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27 - 28 May / Athens

IN COLLABORATION WITH

ATC ATHENS TECHNOLOGY CENTER

ΕΠΙΣΕΥ ICCS

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FORTH INSTITUTE OF CHEMICAL ENGINEERING SCIENCES

NEUROPUBLIC Information Systems & Technologies

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Democratizing digital agriculture: Breakthroughs and challenges

Nikolaos Marianos (GreenSupplyChain DIH), n.marianos@greensupplychain.eu

GreenSupplyChain

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Supported by BDVA TF Agrifood

- Topics
  - Generative AI for Agrifood
  - Data Space for Agriculture
  - Data interoperability
  - Circularity and sustainability
  - Sustainability (data)
  - Trustworthy/XAI
  - Sustainable AI /Green AI
  - Cognitive HMI

- Expected outcomes 2025
  - Selection of relevant R&D call for proposals
  - More members joining the TF or BDVA
  - Brokerage event
  - Data Week 2025
  - EBDVF 2025

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Odyssey of AI:
Navigating the Data Seas

27 - 28 May / Athens

Democratising digital agriculture: Breakthroughs and challenges

27 May / 14:00-15:30 EEST / Room 2

Nikolaos MARIANOS
GreenSupplyChain DIH

Karel CHARVAT
Plan4all

Nikos KALATZIS
GreenSupplyChain DIH

Delia MILAZZO
Engineering Ingegneria Informatica S.p.A.

Chiara CORBO
Politecnico di Milano

Karel CHARVAT JUNIOR
Lesprojekt sluzby

Vassilis PITSILIS
NCSR - Demokritos

Ioanna ROUSSAKI
Institute of Communication & Computer Systems

Runar BERGHEIM
Asplan Viak Digital Services

Radovan HILBERT
YMS Academy

Stelios KOTSOPOULOS
Neuralio AI

Odysseas SEKKAS
NEUROPUBLIC S.A

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The Challenge (1/2)

- Digital Agriculture Technology Solutions can improve the sustainability performance and competitiveness of the agricultural sector.
- DATSs are in many cases too expensive and economic benefits are doubtful for small farmers.
- Most of the business models of AgriTech providers focus on large farms and large-scale crops.
- Most DATSs focus on conventional agriculture, neglecting systems like organic farming and agroecology.
- A lot of the current DATSs are unsuitable for small fields due to the size of the equipment, or the accuracy and level of detail of the data used (e.g. in the use of open satellite data).
- Farmers have low trust in ADSs, because they fear that their data will be used against them or misused, but also because usually the ADSs work like a “black box”.

The Challenge (2/2)

- Farms in remote areas experience problems with network connectivity that affect the performance of the ADS.
- Digital literacy is lower for small farms and significant training and support is needed.
- It’s not easy to find or access relevant R&I results, as they are often locked in silos or available through platforms that are abandoned after the end of the project.
- There is a lack of documentation and support on how to integrate and/or replicate these solutions, and to adapt them to.
- There is lack of data and knowledge that would allow their adaptation to local conditions and different types of farms and cropping systems.

Presenting breakthroughs and open issues

- 2 panels presenting breakthroughs and challenges from innovative initiatives
  - CloudEdgeIoT Continuum, Data interoperability and Open-Source software (Nikos Marianos)
  - GeoAI, Generative AI, Foundational Models and EO (Karel Charvat)
- 5 presentations per panel (5’ each)
- Followed by discussion and Q&A session (15’)

CloudEdgeIoT Continuum, Data interoperability and Open-Source software

- Open source and edge computing. Adding the missing elements of Digital Agriculture solutions (OpenAgri) - Nikos Kalatzis (GSC)
- Continuum technologies for optimising energy consumption in sustainable dairy production (O-CEI) - Vassilis Pitsilis (NCSR-D)
- Leveraging and sharing agricultural data to assess the costs, benefits, and sustainability of Digital Agriculture Technology Solutions (QuantiFarm) - Chiara Corbo (POLIMI)
- Tackling interoperability in agricultural data spaces (DEMETER) - Ioanna Roussaki (ICCS)
- Validating dataspace interoperability with TRUE Connector and developing sustainable business models (DIVINE) – Delia Milazzo (Engineering)

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Open source and edge computing: Adding the missing elements of Digital Agriculture solutions (OpenAgri)

Nikos Kalatzis (GreenSupplyChain DIH),
nikosk@greensupplychain.eu

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The project

- January 2024 – December 2026
- HORIZON Research and Innovation Actions
- Multiactor approach

18 partners from 7 countries, representing farmers, farm advisors, AgriTech providers, scientists and other actors.

Coordinator: University Maastricht

Technical Coordinator: GreenSupplyChain DIH

The Challenge

- ADSs are in many cases too expensive and economic benefits are doubtful, especially for small farmers.
- Farmers have low trust in ADSs, because they fear that their data will be used against them or misused, but also because usually the ADSs work like a “black box”.
- Farms in remote areas experience problems with network connectivity that affect the performance of the ADS.

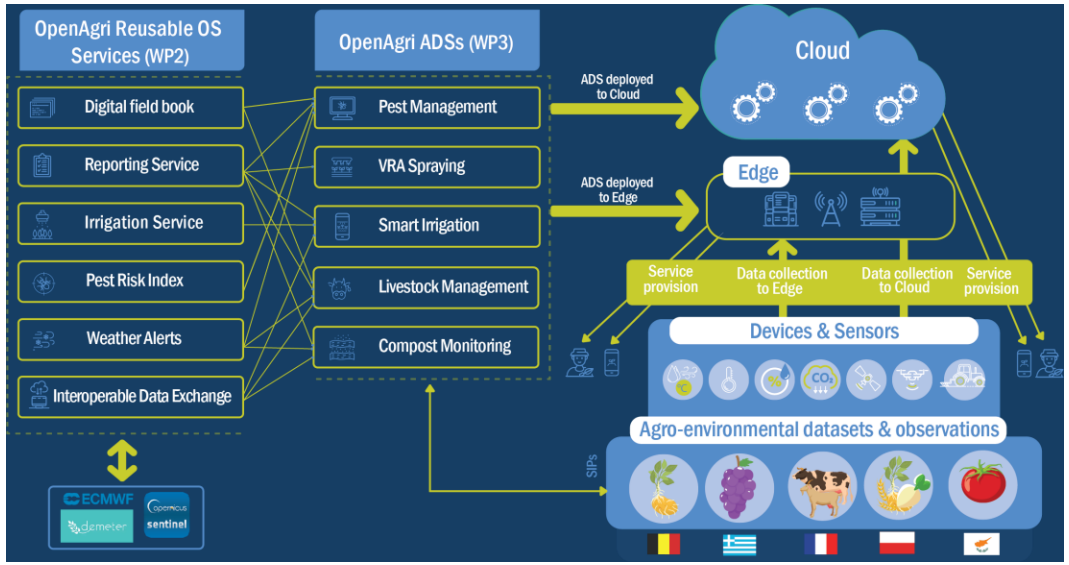
The Solution

Enable the development and deployment of Agricultural Digital Solutions (ADSs) by

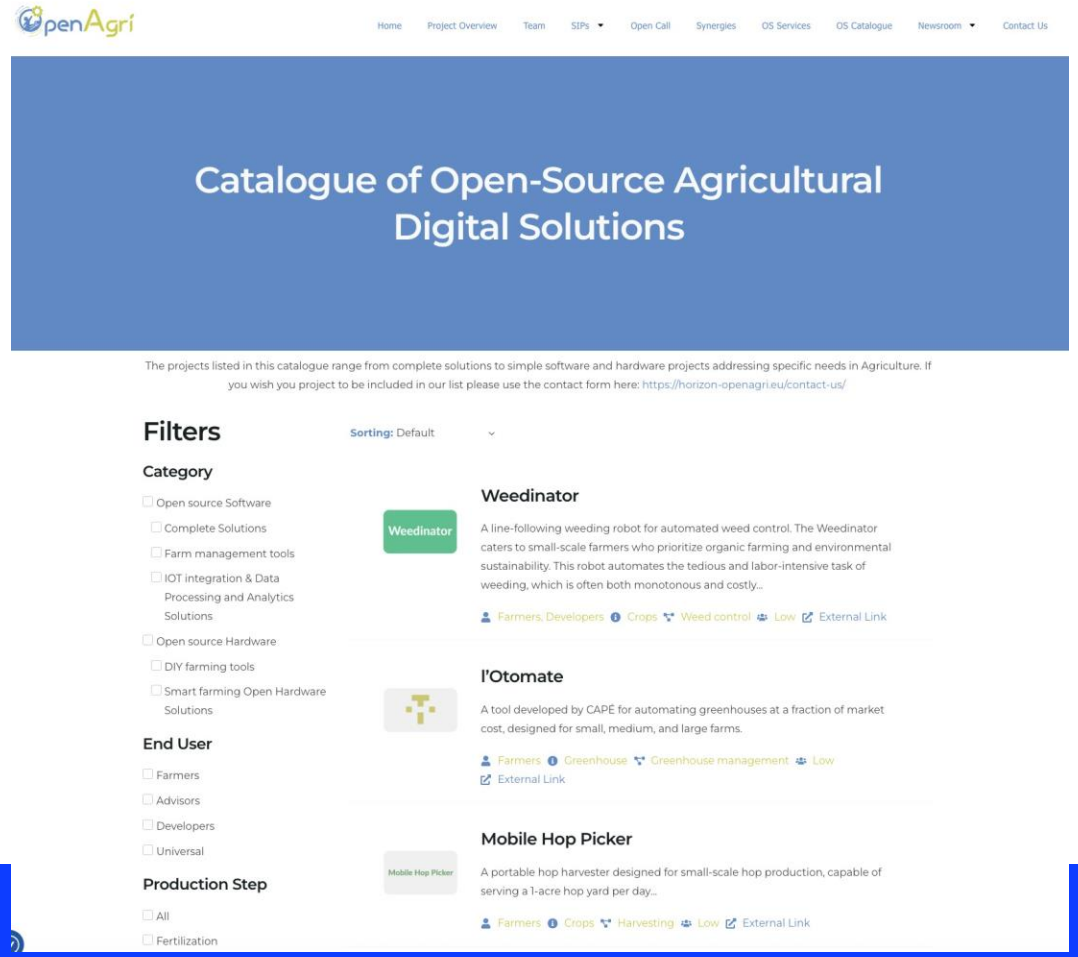
- Promoting the development and reuse of OS software and open hardware, to reduce the cost of the solutions.
- Monitoring and optimising energy consumption towards energy efficient components.
- Adapting edge-computing mechanisms – enable operation at a high performance even in remote areas with weak connectivity.

Tangible Results so far

Reusable software components (6)
https://github.com/openagri-eu/



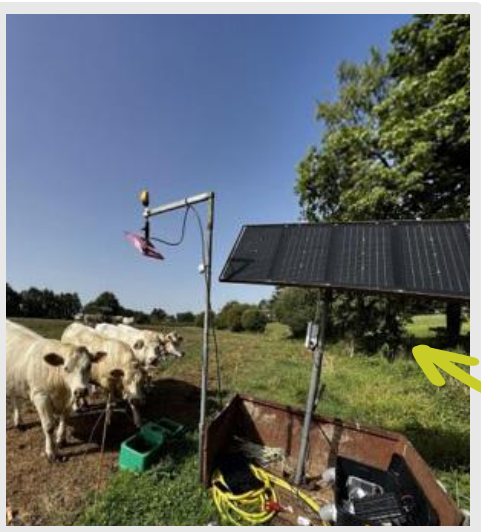
Public catalogue of available Open Source ADSs
https://horizon-openagri.eu/open-source-catalogue/



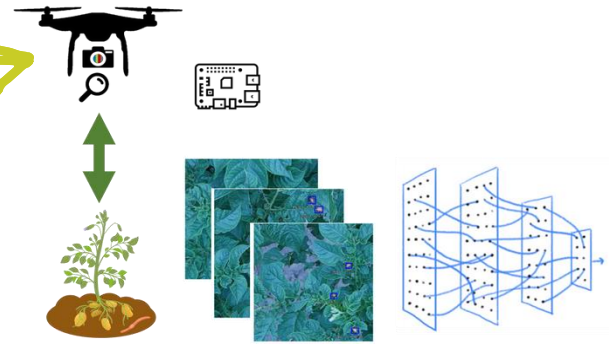
- Supporting cloud, edge computing
- Initiation of an Open-Source software community for digital agriculture supported by the Linux Foundation.

Tangible Results so far

5 Sustainable Innovation Pilots



ADS Descriptive title	Country/Sector
Visual Scouting in Vineyards using a camera-based machinery add-on system	Greece/Grapes
Monitoring the drinking areas frequentation by cattle using UHF RFID	France/Cow meat production
UAV-based detection of Colorado Potato Beetle	Belgium/Potatoes
Open hardware IoT-based smart irrigation system for autonomous irrigation	Poland/Sugar beet and Potatoes
IoT Assisted Organic Compost Production in Open Piles	Cyprus/Cross-Sector tested in Vegetables



- Co-creation of 2 versions of the same ADSs,
- 1 cloud-based and 1 edge or mixed model-based
- Dual comparison: Effectiveness, performance, and energy efficiency

Open issues

- Make the OpenAgri core services useful and reusable
- Maintain and expand the Agri-tech Open-Source community
- Adapt edge-computing mechanisms in a meaningful manner

Thank you.

Nikos Kalatzis
nikosk@greensupplychain.eu

GreenSupplyChain

For more information:
https://horizon-openagri.eu/
https://github.com/openagri-eu/

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Continuum technologies for optimising energy consumption in sustainable dairy production (O-CEI)

Vassilis Pitsilis (NCSR-D)

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The project

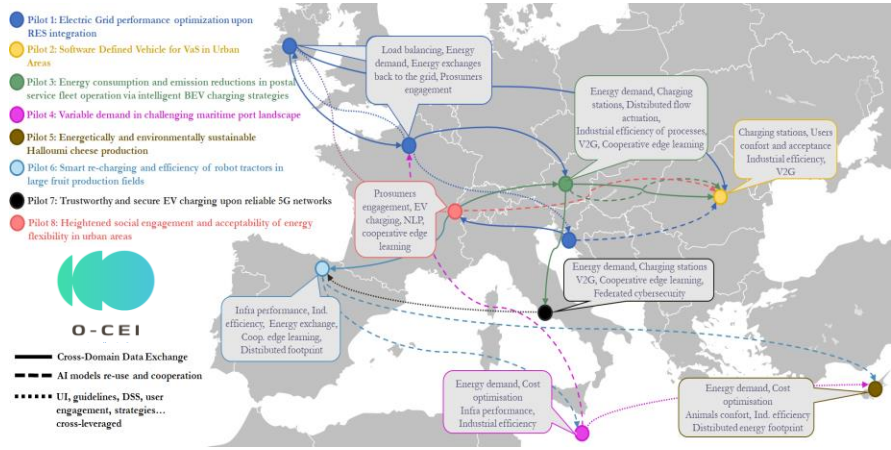
Duration: January 2025 – June 2028

Budget: 31.347.300 €

Partners: 59 from 19 countries

Total scenarios: 28

Transport scenarios: 9



O-CEI Data Sharing Platform
To share metrics and information about prosumers and infrastructure

01

O-CEI Cross-Domain Continuum Ontology
To allow federation of resources

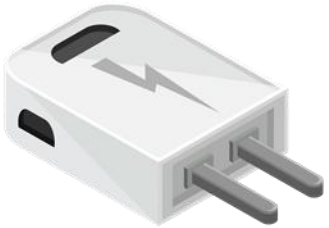
02

Federated marketplace
To discover, select and allow installation from other examples

03

O-CEI

https://o-cei.eu/



04

Pre-normative
Standardisation on O-CEI deployments

05

Adoption methodology
Facilitating uptake for other LSPs based on blueprints

06

Business model
Exploitation roadmap of flexible and efficient energy using edge computing

The Challenge

- Need to expand and enhance digital data collection mechanisms and data analytics service integration to optimise energy use for: A) livestock management and b) dairy production sector in Cyprus.

- Main barriers in the context of Cyprus:
  - Lack of knowledge and trust to such mechanisms
  - Existing available solutions are targeting large farms with good connectivity e.g. located in central Europe.
  - Significant initial investment cost that small farms can't afford.
  - Lack of interoperability – Example: Difficulties in integration of existing software solutions "Herd management software", "Energy Submetering", "Welfare monitoring", "Sharing data about produced milk properties (quality/quantity)"

The Solution

- Use of the O-CEI platform for addressing:
  - Trusted data sharing using DLT
  - Enable data interoperability through common/standardised data models.
  - Leveraging the CEI continuum to dynamically allocate tasks on the most suitable resources (from edge to cloud), balancing data locality and performance requirements for intensive computational tasks (e.g. image analytics for animal welfare)
  - Cross-pilot sharing of best practices and knowledge on energy optimisation mechanisms, e.g. analytics for identifying correlation on energy use with contextual information, discovery of seasonalities, synchronization of farming practices with the performance of energy sources.

Tangible Results so far

Early results (month 5 yet for the project) for the domain include:

- **Identified Key Metrics and Processes**
  Required for monitoring and control for optimizing farming practices.
- **Technology Requirements Identified**
  Including DLT for trusted data sharing, interoperability standards, and continuum practices for offloading resource-intensive tasks.
- **Established Key Partnerships**
  Industry and research partners for innovations integration.
- **Cross-Pilot Collaboration Mechanisms**
  Early-stage collaboration mechanisms defined for sharing best practices and knowledge.

Open issues

- **Expanding Digital Data Use**
  - Familiarize with and introduce digital processes.
  - Overcome trust barriers surrounding digital solutions.
  - Address concerns over data sovereignty and reluctance to share sensitive data.
- **Infrastructure Requirements**
  - Identify and specify the infrastructure needed for adopting digital solutions, including monitoring and automation systems.
  - Support integration of existing edge solutions.

Thank you for your attention!

Learn more about O-CEI Project: https://o-cei.eu

DEMOKRITOS

NCSRD FRONT research group: http://front-research-group.eu
Scientific Lead: Dr. Harilaos Koumaras (koumaras@iit.demokritos.gr)
Technical Lead: Vasilis Pitsilis (vpitsilis@iit.demokritos.gr)

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Leveraging and sharing agricultural data to assess the costs, benefits, and sustainability of Digital Agriculture Technology Solutions

Chiara Corbo, Politecnico di Milano

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The project

OBJECTIVE

To support the deployment of DATSs and their adoption providing farmers with concrete qualitative and quantitative data on costs and benefits and potential sustainability impacts of digital solutions.

HOW?

- A Framework to assess costs & benefits of DATSs + sustainability impacts
- 30 Test Cases in 7 agricultural sectors
- A «toolkit» to support farmers' decision making through tools like a criteria-based interactive recommender tool, a set of costs and benefits calculators and a tool for policy recommendations

The Challenge

- The last decade has seen an explosion of interest and investment in the use of digital technology solutions in agriculture and food production (DATS). Despite the many predicted and promised benefits of their use in agriculture, actual uptake and use by farmers in Europe has been slow and limited because of:
  - Lack of knowledge about DATSs
  - Insufficient clear and “hard” data on the costs and benefits of DATSs and the impact on sustainability
  - Cultural barriers and behavioural attitudes
- The need for real life measurements: despite the existence of several studies on the costs and benefits of DATSs, these are often conducted in experimental settings, which are not easily replicable and not always lead to pragmatic results. Additionally, economic and social aspects are not so often analysed. It is necessary to propose an approach that is based on real data, applicable to differents sectors, replicable and of practical use.

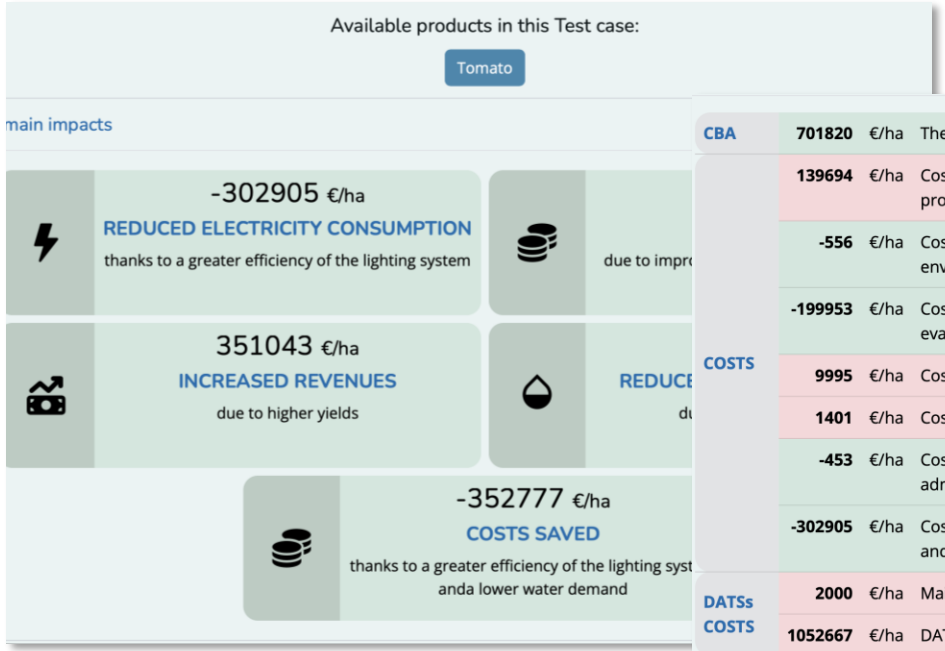
The Solution

Data collected directly from farmers using and not using DATSs through a standardized methodology along three years

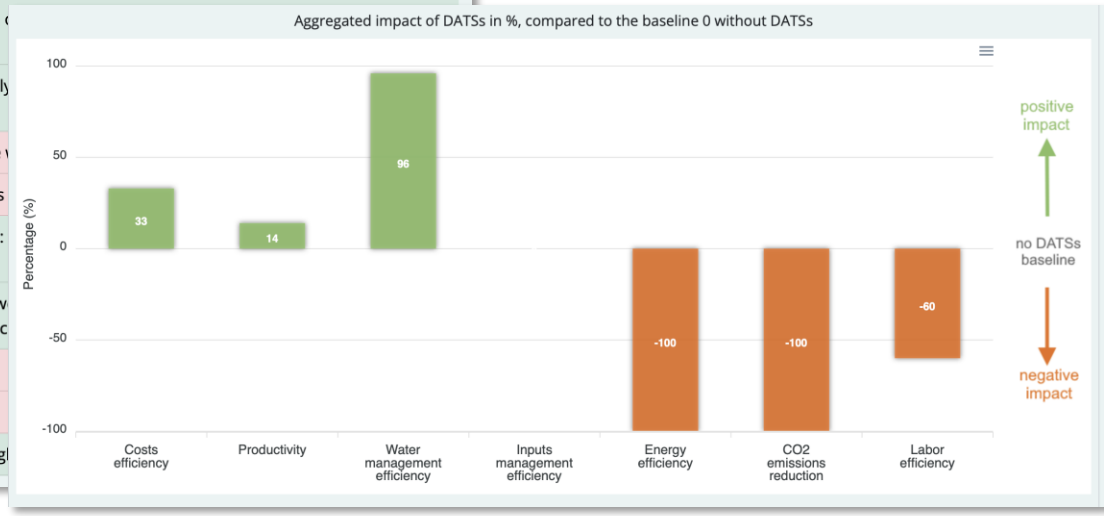
- The **Assessment Framework** (+80 KPIs) applicable to more than 7 agricultural sectors to assess:
  - Monetary impacts of DATSs (Cost-benefit analysis) at farm and ecosystem level
  - Sustainability impacts on the 3 dimensions of sustainability
- The **QuantiFarm Toolkit** (set of decisions support tools) for farmers, cooperatives, advisors, technology providers, policy makers, …
  - Recommender system (based on a catalogue of +100 DATSs)
  - Cost-benefits calculators (based on commercial data + data from TCs)
  - Policy recommendation tool

Tangible Results so far

- **Cost-benefit analysis and impact on sustainability of 30 TCs for 2 years from the application of the Assessment Framework on 30 TCs;**

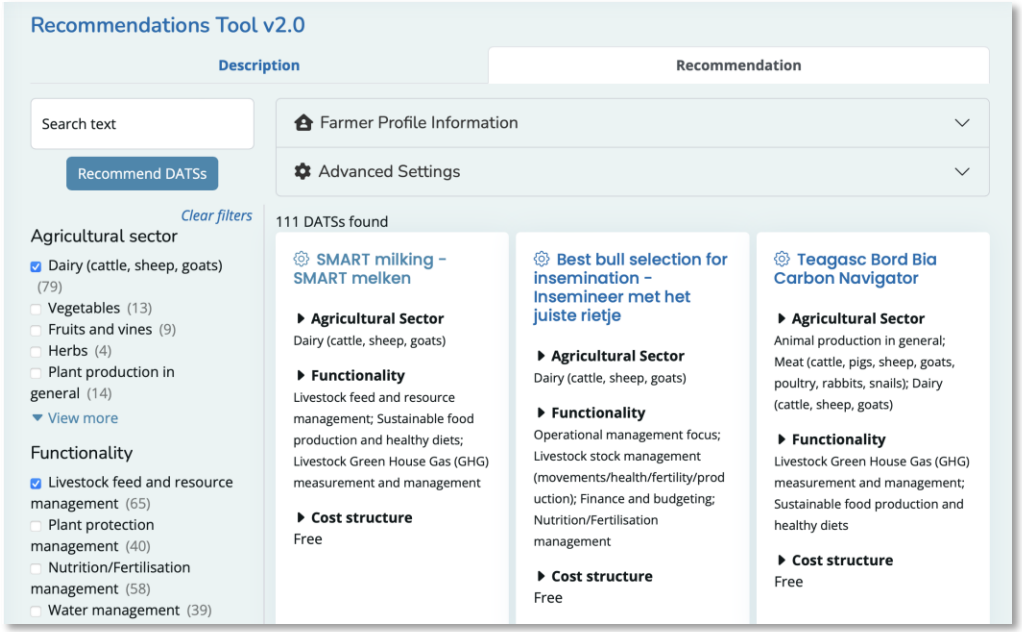


CBA	701820	€/ha	The use of this DATS has brought to farmers a net benefit due to increase of revenues and reduction in total costs
COSTS	139694	€/ha	Cost of fuel: higher cost of fuel due to different fuel utilization rate (different greenhouse structure) and different heat provided by lighting systems
	-556	€/ha	Cost of labour for greenhouse management: an overall reduction c environment is observed thanks to the DATSs
	-199953	€/ha	Cost of water: a decrease in water usage has been recorded, partly evapotranspiration
	9995	€/ha	Cost of labour for field visits: the management of the greenhouse v
	1401	€/ha	Cost of labour for irrigation: it seems that the technology requires
	-453	€/ha	Cost of labour for data management and administrative activities: administrative tasks
	-302905	€/ha	Cost of electricity: lower cost of electricity thanks to the DATSs low and can be adjusted according ot crop needs and environmental c
DATSs COSTS	2000	€/ha	Maintenance costs
	1052667	€/ha	DATS investment cost
OUTPUT	351043	€/ha	The increase in revenue is driven by higher yields achieved through

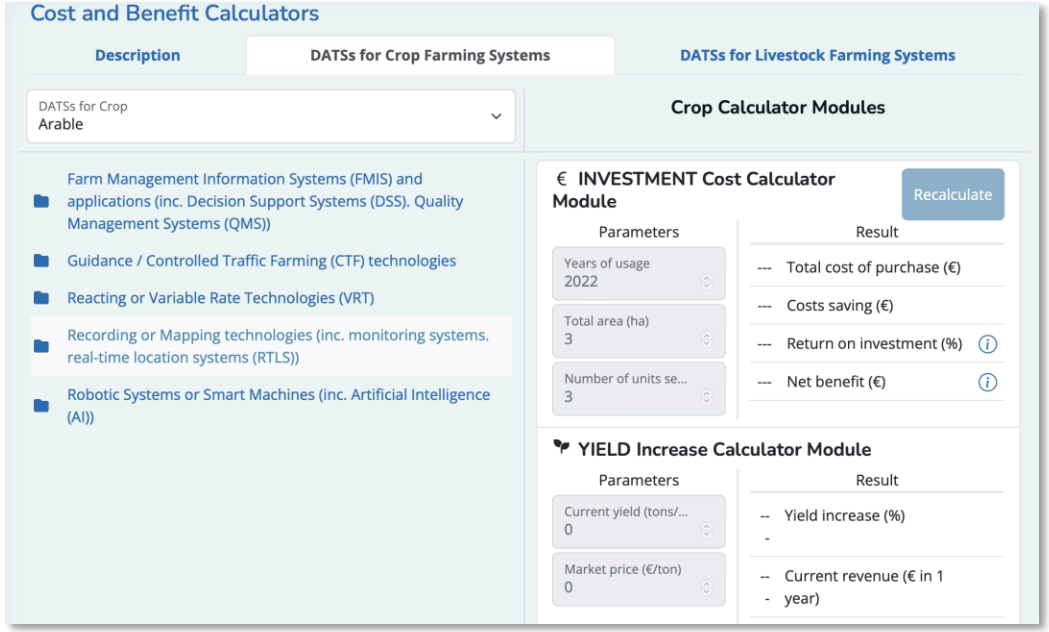


Tangible Results so far

- Recommendation Tool (16 languages): for farmers and advisors to obtain info and recommendations about available DATSs according to their needs (agricultural sector, functionality, Country, …)



- Cost & benefits calculators: for farmers and advisors, to offer a concrete analysis on costs and benefits of selected DATSs (commercial or from TCs).



Open issues

- **Reducing the burden for farmers and increasing data consistency** – In the near future, the more we are able to automate data collection directly from technologies, the more effective we will be in these analyses.
- **Data security** – Farmers need to feel “safe” when they share this data.
- **Data valorisation** - It is fundamental to giving value back to «farmers» and that this value is clear to them.
- **Making data collection a habit for farmers** – Creating a »culture of data» where benefits of digitalization and data valorisation are clear.

Thank you!

chiara.corbo@polimi.it

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Tackling interoperability in agri data spaces

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

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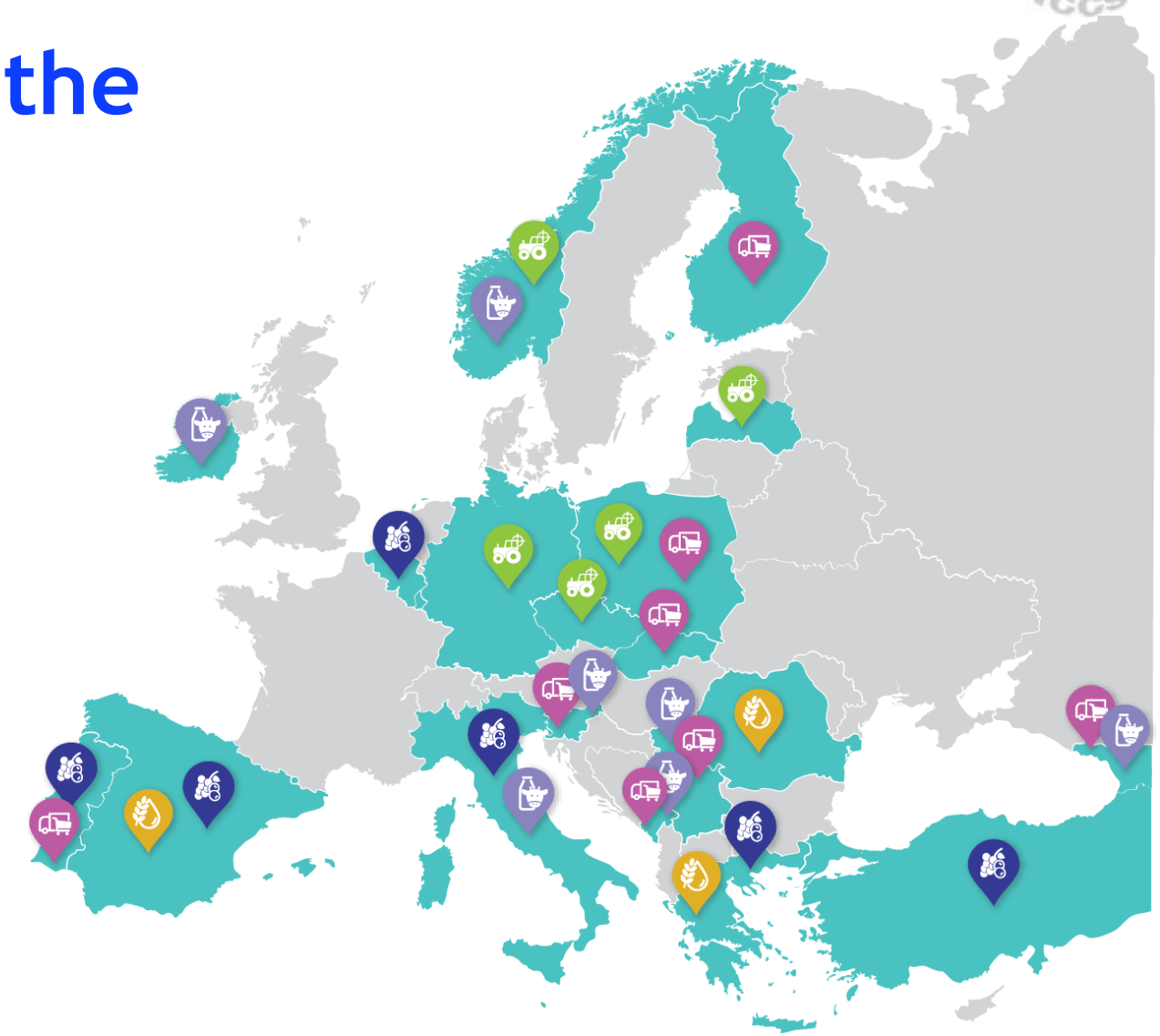
DEMETER:
Data Driven Innovation in the Agrifood sector

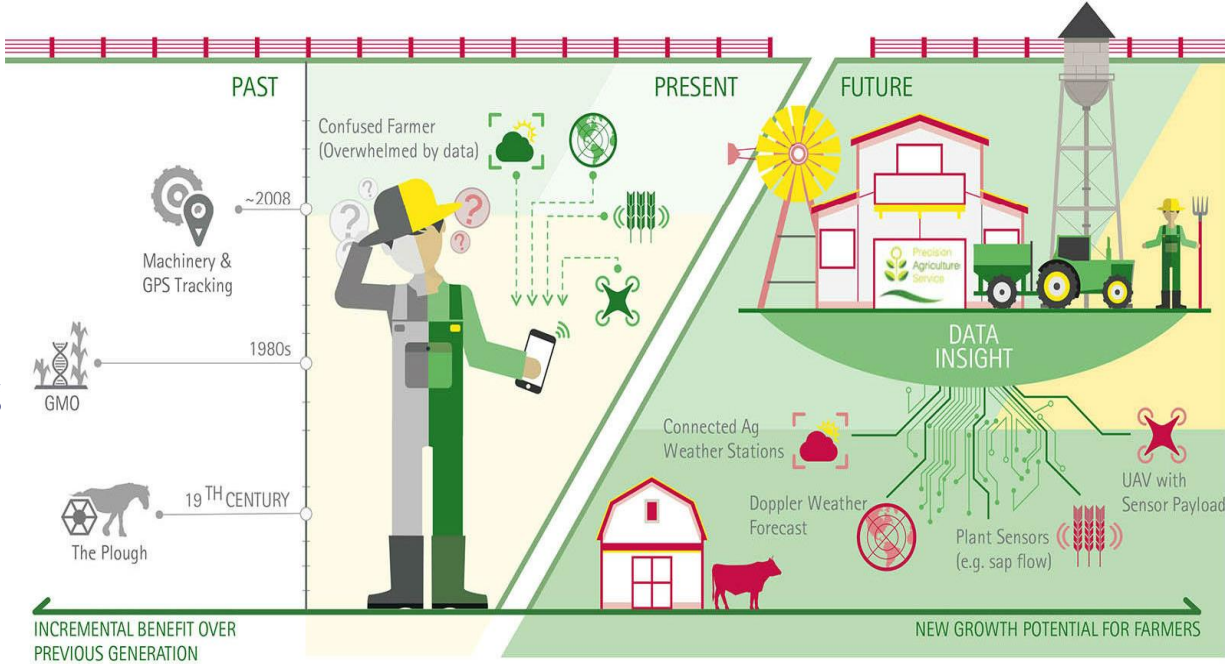


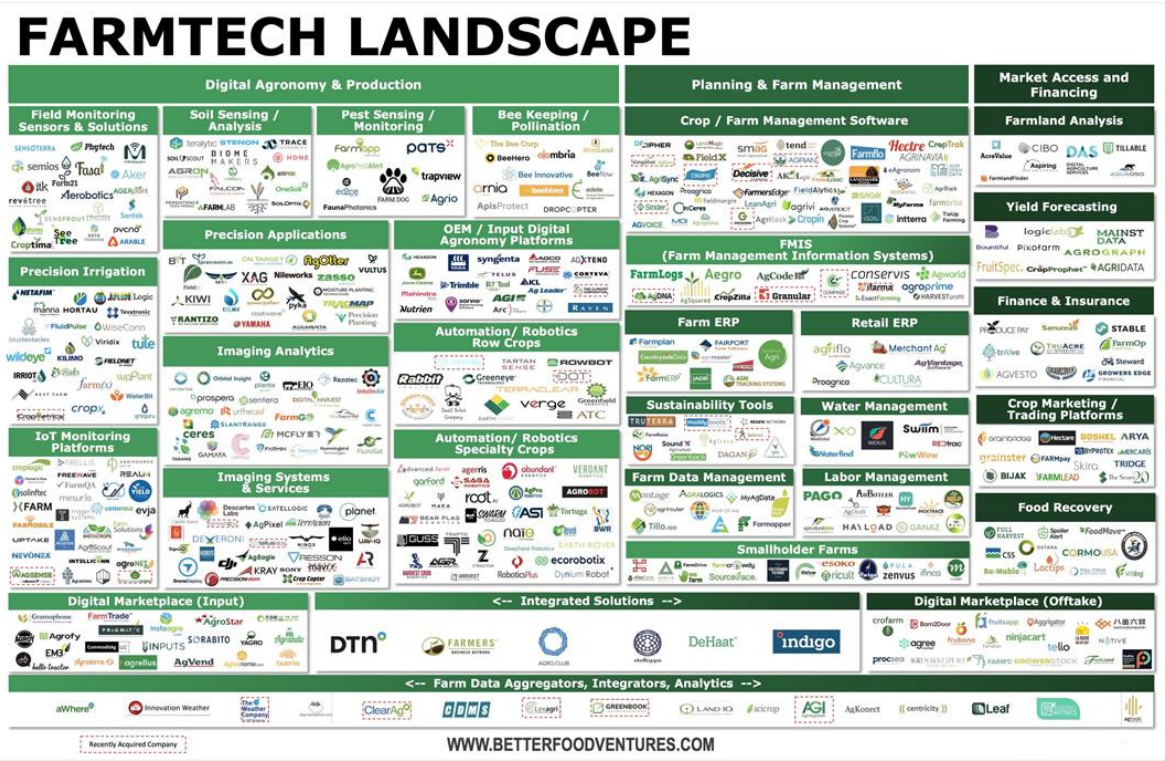
The Challenge

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.

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

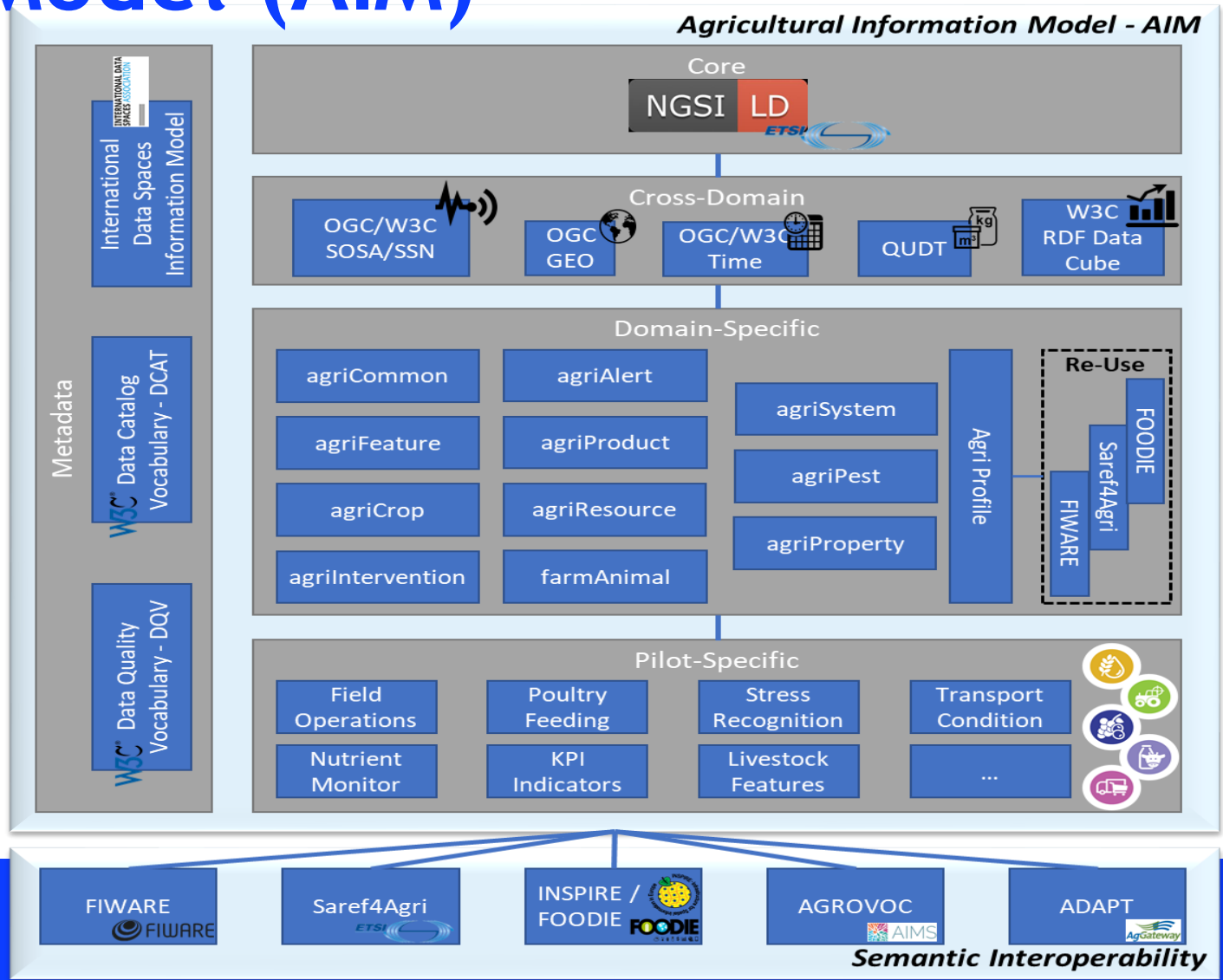




The Solution: DEMETER Agricul -tural Information Model (AIM)

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
- update of the domain model, by modifying only specific module
- mapping to top-level/cross-domain ontologies



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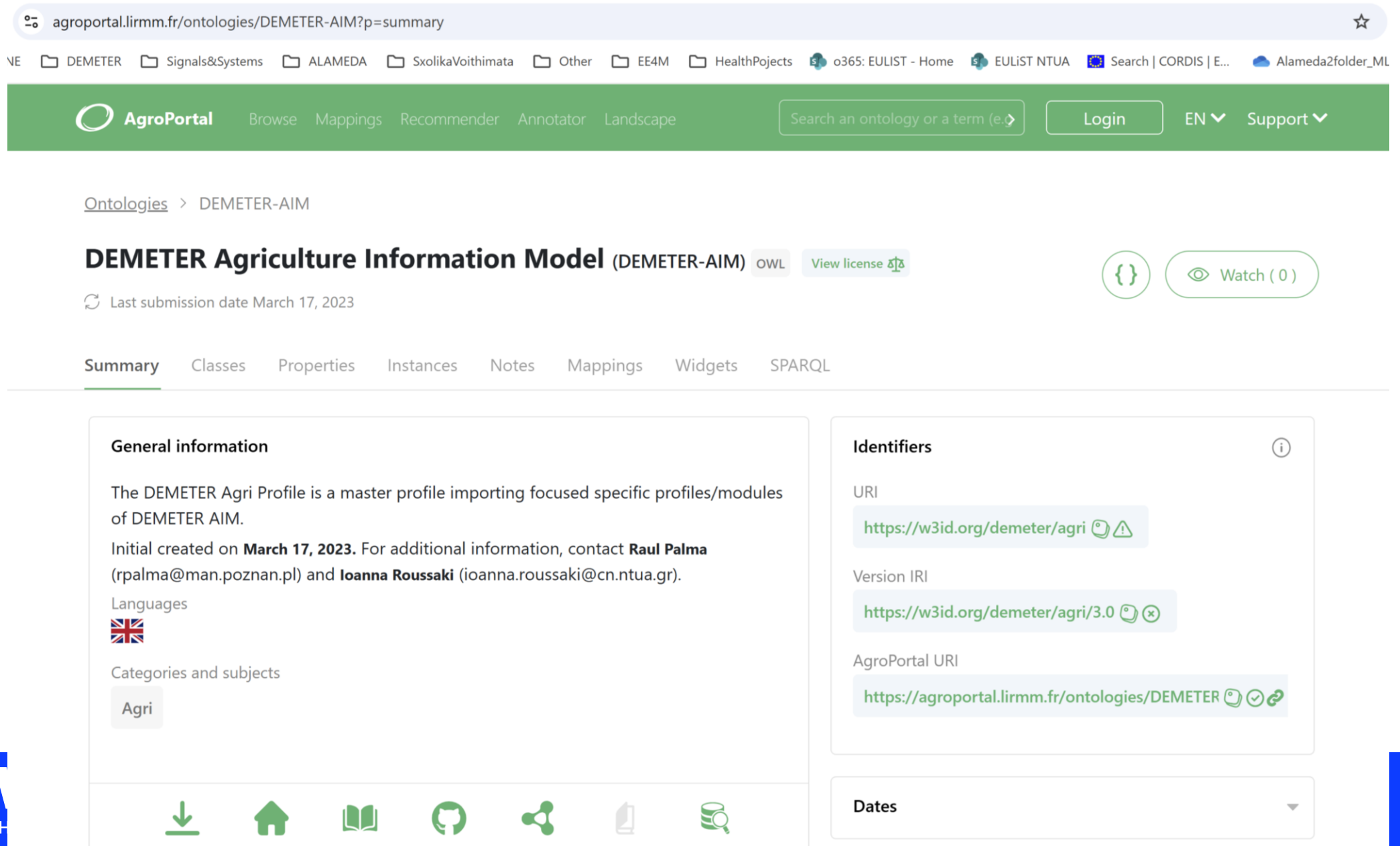
Semantic Interoperability via AIM

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:

- GS1 EPCIS
- FIWARE
- ETSI (Saref4Agri)
- EU initiatives (INSPIRE, FOODIE)
- FAO AIMS (AGROVOC)
- OGC (EO standards)
- ISO standards
- QUDT (Units Ontology)
- AFarCloud
- eCrop
- FOODON
- Other dominant solutions (ADAPT)

Tangible Results so far (I)



Tangible Results so far (II)

AIM available in the OGC server

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

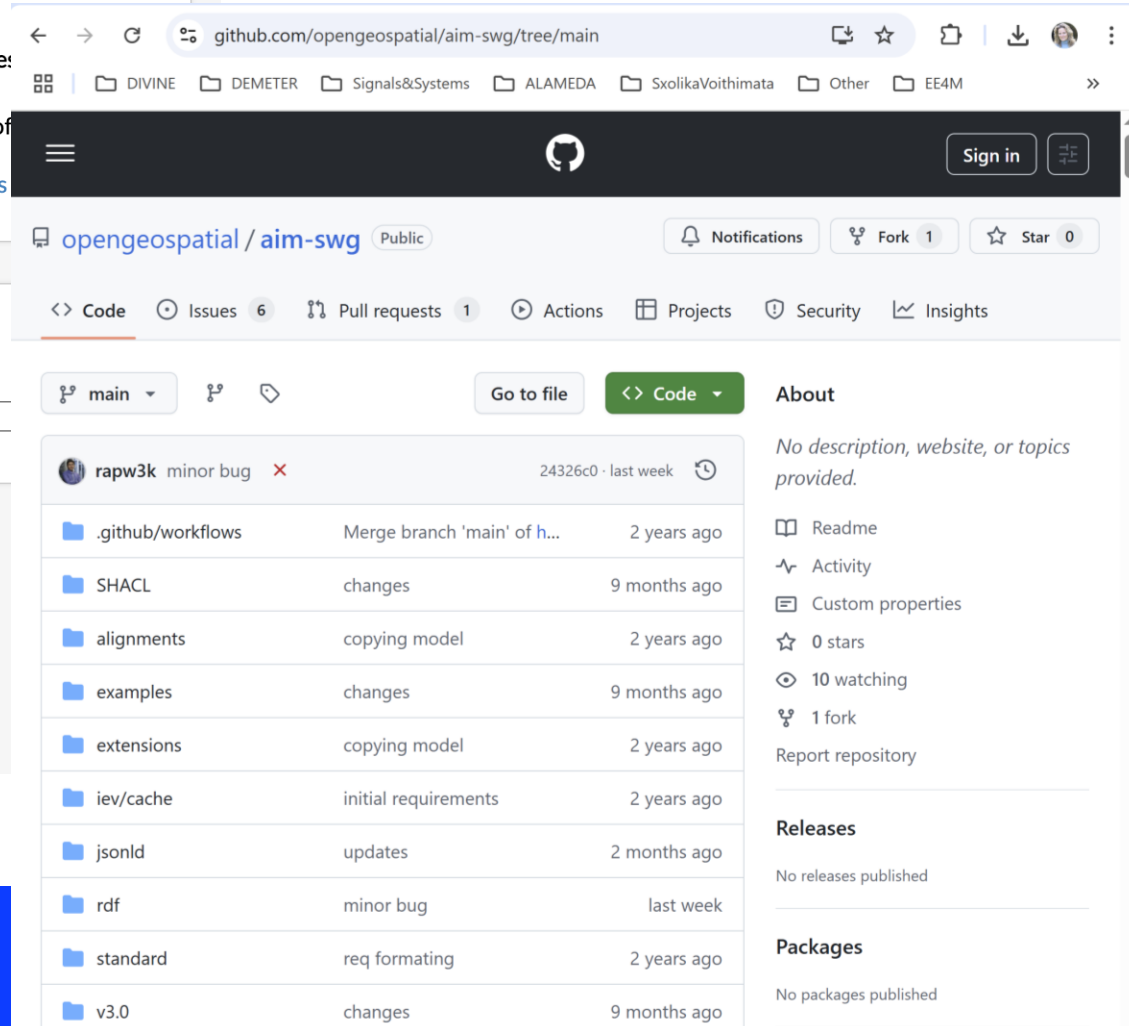
Alternates Profiles

Different views of

Alternate Profiles

Filter

Clear



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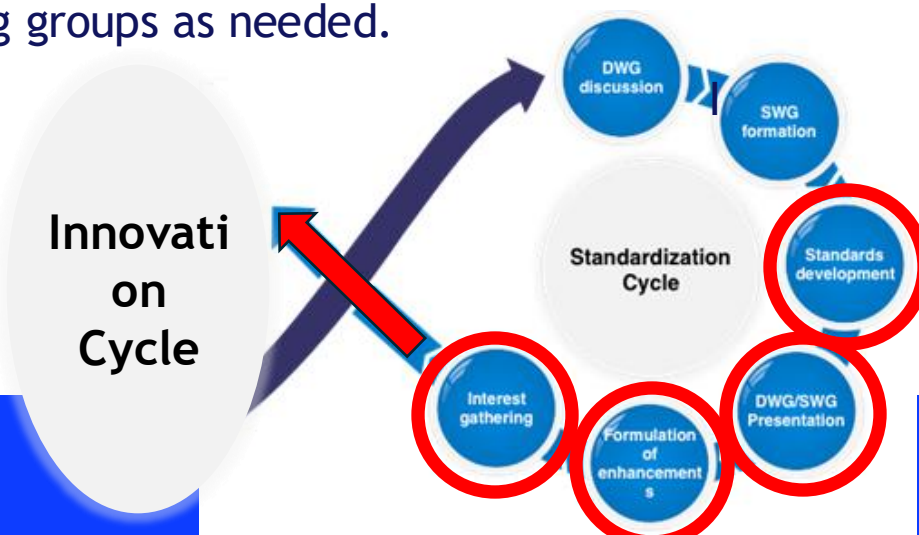
Open Geospatial Consortium

Promoting AIM to a standard

- We are promoting AIM as an international standard of the Open Geospatial Consortium (OGC): We established the new **Agriculture Information Model Standards Working Group (AIM SWG)**. We have transformed Demeter AIM definition into the 'standard' template of the modular specification released.
- The Standard Working Group is established as permanent which means the **AIM will be maintained within the OGC community**.

Adoption and liaisons:

- The liaison with the **ISO Smart Farming** activity group is done through **ISO TC211** and involved joint members of the SWG.
- The MoU with **IDSA** ensures the exchange and access to joint working groups as needed.
- We've established initial exchange with **ADOPT** and SO Smart Farming through **RDA IGAD**.
- Chairs connection are use to link with initiatives such as **FIWARE** (SmartDataModels), **AgriSpace**, **CAPIGI**, **Dutch Information Model** community, etc. that will be invited to join selected SWG meetings.



demeter

Thanks a lot for your attention!

Prof. Ioanna Roussaki
(ioanna.roussaki@cn.ntua.gr)

DATAWEEK
JOIN.LEARN.SHARE.GET VALUE

ORGANISED BY
BDV BIG DATA VALUE ASSOCIATION

HOSTED BY
COSMOTE
Member of T Group

IN COLLABORATION WITH
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DEMOKRITOS NATIONAL CENTRE FOR SCIENTIFIC RESEARCH
FORTH INSTITUTE OF CHEMICAL ENGINEERING SCIENCES
NEUROPUBLIC Information Systems & Technologies

DATAWEEK

JOIN.LEARN.SHARE.GET VALUE

Validating dataspace interoperability with TRUE Connector and developing sustainable business models (DIVINE)

ORGANISED BY

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DEMOKRITOS NATIONAL CENTRE FOR SCIENTIFIC RESEARCH

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NEUROPUBLIC Information Systems & Technologies

DIVINE's vision & main goals

- Build an **ecosystem** for **sharing** and **analysing** agri-**data**;
- Evaluate agri-data sharing **technical, business** & **policy** perspectives;
- Demonstrate agri-data sharing in **real-world pilots**;
- **Boost Agri-data economy**.

  → DIVINE aims to transform agri-food data sharing by addressing **compatibility** issues.

  → Through a robust data-sharing ecosystem and real-world pilots, DIVINE seeks **practical insights** at business, technical, and policy levels.

The Challenge

Access to digital agricultural solutions remains **fragmented** and **limited** due to:

- the absence of **sustainable**, **scalable business models** for data sharing and reuse;
- **low incentives** for data contribution, especially from primary producers;
- **lack of interoperability** between platforms, which **limits service integration.**

Target Groups Affected:

-**Farms and cooperatives** → Limited capacity to adopt digital tools (technical & financial)

- **Actors in remote/rural areas** → Poor connectivity and lack of accessible services

- **Agri-tech SMEs and startups** → Face challenges in monetisation and data collaboration

The Solution

- **Sustainable, Validated Business Models** → Business models for data sharing have been *co-designed* with partners and stakeholders, *validated* in real-world pilots, and *refined* using SMEs input and EU-aligned frameworks (e.g. IDSA, DSSC).
- **Engagement & Empowerment of Stakeholders** → Surveys and co-creation activities have identified the *needs and barriers* faced by SMEs and farmers. These insights have been used to *tailor incentive mechanisms*, *increase the perceived value of data ecosystems* and *encourage active stakeholder participation*.
- **Trusted, Interoperable Data Sharing** → DIVINE promotes interoperability through *open*, *standard-based architectures* and the *TRUE Connector*, enabling seamless integration across systems. This facilitates trusted data exchange, particularly benefiting small farms, remote areas, and SMEs with limited access to complex digital solutions.

Tangible Results so far

- **Business Models Drafted & Pilot-Validated**
  - Initial data space business models co-designed and validated in pilots, refined using SMEs feedback and EU best practices (IDSA, DSSC, etc.)
- **Stakeholder Engagement & KER Identification**
  - Survey-led insights on SMEs needs and barriers; Key Exploitable Results (KERs) identified and prepared for exploitation.
- **Open-Source TRUE Connector & interoperability tools**
  - Release of a TRUE Connector enabling sovereign, interoperable data exchange aligned with Data Space Protocol (DSP).

Open issues

- **Evolving Data-Driven Business Models**→ the need for models to be continuously adapted and tailored to the real needs of data providers and consumers, developed through a bottom-up co-design approach;
- **Robust Governance & Data Sovereignty**→ Still a need to define enforceable, transparent governance frameworks that preserve sovereignty while enabling trusted interoperability across diverse ecosystems.
- **Interoperability Across Federated Data Spaces**→ Ensuring **technical alignment** remains a critical challenge for **cross-sector and cross-border** collaboration.
- **Viable & Hybrid Revenue Models** → Business models must balance **value creation and cost recovery**, exploring **hybrid revenue** streams that incentivise participation across the value chain.
- **Agile Strategy for Dynamic Contexts** → Necessity of **continuous monitoring**, **evaluation**, and **adaptation** of **business and governance models** to reflect changing regulations, technologies, and market realities.

Thank you for your attention

Discussion and Q&A Session