZON 3**

3 to 6 years

- Semantic Infrastructure
Coordination overview

External Coordination and Communication

**SFCC**
Smart Farming Coordination Committee

**Existing TCs**

**TC (DDAFS)**
TC on Data-Driven Agrifood Systems

**JSFLG**
Joint Smart Farming Landscape Group

**COMM**
ISO Communications Team

**User communities**
Enablement & support

Internal Coordination and Communication

Critical first steps; proposals already launched

1. Proposed new org.
What’s in it for ASE-16?

1. There would now be a clear ISO path for ASE-16 standards such as S629:
   • Primary go-to: Technical Committee on Data-Driven Agrifood Systems (currently balloted with the National Standards bodies)
   • Specific go-to: Subcommittee on Sustainability Metrics

2. The US will hold the chair of the TC. ASE-16 could hold the US Tag for the Subcommittee on Sustainability Metrics
Recommendation 3.2.3: Subcommittee on Sustainability Models, Metrics and Data

The SAG recommends that the proposed TC on Data-Driven Agrifood Systems create a subcommittee on sustainability models, metrics and data.

Terms of reference:

• Broadly, the Subcommittee scope is to enable the development of environmental, economic, and social sustainability models for agrifood systems through data.

• Enable standardization of the inputs (i.e., observations and measurements) and outputs of models used to assess sustainability of agrifood systems or parts thereof, including data models, standardized data exchange messages, and the semantic infrastructure (e.g., data type registry and controlled vocabularies) necessary to support them.

• Proposed placement is under the proposed TC on Data-Driven Agrifood Systems

The scope of this subcommittee includes:

• Standardizing, jointly with the Agrisemantics Working Group, the different aspects of observations and measurements (features of interest, observed properties, etc.) applicable to sustainability

• Standardizing the inputs and outputs of simulation models used in the sustainability domain, since these variables fit the data model of observations and measurements and the user community would benefit from having their definitions available through a data type registry.

• Enable prioritization through the formalization of sustainability indicators (variables) and machine-actionable methods for representing prioritization.
Other recommendation topics of interest

- 3.4.2: Data type registry (semantic infrastructure) ... 28
- 3.4.3: Model and controlled vocabulary of crops ... 29
- 3.4.4: Controlled vocabulary of phenological stages ... 30
- 3.4.5: Controlled vocabulary of field operations ... 31
- 3.4.6: Standard machine-actionable set of unit of measure codes ... 32
- 3.4.7: Enable nonstandard unit of measure conversions ... 33
- 3.4.8: Standardize active ingredient reference data ... 33
- 3.4.9: Enable standard crop input product label reference data ... 34
- 3.4.10: Initiate work on a reference architecture for smart farming though an international workshop ... 35
- 3.4.11: Standard for reference architecture for Smart Farming ... 36
- 3.4.12: Enable food loss and waste management through data ... 36
- 3.4.13: Standardize a data model for field boundaries, nomenclature for field boundary use, and data quality measures associated with field boundaries. ... 37
- 3.4.19: A standard to support data exchange between crop and livestock management systems ... 41
- 3.4.20: Standard for representing provenance of agricultural inputs and calculating upstream energy requirements... 42
- 3.4.21: Standard for representing the source, provenance and disposition of irrigation water ... 43
- 3.4.29: Enable codification of agronomy ... 48
- 3.4.30: Enable testing and learning through data ... 49
Implementation is Key

1. Having a strategy and a roadmap does not guarantee success.

2. Communication with user communities and other standards organizations has to grow substantially.

3. Transitioning from a primarily bottom-up standards development approach to a hybrid model that includes top-down strategic planning is not simple: communicating value and having incentives will make or break the plan.

4. Additional standards are needed to make it easier to implement the fiduciary principle and data ethics by design.

5. It is difficult to get smallholder representation in these conversations.

6. Investment in semantic infrastructure and data trusts is necessary.
R. Andres Ferreyra, Ph.D.
Data Asset Manager
Syngenta Digital
andres.Ferreyra@syngenta.com

Ed Barnes, Ph.D.
Senior Director, Agricultural and Environmental Research Division
Cotton Incorporated
ebarnes@cottoninc.com

Use the QR code to Access SAG documents
https://bit.ly/3olkd8x