![i4Trust]

AgriSpace4Trust

Enabling the prosumption of data services to optimise energy inputs in olive production creating new data-driven services

Smart Agrifood

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With the contribution of:

- **Future Intelligence**

Challenge & Context

Climate change is heavily impacting the Agrifood sector, more fiercely than others. Traditional, experience-based practices can no longer tackle changing weather conditions and the consequential impact on crop health. Pest seasonality has changed due to temperature variations, while water stress is an issue in permanent cultivations.

Farmers have started investing in digital tools to mitigate weather dependent-risks. IoT has made it possible for low-cost sensor systems to perform remotely by feeding cloud applications and algorithmic models with data that alert farmers of forthcoming challenges. However, data needs appropriate interpretations conducted by a field expert, such as a farm advisor, who is often not physically available and thus cannot be blindly trusted. Moreover, data ownership and data access conditions are not only an ethical issue but also a means to create value for relevant stakeholders. Seldom do end-users really understand what "GDPR waiver" or "terms and conditions" documents mean to their privacy, security and overall data creation investment. Thus, a "download 'n' play" service-like system of software services that ensures data owners' sovereignty and the freedom to port their data and network services from one tech provider/community to another will be a must in the coming years.

In due time, the Smart Farming industry faces the challenge of not creating additional data silos. Farmers are currently reluctant to share their data mainly because there are no (business) initiatives. The market is missing on-demand subscription-based data access that facilitates an expert to provide data-driven consultation on when to apply a pesticide or a fertiliser or for a cooperative to offer its data to the nearest smart city to adjust green space' irrigation according to the area's real-time precipitation. The real-life examples of meaningful data exhaustion are countless, either within the sector or

cross-domain. Agrispace4Trust, with the support of i4Trust technical tools, must guarantee such an accountable data circularity.

Solution

AgriSpace4Trust proposes to create data hubs - supported by i4Trust data space- that (re)use local weather stations or agro-environmental sensors and opens them to a wider community of local users.

This way, opinion leaders and tech-savvy farmers will invest in buying specialised equipment as they already did but they now have the opportunity to share their data with anyone they would favour, including cooperatives and farm advisors/agronomists, if only the latter are authorised. Then, agronomists, for example, would need to access this local data space to access raw data and metadata, making their advisory services more precise, accurate and fitted to the real-time microclimate conditions of the area. Data and data services offered to the local data hub must be compliant with GDPR, easily findable, accessible, identifiable, reusable, and, thus, credible. Thus, data consumers won't be lost in the usual open data repositories' mesh while subscriptions to data owners will guarantee modern and constant access to real time data. On top of this, data owners (IoT equipment holders) will make use of the data sharing services designed, developed, or integrated within i4Trust to share their device's data on-demand and transform their hardware assets to pay-per-demand data services that serve the proximate community. Last, AgriSpace4Trust will create an open-source Software-Agent Enablement Framework to interoperate with various vendor data models in order to eliminate the possibility of vendor lock-ins or business discontinuities. That said, the replicability of AgriSpace4Trust can act as a trusted intermediary layer that agtech providers have to follow to ensure solutions' interoperability and exploitability in the long term.

Practically, AgriSpace4Trust will resolve two usually encountered problems when FINT commercialises a smart farming solution that consists of hardware and software units. Often, cooperatives (SOlives) decide to invest in weather stations but individual members don't embrace it even if they understand the value of real-time farm data. In this occasion, there is a black-or-white approach: either individual farmers (as external users of the systems) have access to the data-creation equipment or they do not. What AgriSpace4Trust aims to bring is *a la carte* access to data for authorised individuals under a

subscription scheme that compensates the cooperative (the data owner). Secondly, AgriSpace4Trust shall reduce vendor lock-ins by implementing a third-party trust bubble brought by SG with all the required agents/ adapters, data platform and infrastructure. In detail, every tech provider would be invited to interoperate with the AgriSpace4Tust framework, so it can successfully launch its service. This way, future issues on the services' maintainability will be decoupled from potential solution providers' business discontinuities (e.g. bankruptcies, limited after-sales support) while data portability and interoperability are automatically (i4Trust-powered) proven.

How it works

AgriSpace4Trust created three instances each, one for every actor envisioned in the i4Trust experiment's proof of concept (the operating/orchestrating entity, AgriSpace4Trust; farmers as data providers and service consumers; agronomists as data consumers and service providers). The data models follow FIWARE's ontologies but they are upgraded so they make use of linked data following the latest NGSI-LD specifications. In addition, iSHARE integration and the Satellite service validate access, authorization and account control and manage the underlying policies.

The diagram and the paragraphs below describe the chain of relations that are happening in the Minimum Viable Product (MVP) application that was built over the last nine months. The consortium partners' roles are also described.
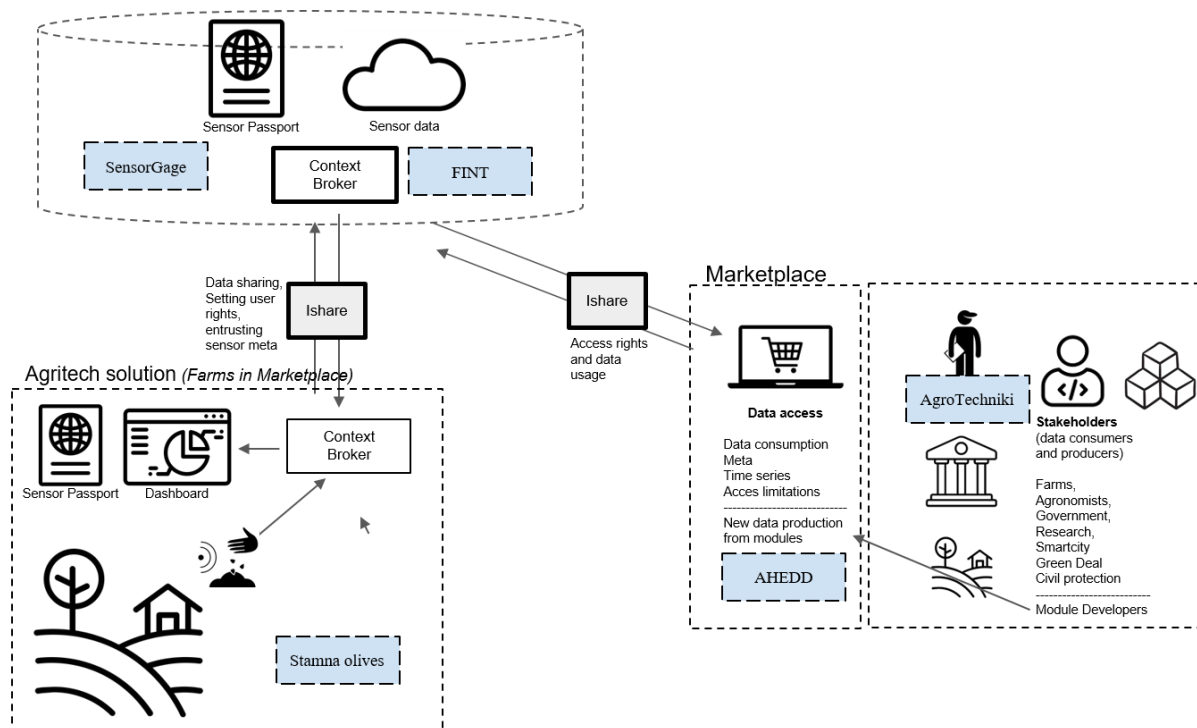
Figure 1. AgriSpace4Trust conceptual Architecture

- **Future Intelligence (FINT)** - a FIWARE expert, iHubs operator (Hellenic FIWARE iHub) and co-founder of ahedd- designed, implemented and tested the associated AgriSpace4Trust software that includes software-agents (adapters) and incorporates a new instance of the current IoT platform to i4Trust ecosystem. With the support of SG, FINT deployed and operates the required i4Trust Building Blocks so data sharing occurs. Moreover, FINT brings in an existing multi-stakeholder agri-food community equipped with IoT weather stations and sensors, and data services like weather forecasts to the Agrispace4Trust Data Marketplace.

- **SensorGage (SG)** connected to incoming data feeds from provider entities as defined by iShare to screen data consistency and quality as per thresholds, measurement alignments expected per IoT hardware measurement type. The purpose of this was to improve the comparability of datasets from different providers such that the value of the data marketplace is based on common standards. The screening also integrates reviewing of the frequency of measures such that GDPR risks were avoided.

Finally, SG promotes the benefits delivered by the AgriSpace4Trust marketplace in terms of protection of data ownership and data accessibility through rights allocation to local stakeholders in Southern Holland.

Stamna Olives (SO), data and IoT equipment owner, offers raw data to the community wishing to reap economic benefits and consume data services e.g. irrigation schedules.

- **AgroTechniki (AgroT),** a reputable farm advisor in the area, consumes data to offer more accurate farm consultancy services. Data on wind, air and solar radiation enable agronomists to assess accurately the water index as well as the potential appearance of insects, fungi or pests in the cultivations. AgroT mainly works with olive producers and fruit and vegetable growers in the region of Western Greece.

- **Attica's Hub for the Economy of Data and Devices (ahedd)** spreads the word about the i4Trust community and its Data Marketplace in the areas where the experiment takes place and beyond. In Western Greece, there is a critical mass of food processors that exploit the outputs of these fertile lands while their involvement in Data Economy is in its infancy, still. Thus, ahedd may present, train and offer them services on how to be part of the under-development data ecosystem and relevant benefits. Moreover, ahedd communicates how AgriSpace4Trust data space affects other sectors in the proximity such as the protection of biodiversity since SOlives olive groves are just next to a Natura-protected lagoon. Apart from the Environmental sector, ahedd exploits its strong ties with Academia, Public and Industry to present the building blocks and pivot AgriSpace4Trust to other markets such as Smart Cities, Smart Energy, and Services and Manufacturing.

Benefits & Impact

AgriSpace4Trust will transform a commercial IoT solution (QUHOMA) to an i4Trust-enabled data space creating added-value services and revenue streams for the currently involved actors and creating innovative data services for additional players. Moreover, the complementary team will pivot the AgriSpace4Trust to a new customer base by federating its services to the i4Trust framework, exploiting the multi-disciplinary background of its

members and providing new data-circulation modules.

Moreover, the experiment engages a third-party service provider that adds a SensorPassport as a service currently exploited in the Smart City domain. This meta-data layer also ensures trust between the sensor/IoT provider and the sensor owner and it is highly relevant to other markets as well (logistics, crisis management, nature and environment preservation).

AgriSpace4Trust tech partners (FINT, SG) come from different markets, Agrifood and Smart Cities. Both being in the IoT value chain they hold complementary positions. The value of AgriSpace4Trust is not limited to the agricultural sector. Data from farms on soil humidity (or lack of) is highly relevant to the civil protection ecosystem for considering the risks of fires. It is relevant to local regions/councils on water management.

Farming data time series is valuable to the food processing industry as it helps forecast the level of supplies and is even relevant for large-scale remote sensing and Copernicus world covering satellite earth observations as the datasets can be used for (near)real-time model validation and optimisation. As an example, AgriSpace4Trust shall push and pull data (air/soil/solar/wind/solar conditions, weather forecasts, extreme events) from and to existing open data portals of the proximity (www.data.gov.gr, https://geodata.gov.gr/, https://fdlmes-ckan.getmap.gr/en).

The AgriSpace4Trust team inspired the project from a commercial need in the agriculture domain. It creates a virtuous data circularity among solution and service producers, data owners and data consumers, monetizing the sharing of secure, authorized and accountable data. Then, the outcome of a software sandbox add-on embedded as a service in the QUHOMA application reaches hundreds of farmers already in the community, engaging their partners like

agronomists, input suppliers, buyers, and later regulators. So, AgriSpace4Trust provides the dynamics for a successful marketplace and the network effects that on-boards a wider range of participating stakeholders. Moreover, the project enables software providers (FINT, SG) collaboration with i4Trust tools so that it validates the data lifecycle. Having created the quality assurance of the gathered data, the platform will activate their connections with open data portals of Smart Cities, Environmental Monitoring, Mobility and Energy across EU.

Added value through i4Trust

AgriSpace4Trust uptakes i4Trust tech mix that ensures the trust level and protection of sovereignty of data as a facilitating factor to onboard an increasing amount of data providers breaking their stand-alone data silos. Thus, SOlives, the sensor owner, shares data with authorized partners exploiting i4Trust tools for revenue-sharing adding extra income. AgroT and other data seekers, gain access to an aggregated set of tools and channels to valuable sources of information with pay-per-use terms. This way, costs for data consumers are low while there is elasticity over accessing real-time versus historical data or datasets per season. In addition, FINT increases the value of the data market realized in QUHOMA, involves new unique users on the app and commissions the additional revenue-sharing services. SG enhances its cross-sector service offering with new features provided by iSHARE while the i4Trust Satellite service enables it to launch AgriSpace4Trust services to other federated data spaces.

AgriSpace4Trust starts from a technical (open-source and CEF-adopted) approach to transform the business models of the involved partners. The differentiation lies in the trust, access control and revenue-sharing that AgriSpace4Trust supplies to data owners. Insights from data analysis could be greatly improved for their benefit when agronomical models (from advisors) are available and implemented as modules (from tech providers). The use of context broker and smart models (TRL6 to TRL8) facilitate comparability and

discoverability of datasets, and the association of iSHARE ensures that data ownership is protected, accessibility rights are respected, and data consumption is accounted for.

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Categories

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farmers, advisors, value chain stakeholders (certifiers, processors, traders, distributors), tech providers, regional/ municipal DPOs

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