



# Agrimed

Data sharing for the sustainability of the agricultural sector



i4Trust – Data Spaces for effective and trusted data sharing www.i4trust.org



Smart Agrifood

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With the contribution of:



Primo Principio

## **Challenge & Context**

Agriculture is going through a moment of great transformation thanks to the proliferation of **data-driven services and technologies**; one of the most promising features of the world of data and related services is the possibility of being able to interface and increase the circulation of information and the creation of knowledge. Greater knowledge means greater sustainability and improved social conditions. The goal of Agrimed is to make this exchange easier and to create a community of services and technologies predisposed to mutual integration.

Agrimed has created a data exchange network (**Data Space**) applied to the world of Agriculture 4.0 with the following objectives: 1) allow **sustainable access** to agro-meteorological data and predictive models (DSS) of pest risk management by the whole interested farmers located in a target area; 2) **continuous improvement** of data analysis models through the insertion of phenological, epidemiological and phytosanitary data (field data) as a continuous learning feedback for the DSS models; 3) allow, by means of a data sharing approach, **minimum service cost** per each farmer and higher DSS **accuracy** thanks to the large amount of available data useful for optimum model training/tuning; 4) **sustainability valorization**: turn information into value elaborating the available data into value-added information about the sustainability of local farming to be used for territorial marketing and communication actions.

The world of agriculture is expecting a **revolution based on digital transformation** and the use of data for sustainability and resource optimization. Through IoT systems forecasting models (DSS) it is possible to **minimise the use of chemical agents**, improve product quality and **increase the quality** of work by minimising production uncertainty. Furthermore, in the context of climate change, farmers who want to maintain high-quality standards (e.g. organic crops) find themselves in a difficult situation, because "traditional knowledge" often no longer corresponds to everyday experience. The forecast **DSS models are able to predict in advance infections and pests** indicating the actual and next-future stages of pathological risks and allowing the optimal planning for treatments.

At the moment only a few steps have been taken with respect to this potential. There are a series of **barriers** that make this transformation and innovation easy to implement, especially in the context of small and medium-sized enterprises: a) access to technological systems: farmers would often need to **cooperate locally** to access large databases; b) forecast algorithms based on BigData Analytics, in order to be effective, require to work on big amounts of **data** which, for small and medium farmers, are possible only by data sharing; c) moreover farmers are not always willing to share key data perceived as sensitive information (number of treatments, type of pesticide, used, damaged plants); finally, sustainable behaviours bv specific d) farmers/groups/areas are too often not **communicated by the market** which struggles to give an effective value to the productions that invest in sustainability, lowering the carbon footprint, and improving the working conditions and healthiness of the food.

# Solution

The Agrimed project, therefore, aimed to create a Data Space that demonstrates how the exchange and **sharing of strategic data within the agri-food chain** can bring relevant benefits for farmers and for local communities: economical advantages, agri-environmental benefits, and support to the sustainability of agri-production. For these reasons, a further objective of the experiment has been to disseminate the results territorially and demonstrate how this approach, based on data sharing and cooperation, can be a best-practice to achieve agri-social innovation.

Agrimed works on creating an open ecosystem that triggers a virtuous circle in the use and sharing of agri-data within the agri-food chain. Within the **Agrimed ecosystem**, **data sharing among farmers and with third parties is safe** and regulated. Moreover, data sharing is rewarding and so **encouraged allowing the achievements of economical, agricultural and environmental benefits** already described: the agri-weather data sharing grants access to innovative digital twin services to improve smart farming efficiency and sustainability (accurate and reliable DSS models, about pest/infections risks). This innovative approach wants to overcome all the barriers currently present that hinder data sharing and consequently the innovation in agriculture which is now possible for the whole production community (small farmers as well).

Another innovative aspect of the experiment relies on the **multidisciplinary nature** of the consortium, which includes farmers, IoT and Data Analytics providers, social impact consultants and analysts. The Data Space created by

Agrimed connects **different operators/actors along the agri-food chain, creating added value through a specific contribution of knowledge and information**. The multidisciplinarity of the Agrimed network allows us to turn shared information into values (i.e. elaborating data about the sustainability of local farming and making them ready and effective for marketing and communication). Moreover, this scenario will also open up the possibility to create **new data-driven business models using data-sharing facilities** within the Agrimed network.

Agrimed methods create the conditions for 1) **favoring the agri-weather data sharing** among farmers and with third parties through mechanisms that overcome the lack of trust; 2) **favor the collection of strategic feedback from the field** (field data) thanks to particular attention to guarantee sovereignty on sensible data; 3) promote the **enhancement of the investment effort** on the market by communicating to the market the value of the social, economic and environmental impact generated by data sharing smart farming; this is possible by opening the data sharing network to **social impact analysts that evaluate SROI of the innovation** (Social Return of Investment).

Agrimed is designed to be an **open system that attracts new members** in order to increase the amount of data on which data analytics systems can be continuously powered and trained. Moreover, the data sharing between relatively close farmers contribute 1) to lowering the cost per capita for the operation of technology; 2) to creating and training new accurate smart farming models/indexes (i.e.maturation indices, production forecasts, loss forecasts) which are tremendously significant to face climate changes; 3) to valorizing best practices and sustainable techniques.

#### How it works

The figure below presents the **high-level architecture of the Agrimed technological infrastructure**: the figure shows the use case where two different platforms (of two different service providers - WiForAgri and Open Impact) are able to interact and exchange data within an i4Trust data space. In the same figure, you can see that also the farms indirectly access the i4Trust data space, acting as weather and field data providers and as a consumer of **DSS services and sustainability assessment services**.



Both WiForAgri and Open Impact Platforms **integrate the FIWARE Context Broker.** The communication between the two Context Brokers is based on Notifications resulting from Subscriptions. The IAM components check incoming notifications for proper access rights based on iSHARE-compliant policies.

WiForAgri solutions include 1) agri-weather stations and ad-hoc IoT sensors (both installed on the field) able to measure specific parameters on air, soil and plant; 2) specific web interface to allow farmers to provide field data coming

from direct field observations. The sensing nodes send different types of data to their IoT agents which update values of attributes corresponding to these metrics in a digital twin of the field where the sensors are installed. Agrimed experiments involve producers of wine and olive oil; therefore we distinguish two different types of fields, vineyard and olive grove, each with a different digital twin with its own specific attributes (many in common but not all).

**WiForAgri DSS models are tuned by means of feedback coming from the field** (some of the field data is provided by farmers). This model's tuning calibrates some weights of the mathematical models used by the DSS. After each model tuning process, the corresponding DSS (running on WiForAgri platform) delivers a new/updated risk assessment of the target pathology (downy mildew, powdery mildew or oil fly).

The WiForAgri DSS outputs are sent to the WiForAgri Context Broker and then notified to the Open Impact Context Broker. The DSS output is used to build a DSS dashboard for farmers' GUI. The Open Impact Context Broker, in turn, uses the received updated DSS output to update the corresponding sustainability assessment calculations. Only the final sustainability assessment output is notified back to the WiForAgri Context Broker and is used to build a DSS dashboard for farmers' GUI. This means that there are subscriptions in both directions between the two Context Brokers.

The shared data space and the sharing policies are obtained using iSharing technologies. As described above, farmers have indirect access to the common data space by means of the WiForAgri Platform. **Under iSHARE, it is possible to provide explicit instructions about the conditions under which data can be exchanged, overcoming the main farmers' barrier to data sharing concerning trust and policies in data management**. Farmers can hold each other to licences because they have all signed the same agreement with the iSHARE satellite thus creating a real network of trust.

## **Benefits & Impact**

Agrimed delivers tangible benefits by creating a space of trust/sharing among different agri-food actors. The main actors are 1) farmers who need DSS to be accurate and low-cost; 2) data service providers; 3) data analysts who need access to more data to demonstrate their business model.

Expected benefits are: a) lower service cost (up to 60% less thanks to data and service sharing); b) higher DSS accuracy (up to 50%); c) analytic data about the sustainability of local farming (not just storytelling) to be used for communication actions.

A relevant increase in customers is expected (more than 300% in 3 years): in each local area, we will be able to sell to hundreds of farmers (instead of the current dozens) offering advantages for all (eliminating the main market barriers: selling price, model accuracy and trust in data management).

Farms are strongly interested in **investing in affordable technologies** that support their corporate mission of sustainability and **social responsibility** and also use this assessment for **marketing** reasons.

The IT company (Primo Principio) has a strategic interest in the project that derives from the multiplier effect that the Agrimed Data Space is expected to generate in terms of the service users and market segments (lower cost per single farmer opens the smart farming solutions also for middle and small companies). The marketing company (Open Impact) has a great opportunity to obtain great visibility and "bottom-up" validation of its innovative business model whose value proposition is based on the evaluation of **SROI (Social Return on Investment)**.

Expected benefits, possible thanks to the Agrimed space of trust and sharing between different actors, are distributed among the participating SMEs. Farmers obtain lower service costs, higher DSS accuracy and analytic indexes about their sustainability to be used for communication actions. Primo Principio is expected to **raise the number of its customers** (farmers): in fact, Agrimed offers sharp advantages for farmers making services more **attractive and sustainable.** Open Impact can have full access to strategic data essential for their analysis, **opening a new market segment** for their services (the agriculture companies) by means of 3 case studies which will be disseminated during the project.

#### Added value through i4Trust

i4Trust technology has made it possible to face the challenges that characterise the development and implementation of digital agriculture services in an integrated way. **The sharing of data within a data space in** 

agriculture is the answer to the following structural problems that currently block the development of this sector:

- high costs of access to technologies
- need to constantly receive feedback data from the field for the continuous improvement of services
- need to open this data to alternative and sustainable business models

These challenges have been overcome through the technologies offered by i4Trust; in particular:

The joint technologies of FIWARE and iSHARE were used to build a data space of sharing and cooperation between farmers characterised by mechanisms of trust and openness. This made it possible to experiment with a **cooperation model that potentially manages to lower the costs of accessing data** by sharing the investment.

In addition, through the policies of use and access to data (through iShare technologies), it is possible **to modulate the level of depth of data sharing**, leaving the full sovereignty of the data in the hands of the individual farmer.

Finally, through the open standards and technologies of APIs, a cross-domain data space was created capable of **demonstrating the technological (and economic) sustainability of an innovative business model** based on the reuse of data through a third sector such as that of analysis. organisational sustainability.

The work done with the i4Trust team was intense and fruitful and the mentors and **tutoring activities have been a great added value for the realisation of the project** both from a technical and economic and business sustainability point of view.

## Next steps (if applicable)

Once the AGRIMED experimentation is finished we would like to create more opportunities to show the benefits of an integrated approach of smart agriculture and smart sustainability by proposing integrated services particularly focused on local cooperatives or territories that are more interested in knowledge sharing.

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