DS2 | AGRICULTURE

Demo site: Greece

PRECISION AGRICULTURE

OVERVIEW

At its core is AgroNIT, a digital platform primarily used to provide farmers with direct access to monitoring tools to inspect field conditions, track crop development, needs or imminent threats, and view localized weather forecasts. It currently offers limited services customization and minimal structured interaction among its users (farmers, agronomists, analysts, etc.).

Within DS2, AgroNIT is being re-architected to function as a federated marketplace. Within it, data and services are published, discovered, and consumed. Farmers receive tailored recommendations. Agronomists offer predictive tools. Analysts contribute models. Services are exchanged securely and transparently.

PURPOSE

This use case addresses the integration of real-time agricultural data, AI services, and cross-sector collaboration within a federated digital environment. It focuses on precision farming in Northern Greece, where diverse actors, such as farmers, agronomists, researchers, service providers, and the agri-food industry, interact through a shared infrastructure. The scope is intentionally broad in technological reach yet specific in its application context: improving crop productivity, resource efficiency, and decision-making, while maintaining full control over data assets.

CHALLENGE

Precision agriculture depends on data that is high-quality, real-time, and context. This use case demonstrates how such data, originating from fields, satellites, weather models, and AI services, is shared, processed, and used to support smarter, more sustainable farming in Northern Greece.

DS2 | AGRICULTURE

Demo site: Greece

PRECISION AGRICULTURE

OFFERED SERVICES

The service supports precision farming by offering AI-driven recommendations on irrigation, crop monitoring, and sourcing logistics. It helps farmers, agronomists, and cooperatives make real-time, data-informed decisions to boost productivity and sustainability. Delivered through the AgroNIT web platform, the service combines dashboards, AI models, and a federated data marketplace. Core data products include IoT sensor data, high-res crop images, weather forecasts, and satellite indices. These are processed across two dataspaces: DigiAgro data space (run by the University of Thessaly) and AgroScience data space (run by CROWNEST).

DATASPACES

Two distinct dataspaces support this system: DigiAgro DS and AgroScience DS. AgroScience DS, which is operated by CROWNEST SA, delivers analytics, decision support tools, and consultancy services by integrating external datasets, such as satellite imagery, short-term forecasts, agronomic baselines, and making them actionable. The DigiAgro DS, operated by the University of Thessaly, serves as a dedicated infrastructure for the acquisition, management, and controlled sharing of agricultural field data.

NON-FUNCTIONAL PROPERTIES

- **Data sovereignty**: Farmers retain ownership and control over their data at all times.
- **Privacy preservation**: Sensitive and proprietary data is not shared unless explicitly permitted; Federated Learning reduces exposure.
- **Compliance**: All operations align with GDPR and European data governance frameworks (IDSA, GAIA-X).
- **Scalability**: The system architecture supports increased data volume, additional farms, and new service providers.
- **Interoperability**: Based on open standards and modular integration, supporting future cross-sector extensions.

FUNCTIONAL PROPERTIES

- Real-time monitoring of environmental and crop conditions via IoT sensors and cameras.
- Visualization of weather forecasts, field metrics, and crop imagery.
- Discovery, publication, and consumption of datasets and digital services within a federated marketplace.
- Secure data exchange between independently operated dataspaces (DigiAgro DS and AgroScience DS).
- Role-based access and dynamic policy enforcement for data usage and service invocation.

DS2 | AGRICULTURE

Demo site: Greece

PRECISION AGRICULTURE

MODULES USED IN THIS USE CASE

DS2 DARC

Added Value: Chatbot to help participants of dataspaces to deploy and configure modules.

DS2 Data Share Controler

Added Value: Continuously monitors, logs, and controls data-exchange operations between DigiAgro and AgroScience dataspaces.

DS2 Model Development Toolkit

Added Value: Trains and deploys AI/ML models for irrigation optimization, pest prediction, and yield estimation.

DS2 Curation

Added Value: Validates, annotates, and enriches data before publication to ensure metadata consistency across dataspaces.

DS2 Data Detection and Transformation

Added Value: Normalizes sensor data into standard acceptable value ranges.

DS2 Edge-to-Cloud Connection

Added Value: Collects IoT and sensor data at the edge and securely transmits it to the DigiAgro cloud for aggregation.

DS2 DRM

Added Value: Provides blockchain-backed proof of data usage rights and access logs, guaranteeing data sovereignty.

DS2 Policy Agreement & Enforcement

Added Value: Defines and enforces who can use data ensuring compliance with farmer consent and dataspace policies.

DS2 Orchestration

Added Value: Coordinates workflows between DigiAgro and AgroScience dataspaces, automating data movement, service execution, ML inference and human feedback.

DS2 Sovereignty Decision Support

Added Value: Allows DigiAgro and AgroScience participants to evaluate data-sharing risks and make informed, sovereignty-aware decisions before exchanging data.

DS2 | AGRICULTURE

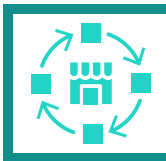
Demo site: Greece

PRECISION AGRICULTURE

MODULES USED IN THIS USE CASE

DS2 Culture and Language

Added Value: Allows Greek-speaking users to interact with DS2 services via natural language, mapping agricultural terms to ontologies for improved data discovery and cross-dataspace interoperability.



DS2 Data Marketplace

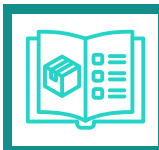
Added Value: Enables DigiAgro and AgroScience to offer agricultural data and AI services as discoverable products for authorized users under defined terms.

DS2 Portal

Added Value: Provides DigiAgro and AgroScience a single entry point to manage their organization and access DS2 services, including IDM, Catalogue, DRM, DARC, and the Marketplace.

DS2 Identity

Added Value: Enables DigiAgro and AgroScience to verify identities and issue credentials, ensuring only trusted organizations access cross-dataspace services.



DS2 Catalog

Added Value: Enables DigiAgro and AgroScience participants to expose data assets and services for discovery by authorized users across data spaces.

DS2 IDT Broker

Added Value: Provides the local runtime for deploying and managing DS2 modules and connectors within each Precision Agriculture data space.

DS2 Containerisation

Added Value: Automates DS2 module deployment on the IDT runtime, helping DigiAgro and AgroScience install and manage services more efficiently.

DS2 Policy Creation

Added Value: Manages data-sharing policies to ensure agricultural datasets and services are accessed only under agreed usage, governance, and compliance rules.

DS2 | AGRICULTURE

Demo site: Greece

PRECISION AGRICULTURE

COMPLEX DATA LIFECYCLE AND REGULATORY COMPLIANCE TESTING

Precision Agriculture creates federated learning scenarios requiring distributed data control across agricultural cooperatives.

BEFORE & AFTER DS2

Before DS2: High-quality agricultural data from field sensors, satellites, and weather models remained fragmented across isolated systems, restricting farmers and agronomists from accessing the integrated, real-time insights needed for sustainable precision farming.

After DS2: A secure federated marketplace called AgroNIT seamlessly connects distinct agricultural dataspaces, empowering stakeholders to exchange real-time IoT data and edge-trained AI models to make smarter, data-informed crop management decisions.

USE CASE PARTICIPANTS

CROWNEST

UNIVERSITY OF THESSALY

MORE INFO

www.dataspace2.eu/precision-agriculture

DS2
DATA SPACE | DATA SHARE

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101135967.