TITAN

Transparency solutions for transforming the food system

# Deliverable 3.3 – Recommended Network of Semantic Resources for the Food Supply Chains

| | |
|---|---|
| Project Name | TITAN |
| Contractual Delivery Date | 31.08.2026 |
| Actual Delivery Date | 31.08.2026 |
| Work Package | WP3 |
| Authors | Bernadette Durand, Catherine Roussey, INRAE |
| Nature | R as Report |
| Security | PU for Public |
| Version | 3.0 |

*Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them*

## Executive Summary

This report will describe the scope of the semantic resources needed for the food chain. The report will include a short description of these resources and some criteria used to select them, in particular on points such as their potential to formalize food chain concepts and to be reused by TITAN partners. In other words, their ability to link data from different use cases and these resources should allow actors to harmonize information exchanges and avoid ambiguities. It also describes the adjustments to the guide for SMEs to navigate the network and apply it at their operational level.

## Authors and Reviewers

| Main Responsible | | |
|---|---|---|
| **Organization** | **Name** | **Mail** |
| INRAE | Catherine Roussey | catherine.roussey@inrae.fr |
| Author(s) / Contributor (s) | | |
| **Organization** | **Name** | **Mail** |
| INRAE | Bernadette Durand | bernadette.durand@inrae.fr |
| Reviewer(s) | | |
| **Organization** | **Name** | **Mail** |
| TU Delft | Marcela Tuler de Oliveira | M.TulerdeOliveira@tudelft.nl |
| TU Delft | Esra Zorer | e.zorer@tudelft.nl |

## Legal Disclaimer

This document is issued within the framework of and for the purpose of the TITAN project. This project has received funding from the European Union's Horizon Europe Framework Program, through the Research Executive Agency (REA) under the powers delegated by the European Commission and under Grant Agreement No. 101060739.
Views and opinions expressed are, however, those of the author only and do not necessarily reflect those of the European Union or of the Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.
This document and its content are the property of the TITAN Consortium. All rights relevant to this document are determined by the applicable laws. Access to this document does not grant any right or license on the document or its contents. This document or its contents are not to be used or treated in any manner inconsistent with the rights or interests of the TITAN Consortium or the Partners detriment and are not to be disclosed externally without prior written consent from the TITAN Partners. Each TITAN Partner may use this document in conformity with the TITAN Consortium Grant Agreement provisions.

# 1 Introduction

This document presents recommended semantic resources and shared standards that can help small and medium-sized enterprises (SMEs) improve data exchange by using shared and documented data models and vocabularies.
The goal is not to require companies to adopt complex semantic Web infrastructures such as RDF triple stores or graph databases. Instead, the document focuses on practical adoption to reuse Web identifiers (URI) defined in existing semantic resources.

## 1.1 Plain Language Glossary

| Term | Meaning |
|---|---|
| Controlled Vocabulary Thesaurus | A standard list of approved terms and their natural language definitions, that may be used to fill in a data model or annotate a document or any Web resource. When the terms are organized in hierarchy, the list of terms is named a thesaurus. |
| Interoperability | The ability of systems to exchange data and interpret it adequately. |
| Knowledge Graph | A dataset organized by an ontology and published on the Web (a kind of graph database). A RDF triple store is the database system that manages the knowledge graph and its ontology. |
| Ontology | A structured definition of classes and their relationships, that is to say a data model (or data schema) published on the Web with natural language definitions. An ontology is a data schema associated with its data dictionary. |
| Semantic Resource | A shared standard for structuring or describing data, accessible on the Web. A semantic resource may be an ontology, a controlled vocabulary, a knowledge graph, or any combination of them. |
| Semantic Web technologies (languages and tools) | Semantic Web technologies enable to store, manage and retrieve dataset structured by ontologies (for more explanation see https://www.w3.org/2001/sw/wiki/Main_Page). Semantic Web technologies use a graph syntax named Resource Description Framework (RDF) to describe types, objects, and associated data ( for more explanations see https://en.wikipedia.org/wiki/Resource_Description_Framework). Semantic Web languages to define data model (ontology) are OWL or RDF Schema (RDFS). SKOS is a language to describe thesauri and controlled vocabulary. The language to query knowledge graph is SPARQL. All identifier should be Web identifier (URI). The RDF graph database system that stores semantic resources is named a triple store. |

### 1.2 You Do Not Need a Triple Store

Most SMEs can benefit from semantic resources simply by using shared controlled vocabulary, and Web identifiers.

- Use semantic resources as reference standards and naming systems.
- Map existing database fields or column headers to standard controlled vocabularies by reusing their Web identifiers.
- Align APIs and exported files with Web identifiers.
- Improve interoperability without changing your current architecture.
- Continue using SQL databases, spreadsheets, ERPs, and existing software.

### 1.3 Purpose

- Improve interoperability between supply chain actors
- Support traceability and transparency
- Enable sustainability and ESG reporting
- Improve data clarity and quality
- Reduce custom integrations between systems
- Support regulatory reporting and compliance

### 1.4 Migration Guidance for SMEs

- Do not replace existing systems immediately.
- Start by aligning terminology and exported fields.
- Use semantic resources as reference standards.
- Pilot implementation in one supply-chain process first.
- Expand interoperability gradually across partners and systems.

### 1.5 Quick Start Guide

| Business Need | Recommended Resource | What It Helps With | SME Complexity | Typical Existing System |
|---|---|---|---|---|
| Product Identification | GS1 | Batch and product tracking | Low | ERP / barcode system |
| Agricultural Terminology | AGROVOC | Consistent crop naming | Low | Spreadsheet / database |
| Food Classification | FoodOn | Food product categorization | Medium | Inventory system |
| Sustainability Reporting | SDGIO | ESG reporting alignment | Medium | Reporting platform |
| Sensor Monitoring | SOSA | Temperature and IoT monitoring | Medium | IoT platform |

### 1.6 Sector-Specific Pathways

| Sector | Recommended Starter Resources | Primary Use | Typical SME Benefit |
|---|---|---|---|
| Agriculture | AGROVOC, CropOntology, GS1 | Crop tracking, farming terminology, traceability | Improved interoperability |
| Hospitality | FoodOn, GS1, SDGIO | Inventory, procurement, ESG reporting | Better reporting and traceability |
| Retail | GS1, FoodOn | Product interoperability and recall management | Faster recalls and inventory alignment |
| Logistics | GS1, FEDeRATED, SOSA | Shipment tracking and cold-chain monitoring | Transport visibility and monitoring |

### 1.7 Adoption Levels

| Level | Typical SME Activity | Technical Requirement | For SMEs? | Time commitment |
|---|---|---|---|---|
| Beginner | Use standard naming conventions | Very Low | Yes | 1 day |
| Intermediate | Align APIs and exports with standards | Low | Yes | Days |
| Advanced | Cross-company interoperability and traceability | Medium | If needed | Months |
| Expert | Knowledge graphs and semantic reasoning | High | Unlikely | Months |

### 1.8 Three Levels of Implementation:

**Level 1: Column Headers + Mapping Table (No Triplestore) – Most SMEs fall here**

**What you do:**

- Rename your spreadsheet column headers to vocabulary terms (e.g., gs1:batchNumber instead of LotNumber).

**OR**

- Keep a mapping table that says "our internal field X is equivalent to term T of vocabulary V " and share it with partners. Note that the equivalent relation may be changed into another mapping relation like: more general than (instead of equivalent to), check the natural language definition of any of the terms T and fields X.

**What you get:**

- Partners and regulators understand your data without calling you
- No more explaining what "OrganicCert" means
- You map once. Many partners use the same map. Or many partners may map their data to the same reference vocabulary.
- Your data is self-documenting

**What you do NOT get:**

- No SPARQL queries
- No automated integration
- No graph visualizations

**Right for you if:**

- You share data with multiple partners or regulators
- You are tired of explaining your column meanings
- You do not have knowledge engineers on staff
- You want value quickly

**Wrong for you if:**

- You need to run complex queries across multiple datasets
- A customer or regulator is demanding SPARQL specifically

**Level 2: JSON-LD Conversion (Static Triplestore) – For publishing a one-time public data release**
**What you do:** Convert a single file or batch of data into JSON-LD or RDF format. Load it into a triplestore once. Run SPARQL queries on that static snapshot.

**Level 3: Live Triplestore with Synchronization - For a large enterprise with engineering resources**
**What you do:** Set up a triplestore that automatically ingests and updates data from your source systems (farm software, ERP, logistics platform). Keep it synchronized in real time or near real time.
**What you get:**

- Everything from Levels 1 and 2
- Live SPARQL queries on your current data
- Automated integration across systems
- A knowledge graph based on semantic Web technologies

**Do all partners need to use the same resources?** No. But every partner who does makes it easier.
**The bottom line:** Start at Level 1. Add complexity only when or if you actually need it.

### 1.9 How to select a Semantic Resource

1. **By using this document**

To navigate the diagram (on page 7), click on the desired section to make your selection. This will direct you to the corresponding page containing links to relevant semantic resources and related topics. You may return to the diagram from any section.

- *The exact resource and terms you choose will depend on the specific use and definition of the resource and term.* -

## 2 Use Case Navigation and Resource Discovery: Sharing Data in an Organic Strawberry Supply Chain

### 2.1 Scenario

A producer, certification body, processor, transporter, retailer, and regulator wish to exchange information about organic strawberries. Rather than developing custom data formats, they use this guide to identify semantic resources that provide common terminology and identifiers for the information being shared.

### 2.1.1 Production

The producer wants to share information about strawberries, farms, farming practices, and crop characteristics.

**Navigation path:** Production → Naming (AGROVOC); Production → Crops (CropOntology)

Here they find **AGROVOC** for agricultural terminology and **CropOntology** for crop-specific information such as varieties and traits.

### 2.1.2 Organic Certification

The producer and certification body need to exchange certification information and link certificates to products and batches.

**Navigation path:** General Supply Chain; Regulation → Sustainability (SDGIO)

Within General Supply Chain they find **GS1** for product, batch, and location identification. They can also explore **ORG**, **Prov-O**, and **TRO** for organisational and traceability information. Within Regulation → Sustainability they find **SDGIO** for sustainability-related claims and reporting.

### 2.1.3 Transformation

The processor wishes to share information about washing, sorting, processing, and packaging activities.

**Navigation path:** Transformation → Processing

Here they find resources such as **PO2** and **TransformOn** for describing food processing and transformation activities.

### 2.1.4 Logistics and Distribution

The transporter and retailer need to exchange information about shipments, locations, product movements, and customs procedures.

**Navigation path:** General Supply Chain (GS1); Distribution → Transportation (GeoSPARQL); Distribution → Customs (FEDeRATED)

Within General Supply Chain they find **GS1** for product and batch identification. Within Distribution → Transportation they find **GeoSPARQL** for location information. Within Distribution → Customs they find **FEDeRATED** for customs and cross-border data exchange.

### 2.1.5 Monitoring and Sensor Data

The transporter also shares temperature measurements collected during transport.

**Navigation path:** Transformation → Sensors and IoT (SOSA); General Supply Chain (Time Ontology)

Within Transformation → Sensors and IoT they find **SOSA** for sensor and observation data. Within General Supply Chain they find the **Time Ontology** for representing dates and times consistently across systems.

### 2.1.6 Traceability

All participants need to know where products originated, which organizations handled them, and when activities occurred.

**Navigation path:** General Supply Chain

Here they find **GS1** for identifying products and batches, **ORG** for organisational information, and **Prov-O** and **TRO** for more advanced provenance and traceability information.

### 2.1.6 Sustainability Reporting

The retailer and regulator wish to exchange sustainability information.

**Navigation path:** Regulation → Sustainability

Here they find **SDGIO** for sustainability reporting and **CEON** for circular economy concepts such as reusable and recyclable materials.

## 2.2 Outcome

Starting from the type of information they wish to exchange, organizations can follow the navigation paths in this guide to identify semantic resources that support interoperability across the supply chain.

2. **By Using Agroportal – Recommender – search relevant resources**

   **Copy a text describing the underlying activities or a list of variables in the recommender in Agroportal. It will then recommend semantic resources that can be used to describe relevant terms.** **VIDEO**

3. **Search terms or sections related to a term inside a resource on Agroportal.**

   **VIDEO**

## 2.3 What To Do With A Semantic Resource Once You've Picked One

*You are going to use the ontology as a reference—a dictionary—to help you name your data consistently.*

**Open the ontology file (it's probably in RDF, OWL, or JSON-LD format)**

- *You do not need to understand this file. You just need to find the 'terms' or 'classes' or 'instances' section. Those are the words the ontology recommends you use. You can do this in Agroportal or in Protégé* **VIDEO**

**Find the terms that matter to you**

- *For example, if you picked GS1 Web Vocabulary, look for terms like 'Product', 'Location', 'Batch', 'Certification'. Those are the words GS1 recommends you use when you name those things in your database.*

**Map your existing data to those terms**

- *Make a simple three-column table in Excel. Left column: what you currently call something (e.g., 'Lot Number'). Middle column: what the ontology calls it (e.g., 'batchNumber'), Right column: the address of the official description of the term. That is your mapping.*

**Use and share the mapping, not the ontology file directly**

### Example Mapping Table

The Variable column represents your field dataset
The Term column term represents the short version of the Web identifier using prefix
The URI column represents the full version of the Web identifier, that you could copy and paste on your web browser to have the documentation of the term

| Variable | Term | URI |
|---|---|---|
| Agent | foaf:Agent | http://xmlns.com/foaf/0.1/Agent |
| Batch | gs1:Lot | https://ref.gs1.org/cbv/Lot |
| Product | gs1:Product | https://gs1.org/voc/Product |
| Farm | agrovoc:Farm | http://aims.fao.org/aos/agrovoc/c_2824 |
| Factory | agro:ProcessingFacility | http://aims.fao.org/aos/agro#ProcessingFacility |
| Site | org:Site | http://www.w3.org/ns/org#Site |
| Address | schema:PostalAddress | https://schema.org/PostalAddress |
| Address (spatial representation) | geo:Feature | http://www.opengis.net/ont/geosparql#Feature |

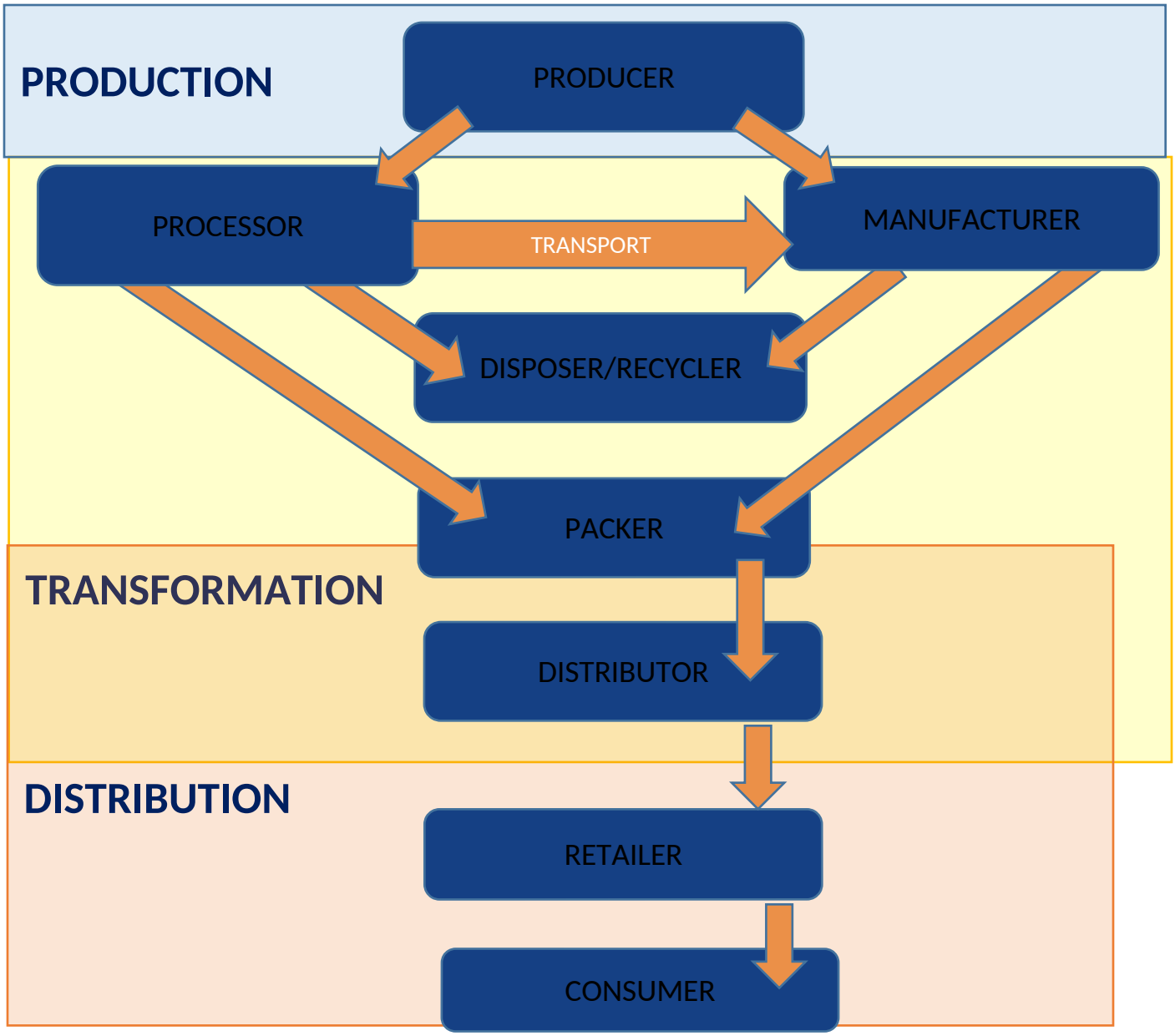
## 3. Navigation

***Click on your primary role in the food supply chain***

TRANSPORTER

REGULATOR

GENERAL SUPPLY CHAIN



# PRODUCTION

*What would you like to focus on ?*

**STANDARDISED NAMING**
**CROPS**
**ANIMAL**
**SEAFOOD**
**GENES**
**MICROBES**

*Useful Links*

**FOOD SAFETY**
**SUSTAINABILITY**
**SENSORS and IOT**

**Return to Diagram**

## STANDARDISED NAMING

Each resource is presented by:

Its name, a short description, the estimated maturity level, the estimated difficulty to adopt it into a system, the official web site and the web link to the resource which is usually on a semantic resource portal like AgroPortal or BioPortal.

- **AGROVOC**

A multilingual thesaurus covering agriculture, food, environment, and related domains.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **The Environment Ontology (ENVO)**

An ontology representing environmental systems, habitats, and ecological processes. ENVO reuses 17 ontologies (FoodOn, Chebi, etc.)

**Maturity**: Developing **Difficulty**: Low *Website* Resource

- **FoodOn**

An network of ontologies describing food products across the entire food chain.

**Maturity**: Developing **Difficulty**: Low *Website* Resource

- **The National Center for Biotechnology Information Taxonomy (NCBITAXON)**

An ontology representing the NCBI Taxonomy which contains the curated classification and naming system for all known organisms used in sequence database.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **TAXREF-LD**

A knowledge graph representing TAXREF, the French national taxonomical register for fauna, flora and fungus, that covers mainland France and overseas territories.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

**Return to Diagram**

## CROPS

- **Agronomy Ontology (AgrO)**

An ontology describing agronomic practices, techniques, and variables used in agronomic experiments. AgrO reuses CHEBI, ENVO, PATO, etc.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **BBCH-Based Plant Phenological Description Ontology (PPDO)**

An ontology defining the content of plant phenological scales, following BBCH organization. The ontology is used to create knowledge graphs that represent a set of aligned phenological scales per crop. For example, PPD-GV is a knowledge graph that contains 5 aligned phenological scales of grapevine.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Catalogue of Cultivated crops in France (GEVES) – Referential resource only**

A web site presenting the national catalogue of plant species and varieties used in agriculture.

**Maturity**: Mature **Difficulty**: Medium *Website*

- **CropOntology (CO)**

A network of ontologies defining phenotypic and genotypic traits. Each ontology is dedicated to a crop and specializes PO or TO. For example, the Resource link points to CO_321, the wheat ontology.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Crop Planning and Production Process Ontology (C3PO)**

A network of ontologies to describe crop planning and agricultural production processes in farm environment.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **EPPO Plant and pest Codes Ontology**

An ontology representing the content of EPPO Global database. EPPO database defines codes for plant pests, diseases, and related taxonomic classification.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Phenotype And Trait Ontology (PATO)**

An ontology describing phenotypic qualities and attributes across biological entities.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Plant Ontology (PO)**

An ontology defining plant anatomical entities and phenotypic traits.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Plant Stress Ontology (PSO)**

An ontology describing biotic and abiotic stresses that a plant may encounter. PSO reuse PO et TO.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Plant Trait Ontology (TO)**

An ontology defining a hierarchy of plant traits.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **ThesOlive**

A thesaurus for olive tree phenotypic traits. The thesaurus is not available on any platform.

**Maturity**: Mature **Difficulty**: Low *Website*

**Return to Diagram**

## ANIMALS

- **Animal Health Ontology for Livestock (AHOL)**

An ontology defining phenotypes of livestock.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Animal Trait Ontology for Livestock (ATOL)**

An ontology defining animal traits.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Uberon Multi-species Anatomy Ontology (Uberon)**

An ontology defining anotomical part of animals.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Vertebrate Breed Ontology (VBO)**

An ontology defining vertebrate animal breed names.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

## SEAFOOD

- **Aquatic Food Ontology (AQFO)**

An ontology defining small scale fisheries and aquaculture entities.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **MarineTLO**

An ontology defining generic and specific entities in the marine and environmental domains.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

## GENES

- **Gene Ontology (GO)**

An ontology describing the functions of gene products from all organisms.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

- **Sequence Types and Features Ontology( SO)**

An ontology defining sequence features used in biological and genomic annotation.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

## MICROBES

- **MYCOBANK Database - Referential resource only**

A database accessible on the Web documenting fungal taxonomy and nomenclature.

**Maturity**: Mature **Difficulty**: Medium *Website*

- **The National Center for Biotechnology Information Taxonomy (NCBITAXON)**

An ontology representing the NCBI Taxonomy which contains the curated classification and naming system for all known organisms used in sequence database.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

**Return to Diagram**

## TRANSFORMATION

*What would you like to focus on ?*

**STANDARDISED NAMING**
**PROCESSING**
**SENSORS and IOT**
**FOOD SAFETY**
**SUSTAINABILITY**
**NUTRITION**

**Return to Diagram**

## PROCESSING

- **Food Classification and Description System (from FSA Food Type identifiers) (FOODEX2)**

A thesaurus which multiple facets describes food items and their process transformation. FOODEX2 organizes food items in a hierarchy of food categories.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

- **FoodOn**

An network of ontologies describing food products across the entire food chain.

**Maturity**: Developing **Difficulty**: Low *Website* Resource

- **Chemical Entities of Biological Interest (ChEBI)**

An ontology describing chemical entities and their relationships in biological systems.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

- **Process and Observation Ontology (PO2)**

An ontology defining transformation processes and their associated observations.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **TransformOn**

An ontology defining food and bioproduct processing and characterization. The ontology is a specialization of the PO2 ontology.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

## SENSORS and IOT

- **Semantic Sensor Network Ontology / Sensor, Observation, Sample and Actuator Ontology (SSN/SOSA)**

A modular ontology describing sensors, observations, measurements, and samples. This ontology has evolved over time and is still in development. Several versions are available. SSN was a first version. SSN/SOSA is a new version with sample and actuator entities.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

- **Smart Applications REFerence ontology (SAREF)**

An ontology describing sensor devices and their measurements. This ontology has evolved over time with several versions. This ontology is specialized by domain.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **SAREF4AGRI**

An ontology specializing SAREF for agriculture and food chain domain.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

**Return to Diagram**

## DISTRIBUTION

*What would you like to focus on ?*

**STANDARDISED NAMING**
**SENSORS**
**TRANSPORTATION**
**CUSTOMS**
**SUSTAINABILITY**
**FOOD SAFETY**

**Return to Diagram**

## TRANSPORTATION

- **European Union Agency for Railways Vocabulary (ERA Vocabulary)**

A network of ontologies and thesaurus describing European railway infrastructure, operations, and rolling stock.

**Maturity**: Mature **Difficulty**: Medium *Website* Resource

- **Geoname – Referential resource**

A multilingual geographic database covering all countries, and containing their placenames.

**Maturity**: Mature **Difficulty**: Low *Website*

- **GeoSPARQL**

An ontology describing geospatial entities and their geographic representations.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Wikidata**

A multilingual knowledge graph gathering information from diverse sources. For example, the resource link points to the presentation of Paris City with its wikidata identifier Q90.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

## CUSTOMS

- **FEDeRATED**

A network of ontologies describing cross-border logistics and regulatory data exchange.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **GS1 Web vocabulary (GS1)**

A network of ontologies extended Schema.org. GS1 describes products, locations, assets and more.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Schema.org**

A network of ontologies for generic purposes. Schema.org contains an ontology of products, offers, places, organizations and so on. The resource link points to the product ontology.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

**Return to Diagram**

## REGULATION

*What would you like to focus on?*

**STANDARDISED NAMING**
SENSORS
FOOD SAFETY
SUSTAINABILITY
NUTRITION
CUSTOMS

**Return to Diagram**

## FOOD SAFETY

- **Food Matrix for Predictive Microbiology (FMPM)**

An ontology defining food items and culture mediums.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Food Safety Ontology (FSO)**

An ontology describing the measurements and analysis made for food safety experiments.

**Maturity**: Incomplete **Difficulty**: Low *Website* Resource

## SUSTAINABILITY

- **AGROVOC**

The multilingual thesaurus contains the 17 Sustainable Development Goals (SDG). The resource link points to the list of SDG.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **Circular Economy Ontology Network (CEON)**

A network of ontologies describing circular economy systems and processes.

**Maturity**: Developing **Difficulty**: Medium *Website* Resource

- **Sustainable Development Goals Interface Ontology (SDGIO)**

An ontology describing the Sustainable Development Goals, their targets, and indicators.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

## NUTRITION

- **Ontology for Nutritional Studies (ONS)**

An ontology describing nutritional studies.

**Maturity**: Developing **Difficulty**: Low *Website* Resource

- **FoodKG**

A knowledge graph and its ontology describing recipes, nutrients, food recommendations and dietary guidance. FoodKG reuse FoodOn.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Compositional Dietry Nutrition Ontology (CDNO)**

An ontology describing nutritional composition and dietary components of food. CDNO reuse FOODON.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

**Return to Diagram**

Return to Diagram

## CONSUMERS

**STANDARDISED NAMING**
FOOD SAFETY
SUSTAINABILITY
NUTRITION

Return to Diagram

## GENERAL SUPPLY CHAIN

All resources recommended to all supply chain actors are mature and easy to integrate

- The Friend of a Friend (FOAF)

Describes people, their attributes, and social relationships on the Web.

- Good Relations

Models e-commerce data such as products, prices, and business offerings.

- The Organization Ontology

Represents organizational structures, roles, and relationships between organizations and people.

- Time Ontology

Models temporal concepts such as time intervals, instants, and durations.

- Provenance (Prov-O)

Represents provenance information about entities, activities, and agents.

- Relations Ontology (RO) – OBO Foundry

Provides standardized relationships for linking concepts across ontologies.

- Global Traceability Standard (GS1 Web Vocabulary)

Standardizes structured product and supply chain data for web publication.

- Traceability Vocabulary (TRO)

Enables representation of verifiable traceability and supply chain credentials.

- Circular Economy Ontology Network (CEON)

Provides a modular vocabulary for representing circular economy systems and processes.

Continues on next page

**Return to Diagram**

## GENERAL SUPPLY CHAIN

- Ontology of Units of Measure (OM)

Defines units, quantities, and relationships between measurement systems for scientific and technical data.

- Quantities, Units, Dimentions and Data Types (QUDT)

  Provides a comprehensive model for quantities, units, dimensions, and data types used in scientific and engineering data.

**Return to Diagram**

Some ontologies were approved by W3C. The website link points to the W3C working group when possible.

- **Circular Economy Ontology Network (CEON)**

A network of ontologies describing circular economy systems and processes.

**Maturity**: Developing **Difficulty**: Medium *Website* Resource

- **The Friend Of A Friend (FOAF)**

An ontology describing people and social relationships. This ontology is approved by W3C.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **GoodRelations**

An ontology describing products sold online. GoodRelations ontology extends schema.org and reuse FOAF. This ontology is approved by W3C.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **GS1 Web vocabulary (GS1)**

A network of ontologies extended Schema.org. GS1 describes products, locations, assets and more.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **OBO Relation Ontology (RO)**

An ontology describing the different relations between entities that could be reuses in various ontologies, like part of, regulates, binds, and so one.

**Maturity:** Mature **Difficulty:** High *Website* Resource

- **Ontology of Units of Measure (OM)**

An ontology describing units.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **The Organization Ontology**

An ontology describing the structuration of organizations. This ontology reuse FOAF. This ontology is approved by W3C.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **Traceability Vocabulary (TRO)**

The W3C is working on a new specification of traceability vocabulary.

**Maturity:** In construction **Difficulty:** to determine *Website*

- **Provenance Ontology (PROV)**

An ontology describing the activities and agents that create or modify entities. This ontology is approved by W3C.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **Quantity, Unit, Dimension and Type (QUDT)**

An network of ontologies and vocabularies describing units and quantity dimension. The resource link points to the Unit vocabulary.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **OBO Relation Ontology (RO)**

An ontology describing the activities and agents that create or modify entities.

**Maturity:** Mature **Difficulty:** Low *Website* Resource

- **Schema.org**

A network of ontologies for generic purposes. Schema.org contains an ontology of products, offers, places, organizations and so on. The resource link points to the product ontology.

**Maturity**: Mature **Difficulty**: Low *Website* Resource

- **Time Ontology**

An ontology describing temporal entities and their relationships. This ontology is approved by W3C.

**Maturity:** Mature **Difficulty:** Low *Website* Resource