DEMETER
Data Driven Innovation in the Agrifood sector

Dr. Ioanna Roussaki
Assoc. Professor (National Technical University of Athens, GREECE)
Institute of Communications & Computer Systems (ICCS)
**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.
AgriTech Interoperability challenges

The rapid advances of IoT technologies, AI and Big Data, among others, have boosted the adoption of smart farming practices. This, however, has led to an explosion of data, generated by a wide range of different systems and platforms that rarely interoperate.

Some of the key challenges hampering the seamless exchange and integration of the data produced or collected by those systems include:

- Availability of data in different formats and represented according to different models
  - heterogeneity of data models and semantics used to represent data
  - lack of related standards dominating this space
- Insufficient interoperability mechanisms that enable the connection of existing agri-food data models
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
AIM layered approach facilitates:

- interoperability with existing models
- alignment with other models, by module instead of the whole model
- extension of the domain/areas covered in AIM with additional modules
- maintenance/update of the domain model, by modifying only specific module
- mapping to top-level/cross-domain ontologies
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** (e.g., operation diary, irrigation, fertilisation, soil tillage)
- **Livestock data**
- **Traceability data** (e.g., farm product logistics, transportation, warehousing, etc.)
- **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
  - Interaction with GAIA-X and IDSA to ensure AIM compliance
  - Interact with the Common Agri Data Spaces initiative of the 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 current version of the DEMETER Common Data Models and Semantic Interoperability Mechanisms is available in Deliverable 2.3 released in April 2021 and its final version will be presented in Deliverable 2.5 to be delivered in October 2022.
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
# DEMETER Agriculture Information Model

Last uploaded: April 14, 2021

<table>
<thead>
<tr>
<th>Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acronym</strong></td>
<td>DEMETER-AIM</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Public</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>The DEMETER Agri Profile is a master profile importing focused specific profiles/modules of DEMETER AIM.</td>
</tr>
<tr>
<td><strong>Status</strong></td>
<td>Beta</td>
</tr>
<tr>
<td><strong>Format</strong></td>
<td>OWL</td>
</tr>
<tr>
<td><strong>Contact</strong></td>
<td>Raul Palma, <a href="mailto:rpalma@man.poznan.pl">rpalma@man.poznan.pl</a>, Ioanna Roussaki, <a href="mailto:ioanna.roussaki@cn.ntua.gr">ioanna.roussaki@cn.ntua.gr</a></td>
</tr>
<tr>
<td><strong>Categories</strong></td>
<td>Farms and Farming Systems</td>
</tr>
</tbody>
</table>

## Additional Metadata

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>URI</td>
<td><a href="https://w3id.org/demeter/agri">https://w3id.org/demeter/agri</a></td>
</tr>
<tr>
<td>Deprecated</td>
<td>false</td>
</tr>
<tr>
<td>Endorsed By</td>
<td></td>
</tr>
<tr>
<td>Endpoint</td>
<td></td>
</tr>
</tbody>
</table>

## 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
- **Classes With More Than 5 Children**: 9
Horizon Europe DIVINE project outline

DIVINE is a Research and Innovation Action with full title:

- Demonstrating the Value of data sharing to boost the agri-data Economy

Funded under:

- HORIZON-CL6-2021-GOVERNANCE-01-20: Data economy in the field of agriculture – effects of data sharing and big data

DIVINE duration:

- October 2022 – September 2025
DIVINE vision and scale

Vision:
- to build an ecosystem for sharing and analysing agri-data
- to investigate the value of agri-data sharing from a technical, business and policy perspective
- to demonstrate this value via series of real-world pilots
- to boost the agri-data economy

Scale:
- 15 partners, 8 member states, 4 pilots.
- Potential to impact 4 Ministries of Agriculture and reach 14 Farmer Associations, 15 M farmers worldwide (via WFO) and 10 EU working groups.
INFORMATION MODEL
Analyze and adapt existing information models in the agriculture sector

DATA MARKETPLACE
Enhance and extend agri-data exploitation

MULTI-ACTOR APPROACH
Engage farmers and domain experts to enable co-creation

GOVERNANCE & POLICY
Increase use by public and private actors

TRANSPARENCY
Increase data sharing, data trust & sovereignty, data traceability & usage monitoring

DIVINE
DIVINE expected outcomes

- **EO1 - Awareness and informed decisions** based on the demonstration of the costs, benefits, risks, and added value as well as the economic and societal potential of agricultural data sharing taking an EU perspective.

- **EO2 - Increase in transparency in data sharing** in the agricultural value chain.

- **EO3 - Increased sharing of agricultural data**, effective and efficient use of private and public data for private and public purpose, particularly through demonstration of the costs, benefits, risks, and added value as well as the economic and societal potential of agricultural data sharing taking an EU perspective.

- **EO4 - Contribute to an increased uptake of digital and data technologies in the agricultural sector** and indirectly contribute to an increase in environmental and economic performance through increased and enhanced use of digital technologies and data.

- **EO5 - Strengthen policy-making & monitoring capacities** in agriculture and data technologies.
Key Technical Considerations

- Data modelling, sharing & semantic interoperability
- Agri Data Analytics, Fusion & Knowledge extraction
- Transparent Decision Making Support & Benchmarking for agri stakeholders
- Agri Data Security, Transparency, Trust, Sovereignty, Traceability
- Agri Data Sharing Governance Models & Policy making
- Stakeholder Open Collaboration Space

- **Agricultural Data Space Ecosystem**
For more information visit:

www.h2020-demeter.eu

or Email us at:

info@h2020-demeter.eu

&

ioanna.roussaki@cn.ntua.gr