



Good Practice Workshop 20-21 October 2021



DEMETER

Data Driven Innovation in the Agrifood sector

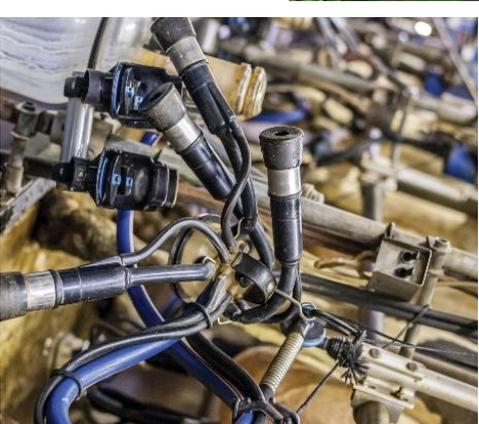
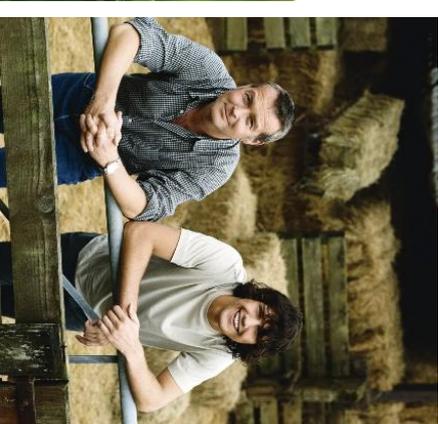
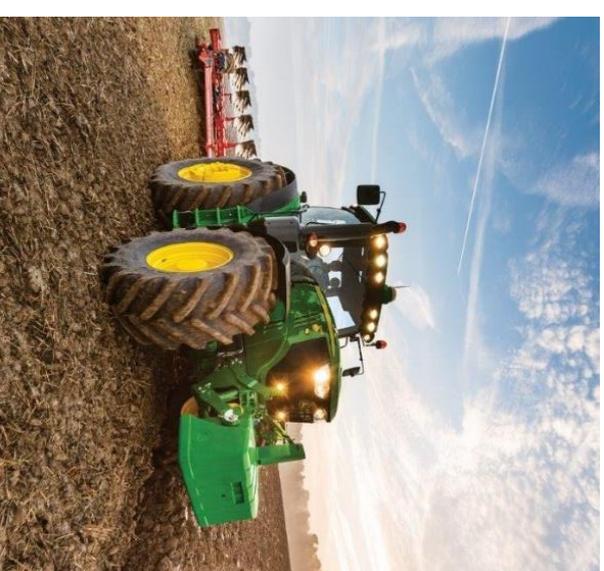


Dr. Ioanna Roussaki

Assist. Professor (National Technical University of Athens, GREECE)
Institute of Communications & Computer Systems (ICCS)



Horizon 2020
European Union Funding
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Outline

- DEMETER Signature
- DEMETER concepts, objectives and pilots
- DEMETER Agricultural Information Model (AIM)



Sectorial Challenges

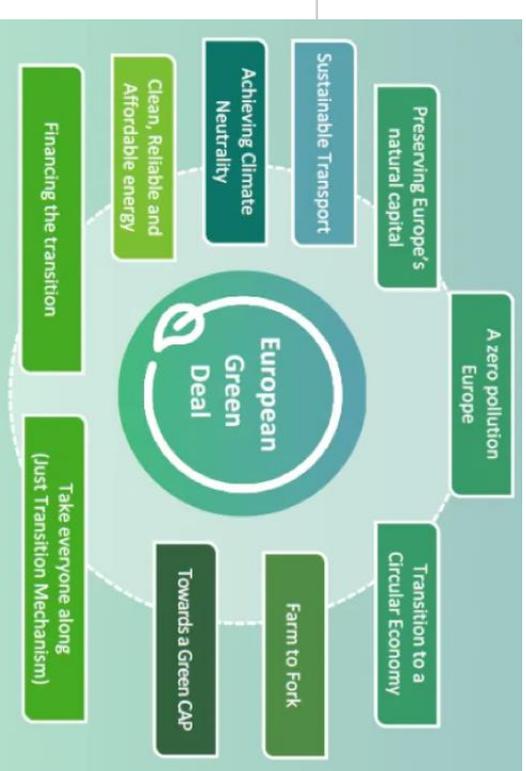
Digitalisation brings opportunities to the EU farming sector and rural areas...

... but there are limiting factors and bottlenecks to overcome

- Infrastructure / connectivity / broadband
- Farmers' awareness about benefits
- Farmers' skills
- Standardisation/interoperability of systems
- Data ownership
- Financing investments

...and potential risks to consider

- Digital divide
- Data ownership
- Increased concentration in the agri-food chain
- Uncertain impact on jobs
- Socio-economic impact overall

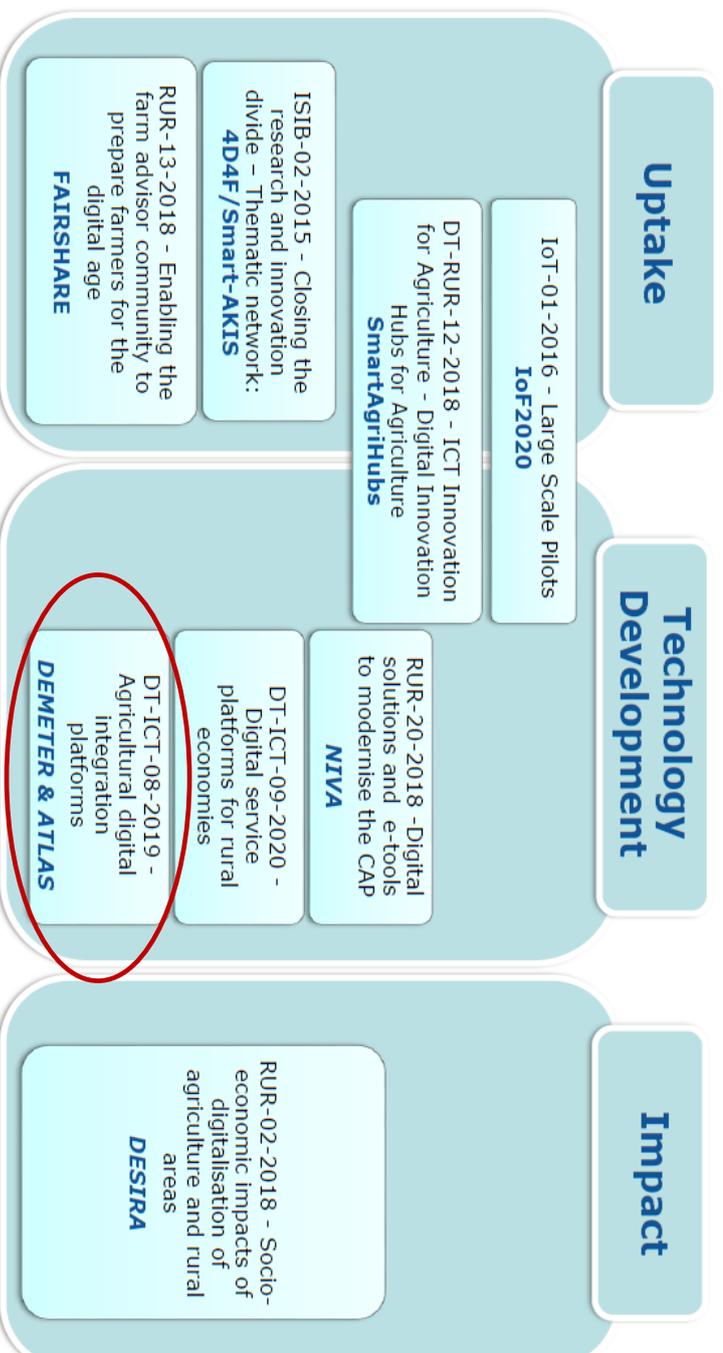




EU R&I Addressing Challenges

Research & Innovation

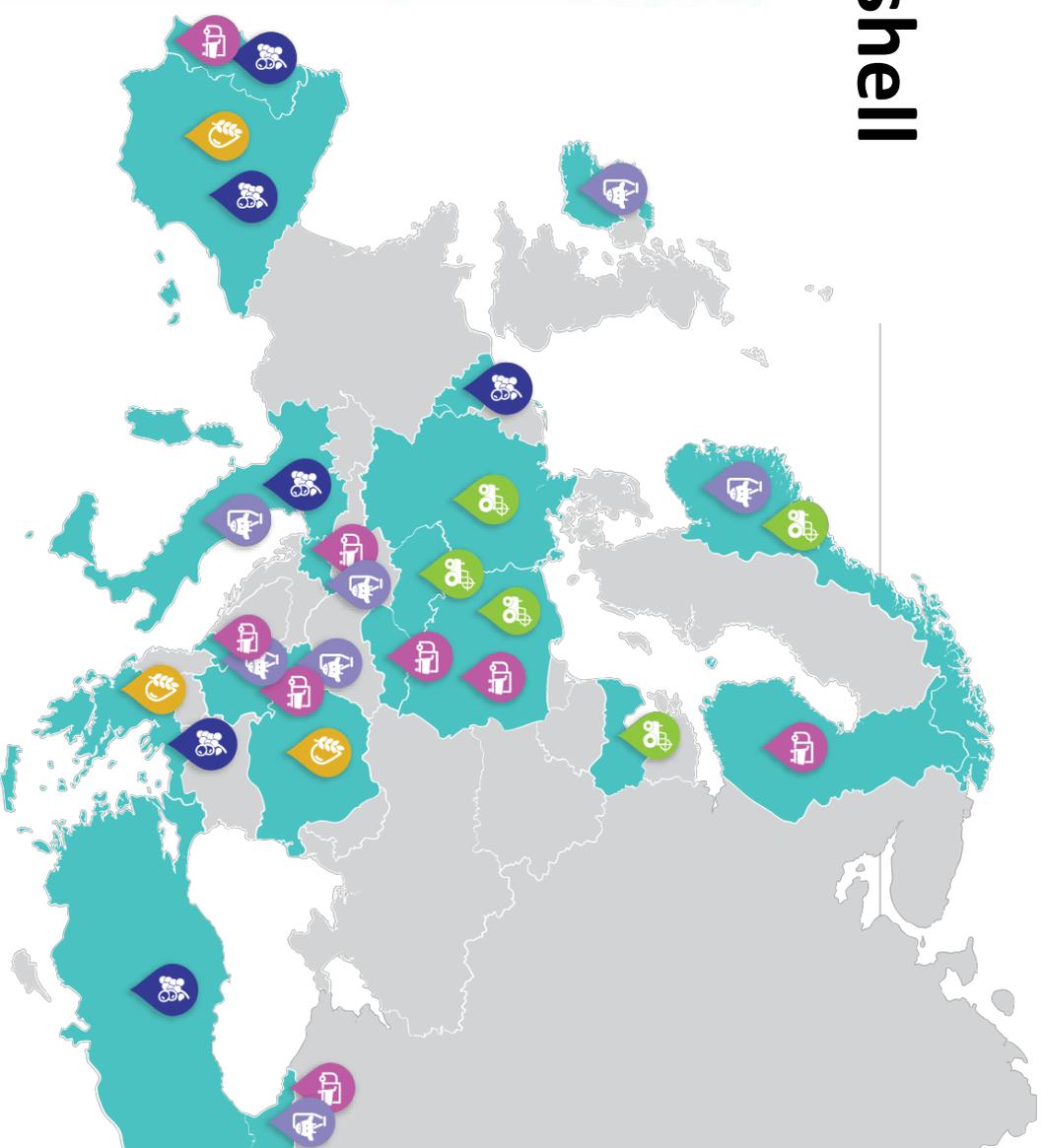
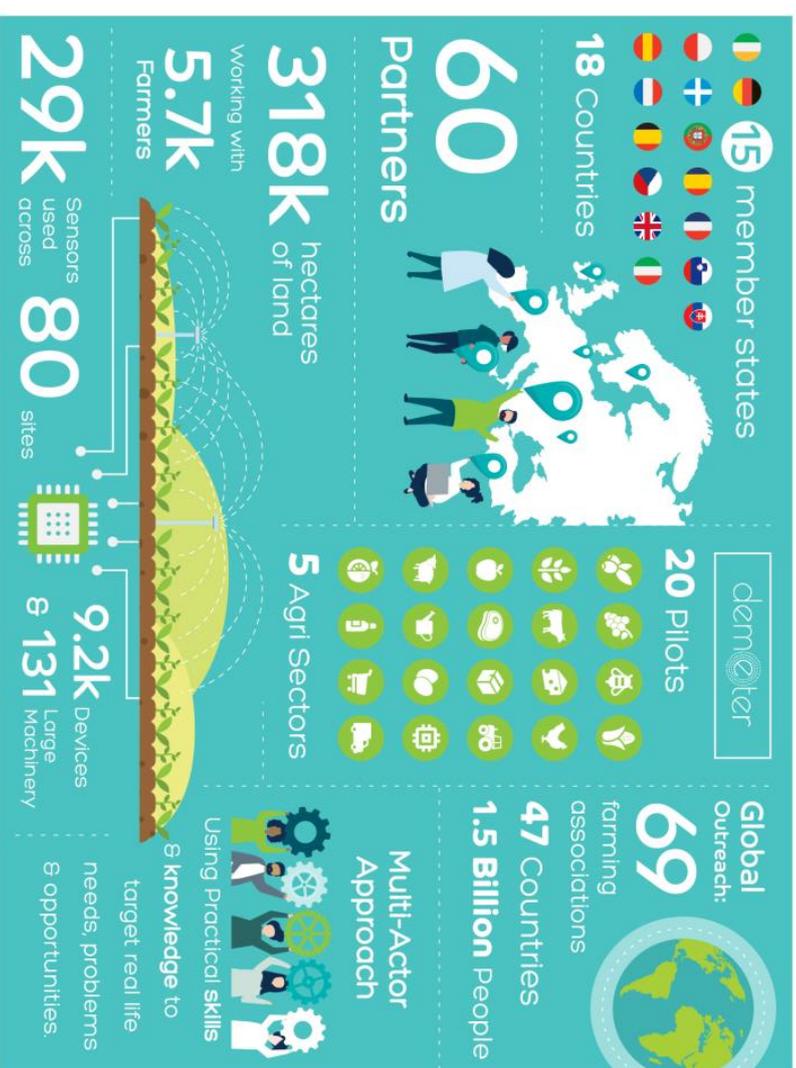
H2020 WP 2018-2020 Topics: Digital transformation in agriculture and rural areas



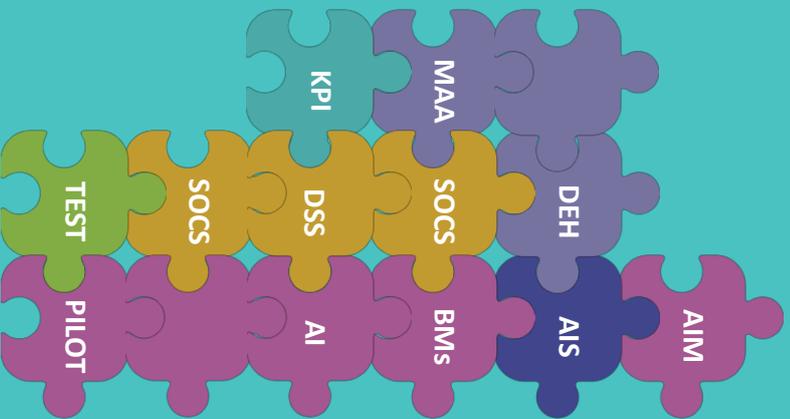
Other SFS topic supporting the Focus Area "Digitising and transforming EU industry and services:
DT-SFS-14-2018: Personal nutrition, DT-SFS-26-2019: Food cloud demonstrator



DEMETER - In a nutshell



DEMETER Objectives and Assets



Objective 1: Adopt and enhance existing **Information Models** in the agri-food sector easing **data sharing and interoperability** across multiple IoT systems and FMIS and associated technologies

Objective 2: Deliver an **Interoperability Space** for the agri-food domain and using a core set of **open standards** coupled with **security and privacy** protection mechanisms

Objective 3: Empower the **farmer to gain control in the data-food-chain** by identifying a series of new IoT-based, data-driven, business models

Objective 4: Establish a **benchmarking mechanism** for agriculture solutions, targeting end-goals in terms of productivity and sustainability performance

Objective 5: **Reverse the relationship with suppliers**, where suppliers are responsible for ensuring that a final solution is **optimal** to the farmer's needs

Objective 6: **Demonstrate the impact of digital innovations** across a variety of sectors and at European level





Pilots Overview



Sector: Arable Crops

Focus: Water & Energy Management

- Water savings in irrigated crops
- Smart energy management in irrigated & arable crops
- Optimal Quality Rice Irrigation IoT Corn Management & Decision Support Platform



Sector: Arable Crops

Focus: Agricultural Machinery Precision Farming

- In-Service Condition Monitoring of Agricultural Machinery
- Automated documentation of arable crop farming processes (farming)Data Brokerage Service and Decision Support System for Farm Management
- Benchmarking at Farm Level Decision Support System



Sector: Fruit & Vegetables

Focus: Health and high-quality crops

- Decision Support System to support olive growers
- Precision Farming for Mediterranean Woody Crops
- Pest Management Control on Fruit Fly
- Open platform for improved crop monitoring in potato farms



Sector: Livestock

Focus: Animal Health, High Quality

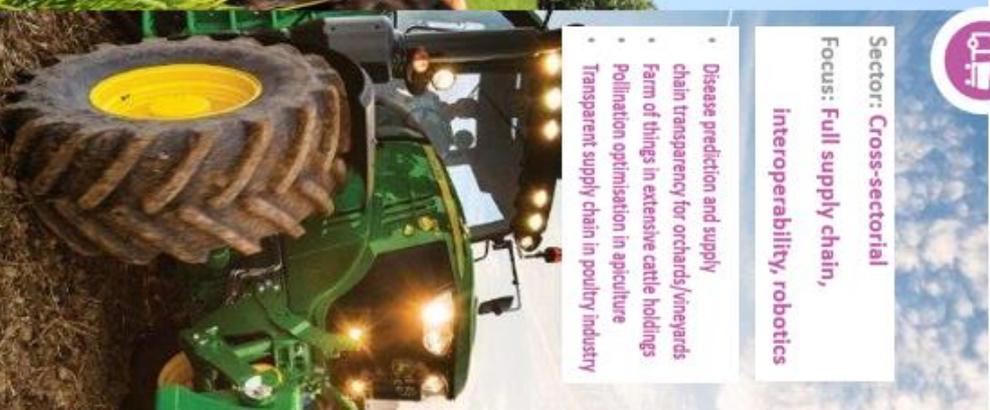
- Dairy Farmers Dashboard for the entire milk and meat production value chain
- Consumer awareness: Milk quality and animal welfare tracking
- Proactive milk quality control
- Optimal chicken farm management



Sector: Cross-sectorial

Focus: Full supply chain, Interoperability, robotics

- Disease prediction and supply chain transparency for orchards/vineyards
- Farm of things in extensive cattle holdings
- Pollination optimisation in agriculture
- Transparent supply chain in poultry industry



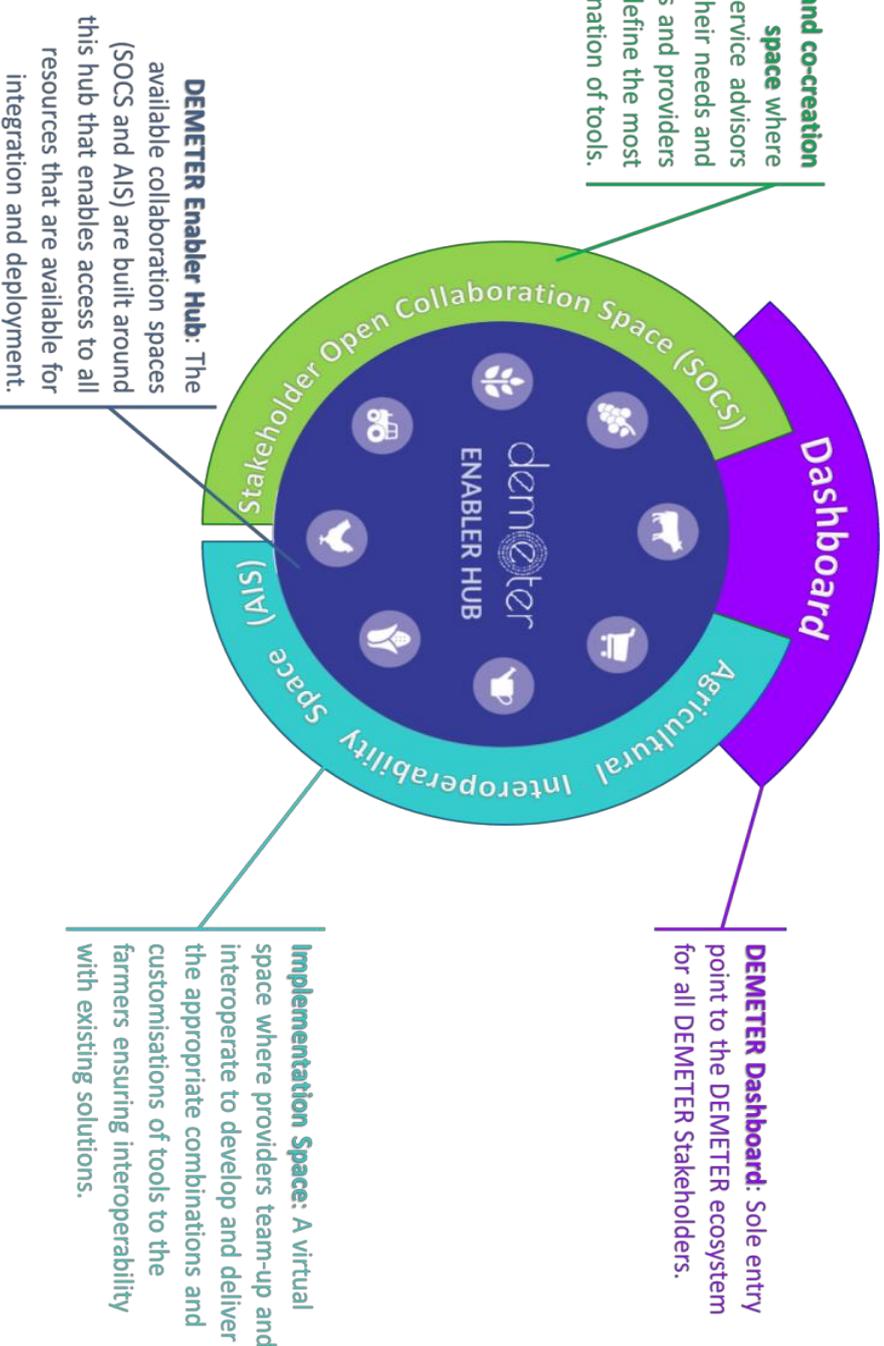


The DEMETER Approach

Knowledge sharing and co-creation space where

- Farmers/service advisors express their needs and
- Service advisors and providers team-up to define the most appropriate combination of tools.

- DEMETER MAA
- Co-creation of needs
 - Co-generation of solutions
 - Co-shared responsibility for efficient deployment
 - Co-organise support for optimal adoption





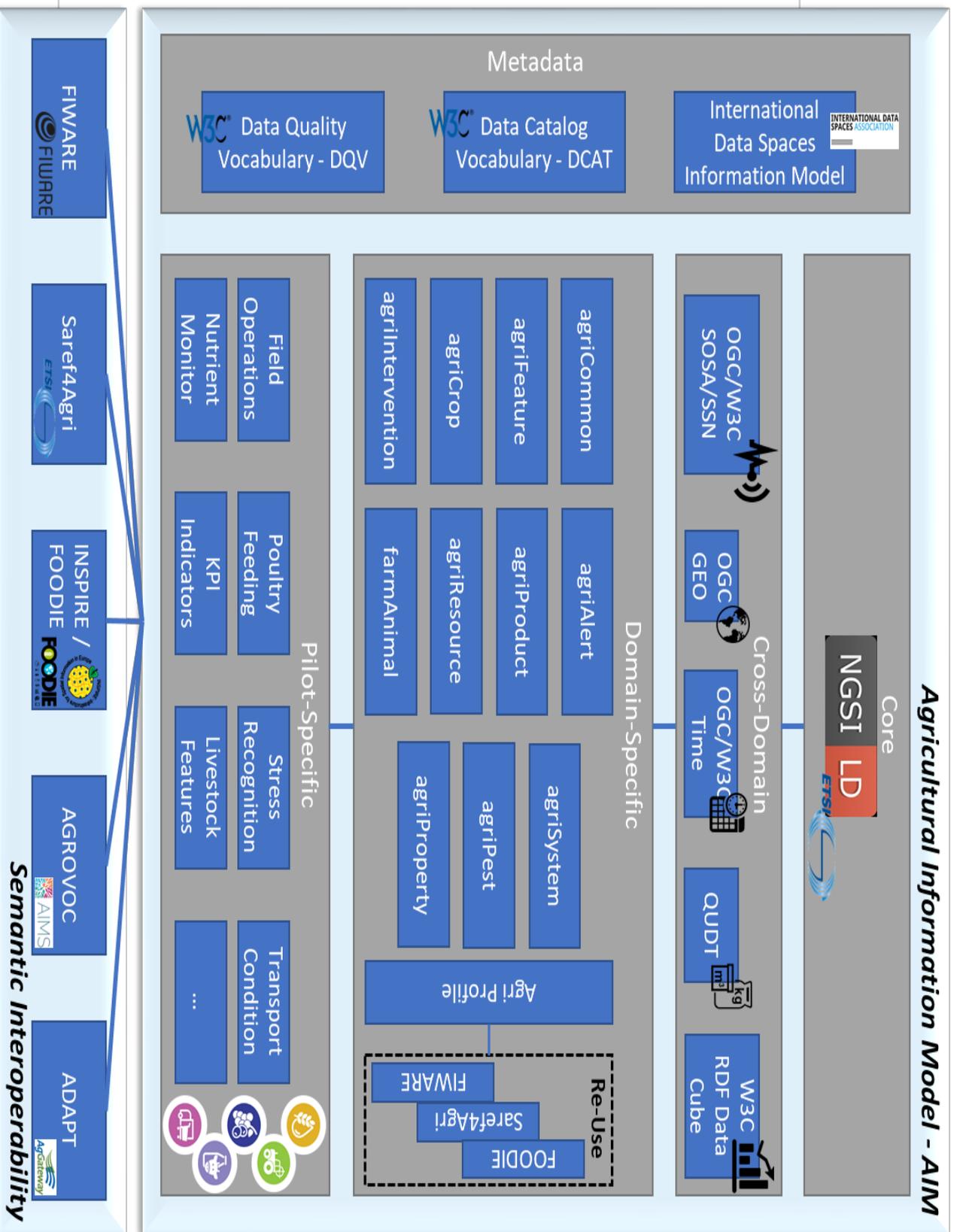
DEMETER's response to data interop challenges: Agricultural Information Model (AIM)

AIM consists of 5 main parts:

- Core meta-model
- Cross-Domain ontology
- Domain-Specific ontologies
- Pilot-Specific ontologies
- Metadata Schema



Layers of the DEMETER Agricultural Information Model (AIM)





Types of data represented via AIM (I)

AIM represents a wide variety of data types that are generic or are specific to the agrifood domain, such as the following:

- **Farm data** (e.g., field data, field status, soil data, Crops/treatment/fertilisation data, farm input data, energy consumption data, ...)
- **Earth Observation Data** (e.g., satellite data, remote sensing imagery, soil maps, vegetation indices, such as NDVI, EVI, NDRE, NDMI)
- **Meteorological data** (e.g., temperature, humidity, wind speed/direction, solar radiation, pressure, etc.)

cont. →



Types of data represented via AIM (II)

cont. →

- **Agricultural machinery data** (e.g., engine data, fuel consumption, emissions, exhaust gas, NOx-conversion, exhaust temperatures, ...)
- Representation of **data quality metrics**
- **Field Operations data** (irrigation, fertilisation, soil tillage)
- **Livestock data**
- **Traceability data** (transport)
- **Financial farm data, benchmarking data and KPIs**
- **Farmer information**

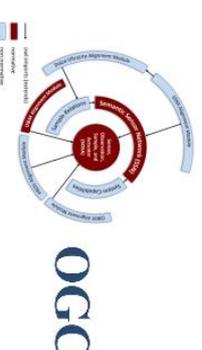


Semantic Interoperability via AIM

AIM provides the basis to enable a semantic interoperability data space: it defines the data elements (concepts, properties and relations) relevant to agri applications, including the semantics associated to the information exchanged.

AIM establishes (semantic) mappings to various standards/ontologies:

- FIWARE (NGSI-LD)
- ETSI (Saref4Agri)
- EU initiatives (INSPIRE, FOODIE)
- FAO AIMS (AGROVOC)
- OGC (EO standards)
- ISO standards
- QUDT (Units Ontology)
- Other dominant solutions (ADAPT)





Next Steps and Future Plans for AIM

- Further extension of AIM with regards to:
 - traceability concepts (drawing from **UN ecrop**, **GS1 EPCIS** and **FOODON**)
 - integration of some further **ISOBUS** concepts as needed
 - Interact with GALIA-X and ensure AIM compliance
 - Impact the Common Agri Data Spaces initiative of EC
- Carry on the extension of AIM with **additional semantic mappings** and adding concepts to address final pilot needs (continuous work), e.g. adding additional vegetation indices in the AIM concepts/vocabulary as needed by pilots
- The final version of the DEMETER Common Data Models and Semantic Interoperability Mechanisms will be presented in **Deliverable 2.5** to be delivered in October 2022.

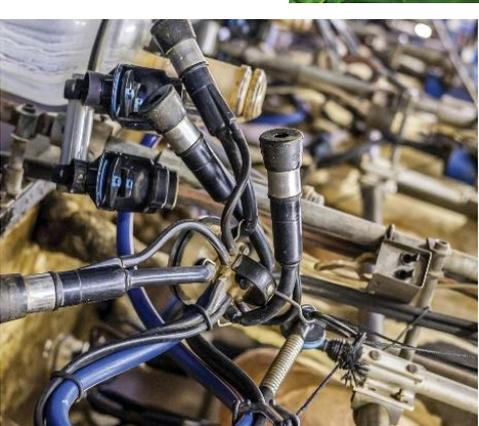
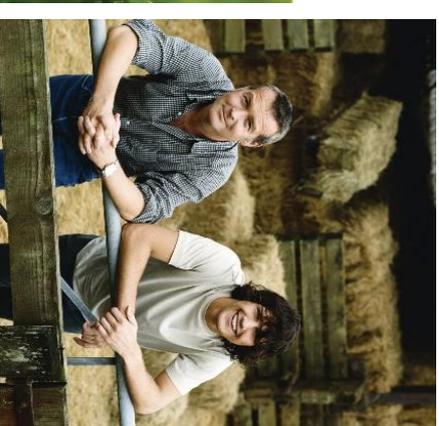
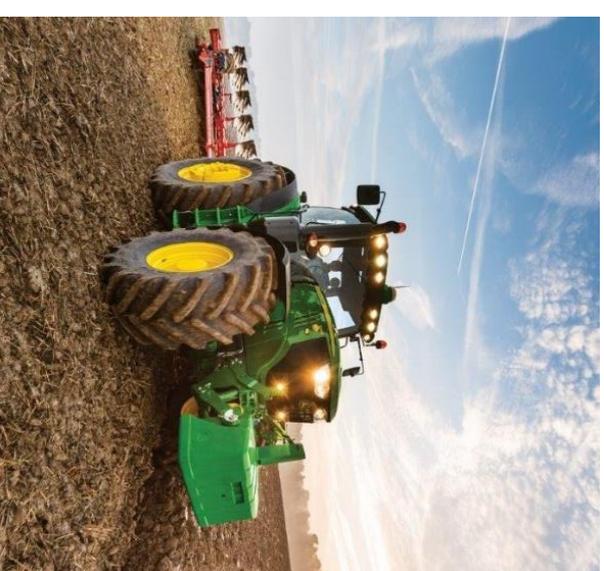


For more information visit:

www.h2020-demeter.eu

or Email us at :

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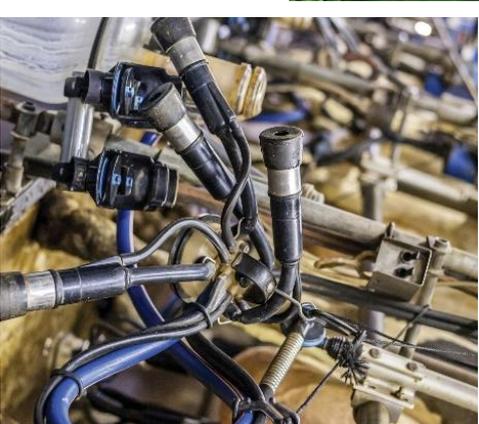
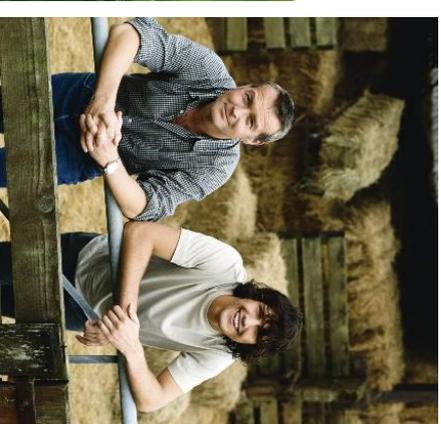
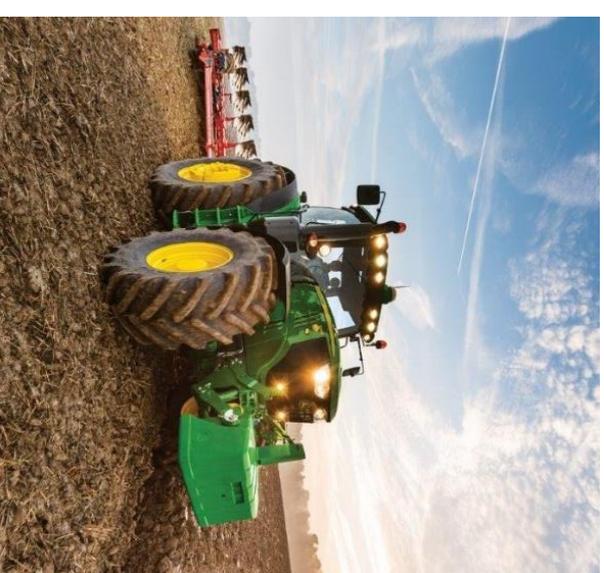


Dr. Raul Palma

Head of Data Analytics and Semantics Department
(Poznan Supercomputing and Networking Center – PSNC)

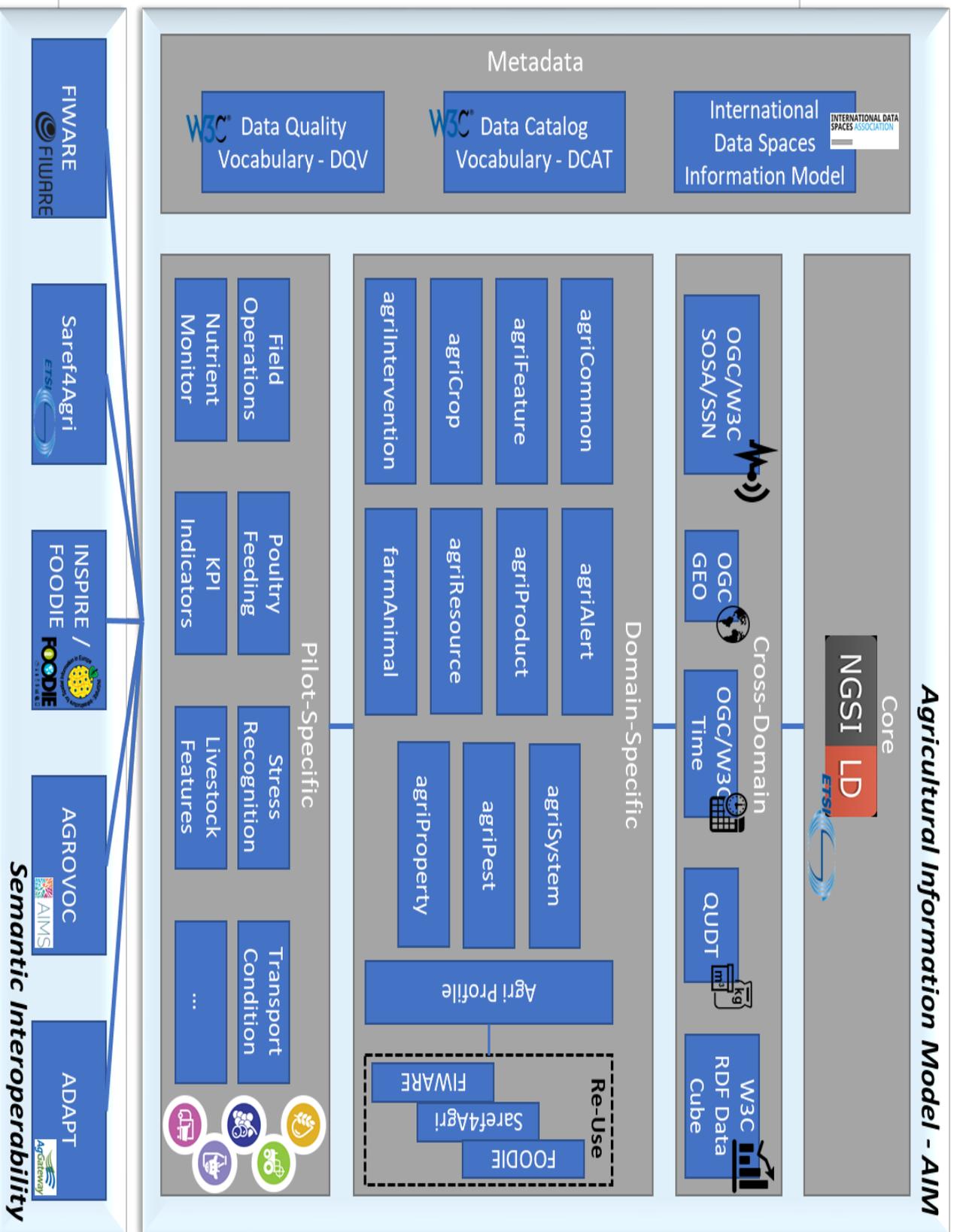


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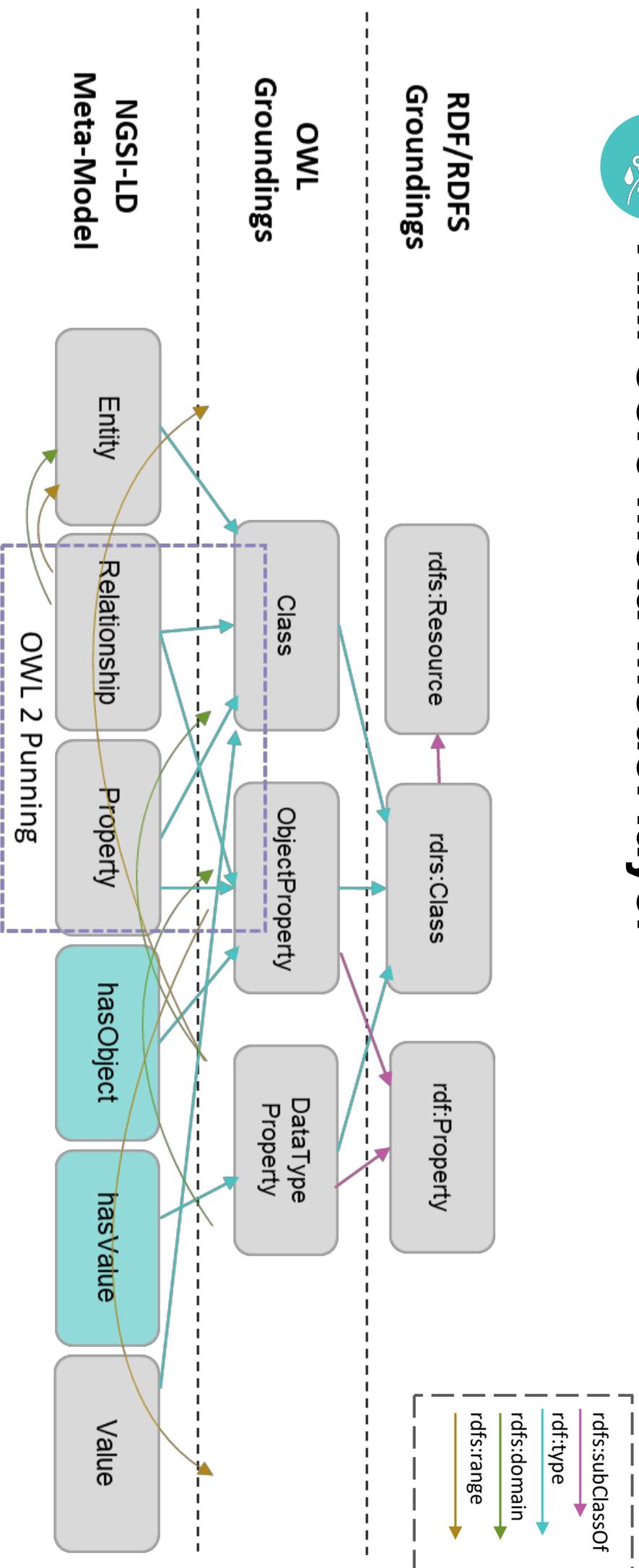


Layers of the DEMETER Agricultural Information Model (AIM)

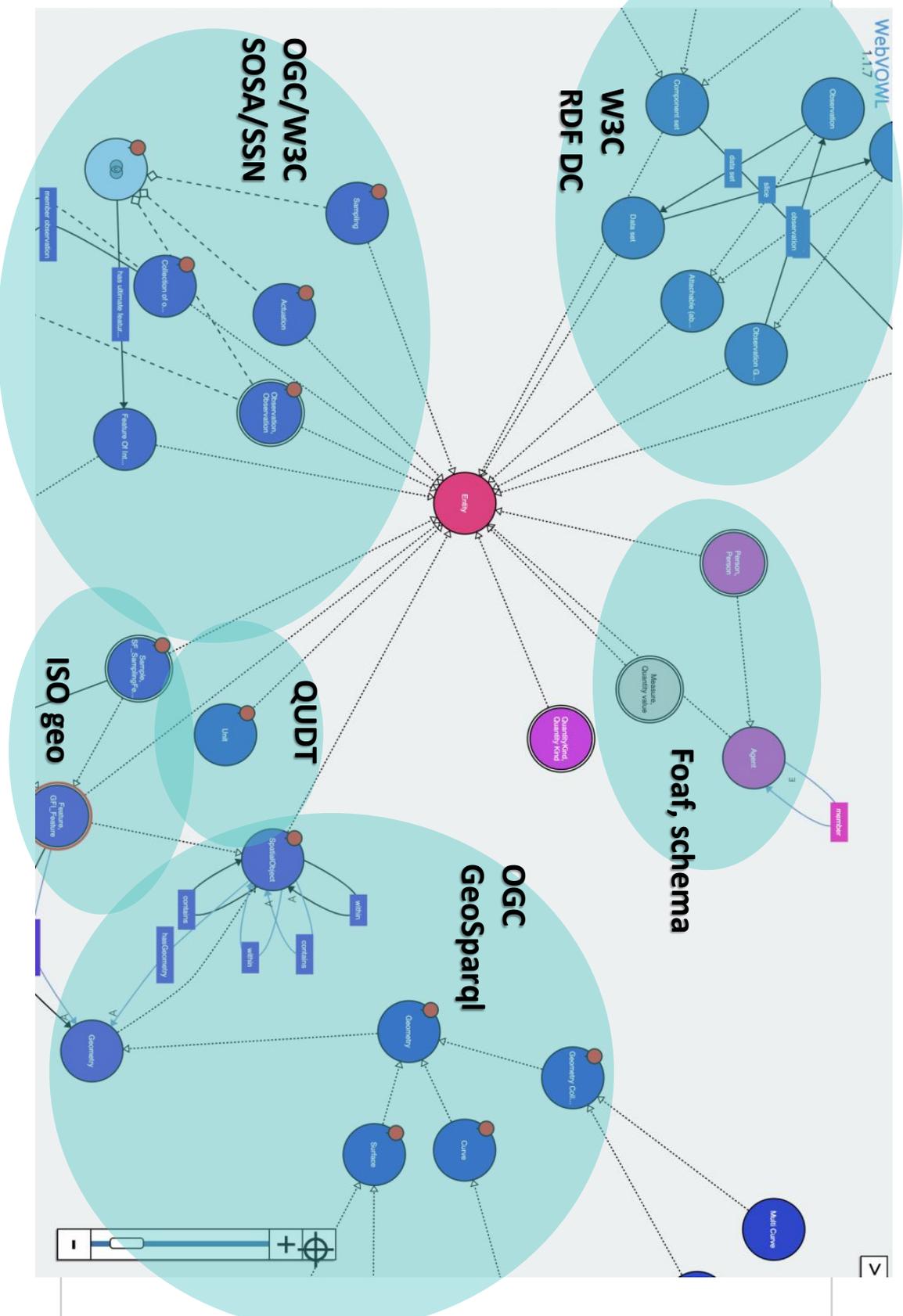




AIM Core meta-model layer



AIM Cross-Domain Ontology overview



DEMETER Cross-Domain

<https://w3id.org/demeter/crossDomain>

Version: 1.0

Author(s): :genid3603098

Language: **en**

Description

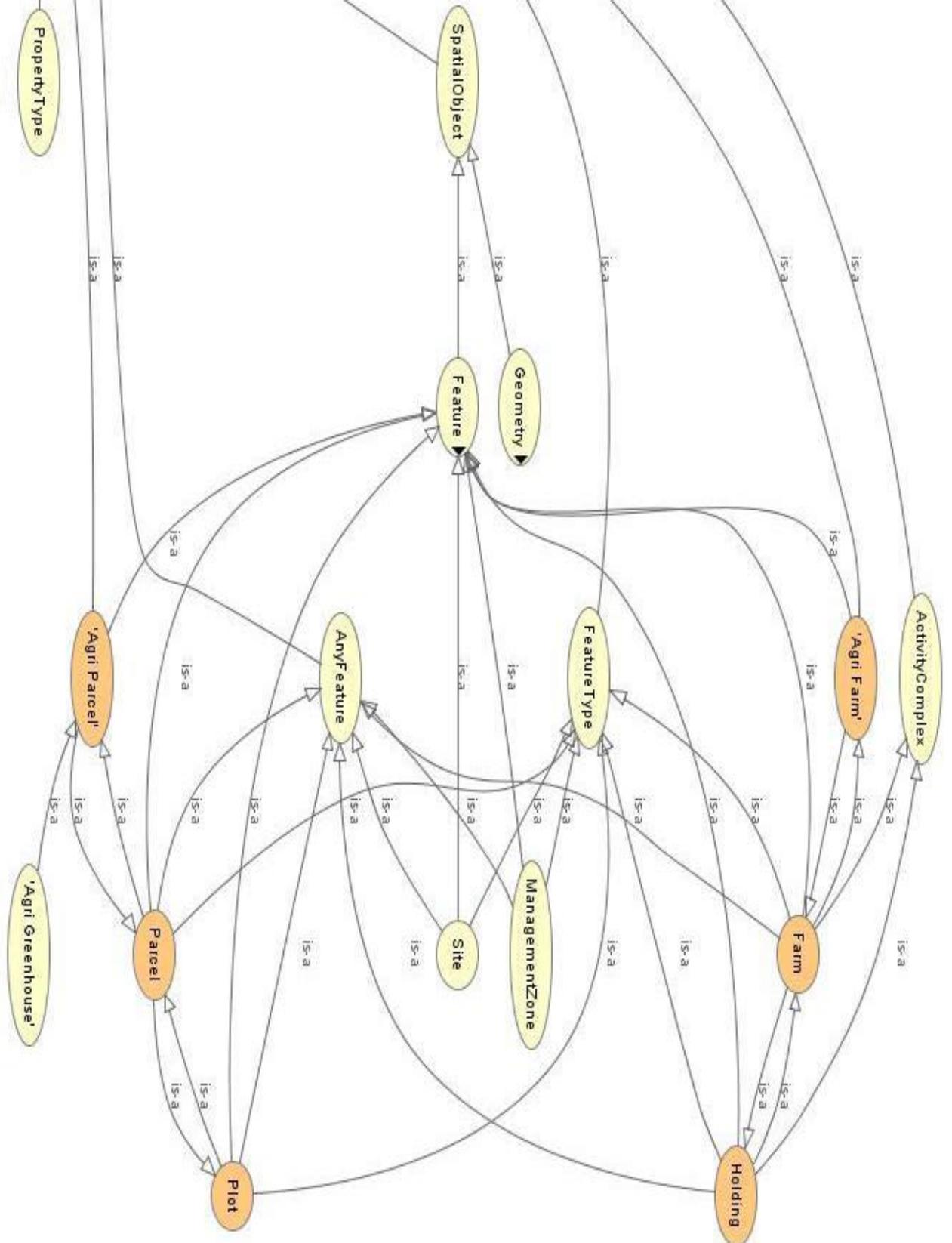
The DEMETER cross domain ontology 1) defines concepts and terms that are generic and applicable to various domains; ii) avoids conflicting or redundant definitions of the same concept in different domain specific models; iii) provides the basis for interoperability. The ontology is specified by reusing concepts and terms from a number of standard ontologies and vocabularies including OGC/W3C SOSA/SSN, OGC Geosparql, W3C RDF data cube, QUDT, FOAF, schema.org and others. It includes alignment to ISO standards and with DEMETER core meta-model (NGSI-LD).

Metadata

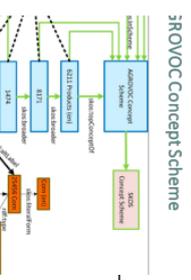
Statistics

Selection Details

Name: *Observation*
Type: *owl:equivalentClass*
Equiv.: *Observation*
Charac.: *external, equivalent*
Comment: *If values are not provided for the following Observation properties, they may be provided by the ObservationCollection of which it is a member - hasFeatureOfInterest - hasUltimateFeatureOfInterest - madeBySensor - observedProperty - phenomenonTime - resultTime - usedProcedure*



agriCommon	
Agent	
Person	
Farmer	
code	
description	
createdAt	
hasTimestamp	



agriSystem	
Actuator	
Platform	
Sensor	
In deployment	

agriPest	
hasAgriProductType	
name	
description	

agriFeature	
Farm	
Parcel	
Site	
Building	
Geometry	
area	
has serialization	

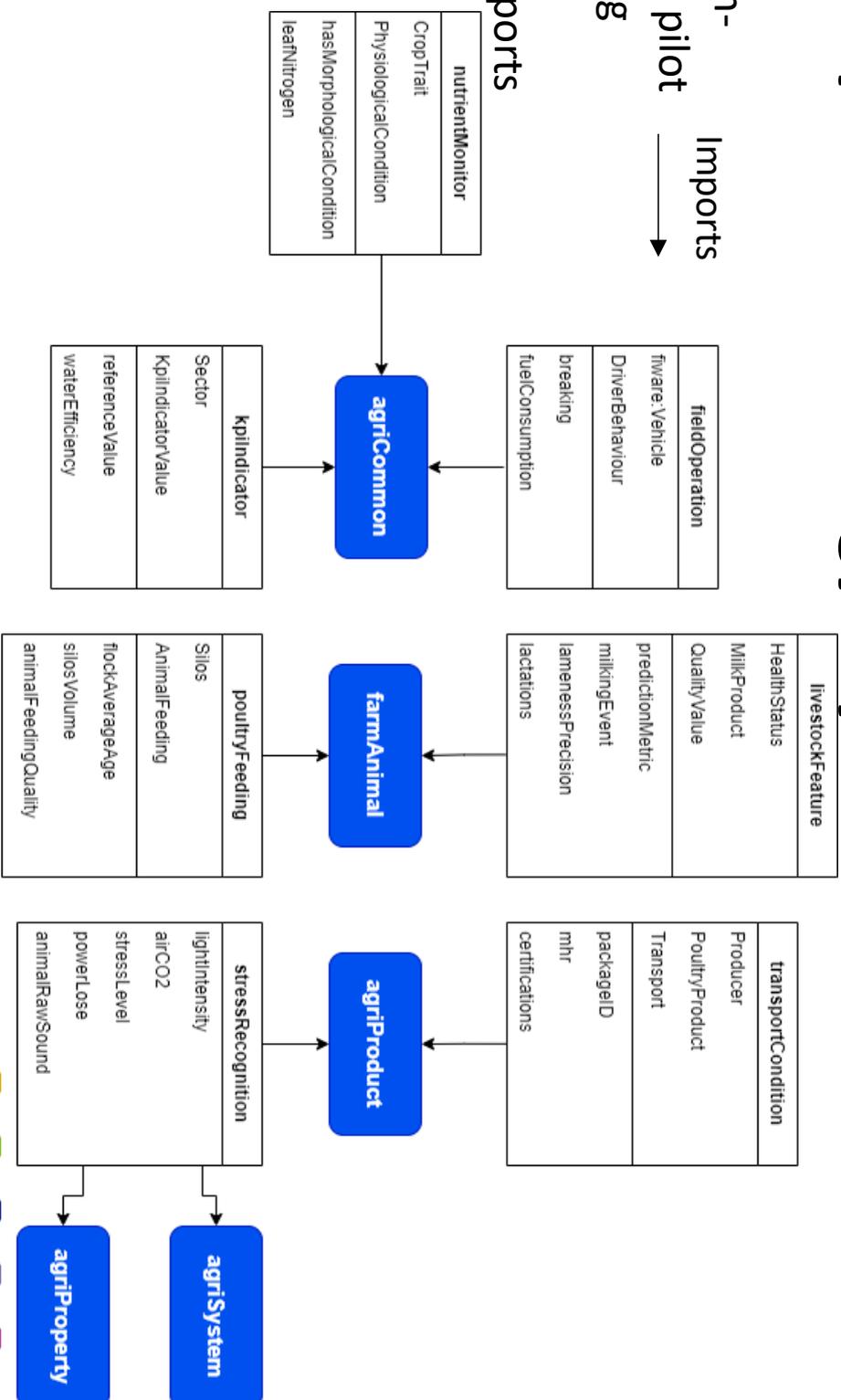


AIM Pilot-Specific Ontology Layer

Designed to extend the domain-specific layer towards covering pilot specific needs and/or extending coverage of AIM.

Each pilot-specific ontology imports at least one domain module (and thus cross-domain)

- fieldOperation
- kpilIndicator
- livestockFeature
- nutrientMonitor
- poultryFeeding
- stressRecognition
- transportCondition



DEMETER Agriculture Information Model

Last uploaded: April 14, 2021

- Summary
- Classes
- Properties
- Notes
- Mappings
- Widgets

Details

Acronym	DEMETER-AIM
Visibility	Public
Description	The DEMETER Agri Profile is a master profile importing focused specific profiles/modules of DEMETER AIM.
Status	Beta
Format	OWL
Contact	Raul Palma, rpalma@man.poznan.pl Ioanna Roussaki, ioanna.roussaki@cn.ntua.gr
Categories	Farms and Farming Systems

Additional Metadata

URI	https://w3id.org/demeter/agri
Deprecated	false
Endorsed By	
Endpoint	



Links

Go to the REST API JSON entry

Get my metadata back

- N-Triple
- Json-LD
- RDF/XML

Metrics ?

Classes	180
Individuals	137
Properties	286
Maximum Depth	6
Maximum Number Of Children	45
Average Number Of Children	7
Classes With A Single Child	14



[System Home](#) | [Models](#) | [Search](#) | [SPARQL](#) | [About the System](#)

DEMETER AIM

URI

<https://w3id.org/demeter/agri/agriCrop>

Description

Agriculture Information Model managed on behalf of DEMETER project

Members

- <https://w3id.org/demeter/agri>
- <https://w3id.org/demeter/agri/agriAlert>
- <https://w3id.org/demeter/agri/agriCommon>
- <https://w3id.org/demeter/agri/agriCrop>
- <https://w3id.org/demeter/agri/agriFeature>
- <https://w3id.org/demeter/agri/agriIntervention>
- <https://w3id.org/demeter/agri/agriPest>
- <https://w3id.org/demeter/agri/agriProduct>
- <https://w3id.org/demeter/agri/agriProperty>
- <https://w3id.org/demeter/agri/agriSystem>
- <https://w3id.org/demeter/agri/farmAnimal>

Alternates Profiles

Different views of and formats:

[Alternate Profiles ?](#) ...

Filter

[Filter ?](#) ...

[Clear](#)



AIM available in the OGC server





For more information visit:

www.h2020-demeter.eu

or Email us at :

info@h2020-demeter.eu

