

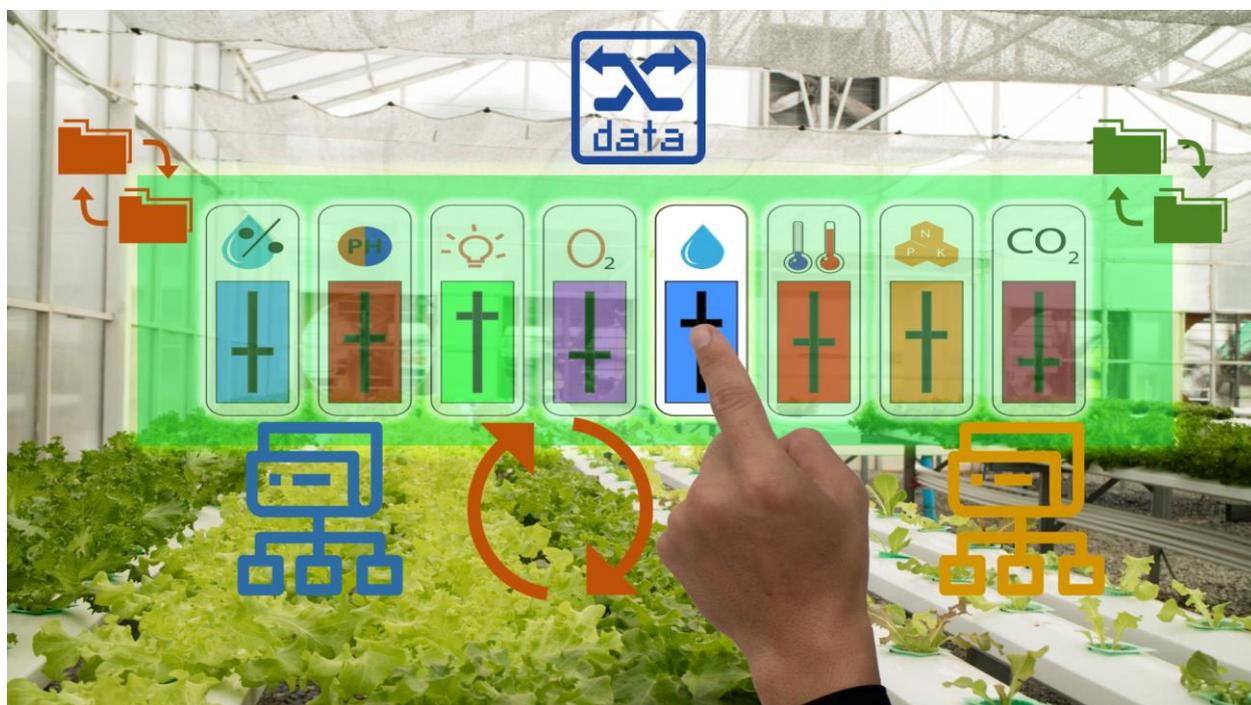
# Data sharing in agriculture. Towards a European agriculture data space.

Online workshop

10 June 2020, Webinar

Co-organised and supported by the Alliance for Internet of Things Innovation (AIOTI)

## Workshop Report



# 1. EXECUTIVE SUMMARY

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## Publishable summary

Recent years have seen an increasing interest in the use of digital technologies as tools to contribute to the wide sustainability of the agri-food sector. Precision/smart farming, Agriculture 4.0, and the like are concepts no longer attached to academic research, but they have been making their way through the market and the real life of farmers during the past years. Smart farming techniques supported by new technologies such as Artificial Intelligence, Robotics, IoT, drones and Big Data play a key role in streamlining and making processes more efficient, resulting in a cost reduction for farmers, improving soil management and water quality, reducing the use of fertilisers, pesticides and GHG emissions, improving animal health and wellbeing, and creating a healthier environment for biodiversity, farmers and citizens. As a direct consequence, this can also lead to the creation of new products and services that farmers and their cooperatives, by being better skilled and equipped, will thus be able to provide to the society as a whole. Moreover, agricultural robots and Artificial Intelligence are helping to tackle some of the labour shortages in rural areas, helping to handle essential agricultural tasks such as harvesting crops or milking cows. Clearly, digital technologies bring a positive impact in farming productivity and environmental footprint, in line with the Sustainable Development Goals (SDG) and climate change strategies.

In addition, digital technologies play a strong role in enhancing food traceability throughout the whole food chain addressing food safety, fraud prevention, compliance with certifications and regulations, etc.

At the heart of this digitally-enabled revolution in the agri-food sector it is the data, which comes from multiple sources: remote sensing platforms, weather forecasting services, raw material market prices and especially from the Internet of Things (IoT) gathering data directly from the field and the farm through sensing devices and connected machines (tractors, their implements, and smaller agri-robots). This new paradigm paves the way also to new data-driven business models for agriculture and kickstarts the interest in data sharing mechanisms that can fully exploit the value of data for the benefit of the agri-food sector.

In this context, CREATE-IoT as part of the IoT Large-Scale Pilots Programme with support of AIOTI (Alliance for Internet of Things Innovation), DG CONNECT and DG AGRI, organised a workshop to gather views from stakeholders on the possibilities of establishing a European Data Space for the agri-food sector, in connection with the European Strategy for Data.

The workshop was organised in two sessions, gathering more than 140 attendants. The first session addressed the current framework for data sharing in the European agri-food sector by focusing on the “EU code of conduct on agricultural data sharing by contractual agreement”, which reflects the agreement of the main stakeholders on the principles that should regulate agricultural data sharing, building trust for the farming sector from the very beginning. The workshop reviews current initiatives built upon the code of conduct.

The second session of the workshop was devoted to the technical aspects needed to make agriculture data sharing a reality. From high-level generic architectures to practical implementations in real agri-food use cases, the workshop discusses about technologies, architectures and standards that are needed for achieving a true European data space for agriculture.

An online questionnaire was also conducted for gathering further views from the EU stakeholders on key aspects of the agriculture data spaces.

## Non-publishable information

None, the document is public.

## 2. INTRODUCTION

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### 2.1 Purpose and target group

The overall objective of the workshop is to gather views from different EU stakeholders on current experiences and possible implementations of data sharing in the agri-food sector, looking forward to the implementation of a European-wide agriculture data space in line with the European Strategy for Data. Hence, the main target groups of the workshop are:

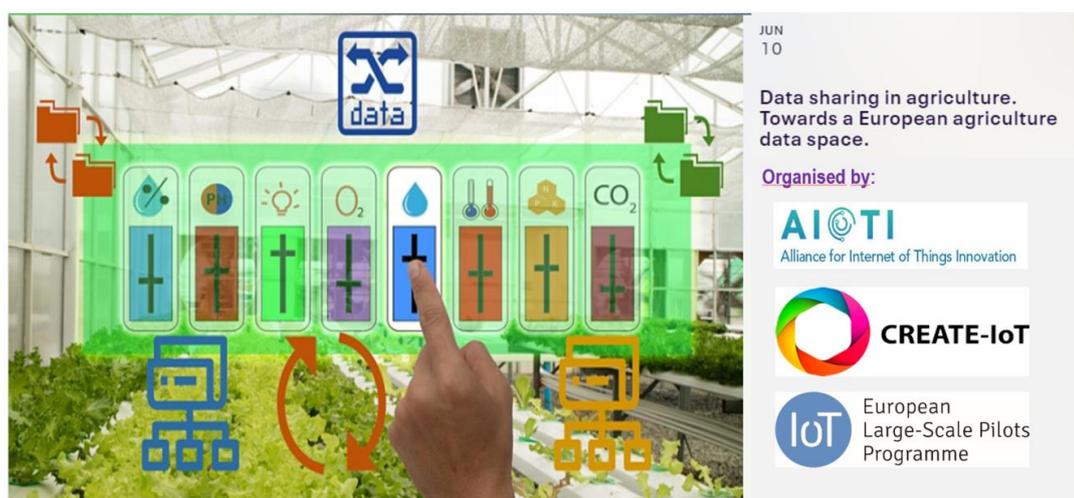
- Organisations in Europe involved in the definition of the framework for data sharing in the agri-food sector
- Public officials involved in EU/national programs for the support/implementation of agriculture data sharing
- Private initiatives building data sharing platforms and systems for the agri-food sector
- H2020 projects and other consortia developing data sharing architectures and tools for the agri-food sectors

The event was organized within the framework of activities of CREATE-IoT project falling under WP01 on Coordination and Support to the IoT Focus Area.

## 3. WORKSHOP OBJECTIVES

### 3.1 Workshop description

In the context of the EU Strategy for Data released on February 2020, the European Commission is gathering views from different stakeholders to gain insights on how to build a European data space for the agri-food sector. CREATE-IoT, as part of the IoT Large-Scale Pilots Programme with support of AIOTI (Alliance for Internet of Things Innovation), DG CONNECT and DG AGRI, organised an online workshop to provide a structured input.



The workshop was organised in two sessions. The first one addressed the current framework for data sharing in the European agri-food sector by focusing on the “EU code of conduct on agricultural data sharing by contractual agreement”, which reflects the agreement of the main stakeholders on the principles that should regulate agricultural data sharing, building trust for the farming sector from the very beginning. Two of the main promoters of the EU Code of Conduct, COPA-COGECA and CEMA, participated in the session. A researcher from Wageningen University provided a reflection on the Code from a more societal point of view, and some of the current initiatives built at national level upon the code of conduct were reviewed, in particular from Germany, France and Spain.

The second session of the workshop was devoted to the technical aspects needed to make agriculture data sharing a reality, focusing on technologies, architectures and standards. The session discussed about high-level generic distributed architectures, reviewed the current approached by the two flagship H2020 digital agriculture projects, and presented real implementations by the private sector.

The workshop was fully conducted online, gathering more than 140 attendants.

In addition, an online questionnaire was launched for gathering further views from the stakeholders about key aspects of the agriculture data spaces. The results are also reflected in this report.



## 4.2 Overview by the EC DG CONNECT and DG AGRI

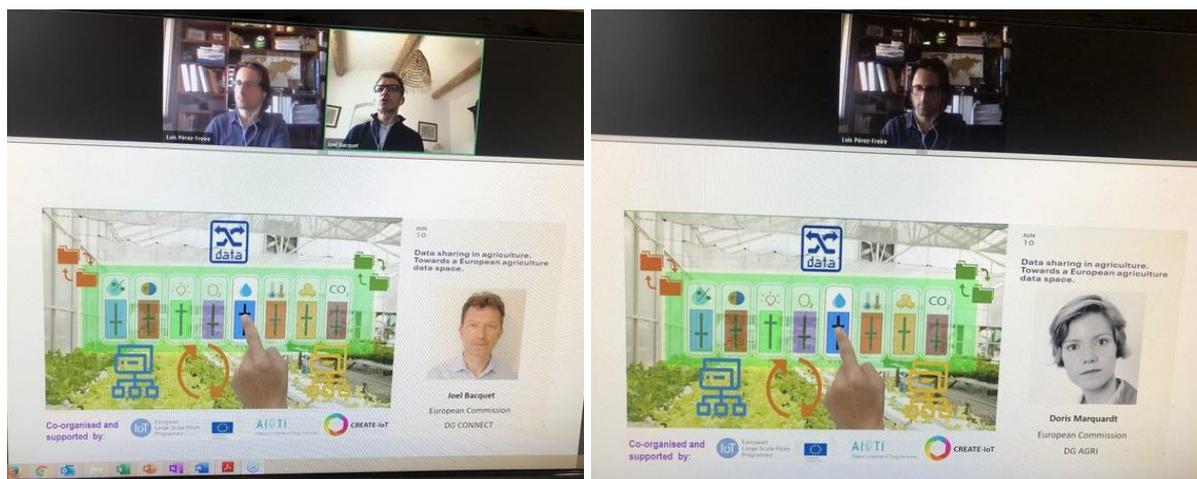


Figure 2: Joel Bacquet and Doris Marquardt, from DG CONNECT and DG AGRI, respectively, during their opening remarks

Joel Bacquet, from Unit E4 (Internet of Things) at DG CONNECT, elaborates on the links of the workshop to the policy context of the European Data Strategy [3], which is built on top of four pillars:

1. Cross-sectoral governance framework for data access and use
2. Enablers: investments in data and strengthening Europe's capabilities and infrastructures for hosting, processing and using data, interoperability
3. Competences: empowering individuals, investing in skills and in SMEs
4. Common European data spaces in strategic sectors and domains of public interest. Agriculture is envisaged as one of these strategic sectors.

The European data spaces a single market for data where data can flow among different parties, in a way which is fair and creates value for all stakeholders and strategic sectors in Europe. The workshop comes very timely in terms of policy development, and Mr. Bacquet remarks the interest of DG CONNECT in the outcomes of this workshop.

Doris Marquardt, from Unit B2 (Research and Innovation) at DG AGRI, remarks that digitalisation is at the core of the EC strategy for modernisation of the agriculture. It can be a crucial enabling factor for achieving the major objective of agricultural sustainability in the long term, increasing the competitiveness of the agri-food sector as well.

Mrs. Marquardt emphasizes that trust in data-sharing is an essential element to trigger and accelerate digitisation of agriculture.

## 5. THE FRAMEWORK FOR AGRICULTURE DATA SHARING

This section provides the notes from the presentations during the morning session of the workshop.

### 5.1 Code of conduct for agricultural data sharing by contractual agreement

The screenshot shows a presentation slide with the following content:

- Title:** EU code of conduct on agricultural data sharing by contractual arrangement
- Key Message:** Transparency, defining responsibilities, creating trust!
- Key Points:**
  - Right on data produced on the farm or during farming operations is attributed to the farmer and may be used extensively by him/her;
  - Leading role in controlling the access to and use of data from their business
  - Benefit from sharing the data with different partners
  - It addresses, portability of data, opt out, sensitive information, security, etc;
  - National codes (e.g. FR);
  - Referred in the Commission data strategy;
- Logos:** fertilizers europe, copacogeca, EFFAB, European Crop Protection, CEJA, FEFAC, ESA, CEJA, FEFAC, ESA, CEJA, FEFAC, ESA.

Figure 3: Excerpt of the presentation by Daniel Azevedo. COPA-COGECA, agricultural technology director

COPA-COGECA [4] is the representative of the European farmers and agri-food cooperatives. The farming community is a key player within the Green Deal framework and the agri-food chain is a relevant driver of the EU economy.

COPA-COGECA is one of the main promoters of the Code of Conduct for agricultural data sharing by contractual agreement [5], which is arguably the first attempt at defining a framework for data sharing within an industry sector.

Key messages:

- Digital technology can help in resource optimisation not only at farm level, but throughout the whole food chain
- Digital technology needs to clearly demonstrate value created and this value must be retained by the farming community, not only by the rest of the food chain. This is regarded as a key requirement.
- Strategy (not technology) must be the real driver for digital transformation
- The Code of Conduct was intended to agree on the main principles for building trust in data sharing by the agri-food sector:
  - Providing transparency to data sharing mechanisms
  - Attributing the rights over the farming data to the farmer (data ownership), and providing a leading role in controlling the access and use of his/her data (data access, control and portability)
  - Clearly identifying responsibilities in terms of liability and intellectual property rights, and also in terms of privacy and security.

## 5.2 Society relevance of data sharing: reflections beyond the Code of Conduct

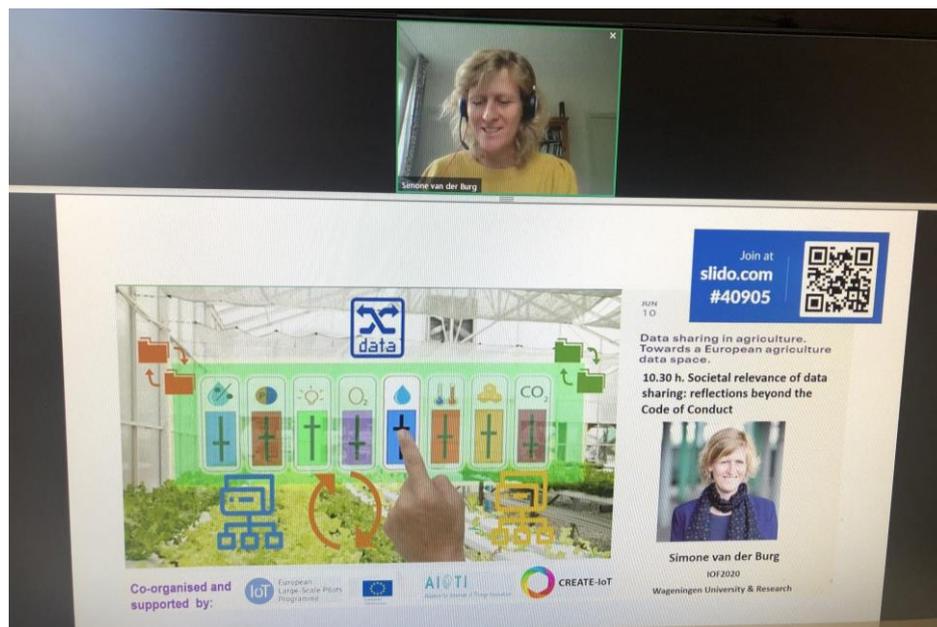


Figure 4. Excerpt of the presentation by Simone van der Burg. Wageningen University & Research. IoF2020 work package leader.

### Key messages:

- Whereas GDPR is for personal data, non-personal data falls under the umbrella of the Free-Flow regulation of non-personal data [6].
- The Code of Conduct seeks to provide trust through a contract
  - Main strengths perceived
    - It is proposed and agreed by actors in the agri-food ecosystem
    - It is a serious attempt at protecting personal interests, rights and freedoms
    - It proposes a practical and concrete solution: a contract
  - Main weaknesses perceived
    - No specific attention is paid to societal values affected by data sharing
    - Business point of view, not a citizen-self-regulator point of view
    - Possible problem of scalability as network of data sharing actors expands
- To go beyond the EU CoC, a layered approach is proposed.
  - Data shared on platform are seen as “commons”
  - Contracts are made when data originators share data on a platform
  - Based on “play rules” that include the use of the data for societal goals
  - Consider the societal purposes of sharing agriculture data: e.g. for monitoring how digital farming contributes to realize the production of higher quality, safer food, with less burden for the environment. Consider the possibility of data access for policy makers, researchers and other actors.

### 5.3 Strategy for full deployment of agricultural machinery data sharing

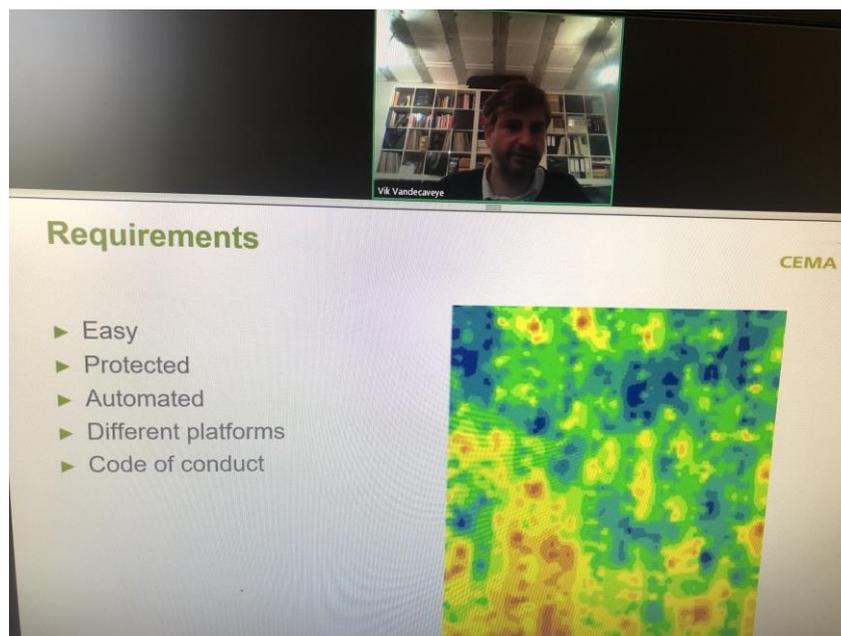


Figure 5. Excerpt of the presentation by Vik Vandecaveye. CEMA, chair project team “Digital Farming”. CNH Industrial, Mgr Advanced Data Analysis and Application Development.

CEMA is the European Agricultural Machinery Association [7], one of the main promoters of the Code of Conduct [5] together with COPA-COGECA. CEMA has presented recently a position paper [8] with its strategy to implement data-sharing by the agricultural machinery industry.

#### Key messages:

- Agricultural machinery already generates large amounts of farming data. They also need to be fed with data to optimise farming operation.
- Data sharing is seen as an essential element to achieve the full potential of digital farming. To be successful, this sharing must be easy and automated, but of course providing a high degree of data protection.
- Technical mechanisms for data sharing must stay in line with the Code of Conduct.
- Data sharing should be restricted to data sets with clear value, minimizing the amount of data exposed.
  - Define governance scheme supporting different types of data with different protection/access levels. For example: 1) highly protected data for farmers only, 2) certified data for proof of compliance, 3) open data, ... The levels need to be defined in collaboration with the farmers and eco-system participants.
- The cloud must be the entry point for accessing the data, not the machine.
- Sharing/communication between different platforms (from different manufacturers) must be supported.
  - Keep the number of allowed data formats to a minimum, to facilitate compatibility.
  - Use standard APIs. Currently working on developing standards (AEF, AgGateway, ETSI) and EU projects (IoF2020, ATLAS)
- Rely on certification for guaranteeing standardisation and security, thus increasing the trust level on data sharing.

## 5.4 National approaches to agriculture data sharing

This section brings the perspectives of three EU Member States on the national adoption/promotion of data sharing in agriculture.

### 5.4.1 Germany

#### Questions about data sovereignty, data security and the provision of data.

- Agricultural machines generate a lot of data.
- Farmers are primarily entitled to the **right of use** of this data.
- The BMEL supports and promotes an **open and transparent data use** in agriculture which serves both farmers and the common good.
- Currently conducted: **Feasibility study**



Figure 6: Excerpt of the presentation by Steffen Beerbaum, Joschua Möhring and Jürgen Stephan. German Ministry of Food and Agriculture.

Three representatives of the German Federal Ministry of Food and Agriculture (BMEL) presented the German approach and current status to support agriculture data sharing.

Key messages:

- The German BMEL supports and promotes the adoption of data sharing in agriculture both for the benefit of the farming sector and for the common good.
- The German BMEL is currently conducting a feasibility study on how to build a digital environment that supports those objectives.
  - Looking into technological aspects but also legal and data governance aspects.
  - Involving all the relevant stakeholders: farmers, authorities, companies, etc.
  - First results of the study will be released by Fall 2020
- A federated digital infrastructure is envisaged to be built on the GAIA-X initiative, jointly with France
  - Agriculture is one of the 8 domains considered
  - Two parallel workstreams: 1) technical foundations, and 2) user perspective
- Identification and selection of agriculture use cases is currently ongoing
- Relevant aspects under consideration:
  - Data sharing and storage
  - Ownership/sovereignty of data
  - Data availability and interoperability
- There is a roadmap established for performing a consultation to Member States during Germany's Presidency of the Council
  - Based on the European Data Strategy
  - Taking stock of the experiences gained with the Code of Conduct
  - Consulting Member States in the summer
  - Organising a EU conference on digital transformation in agriculture on 2<sup>nd</sup>-3<sup>rd</sup> December 2020

## 5.4.2 France

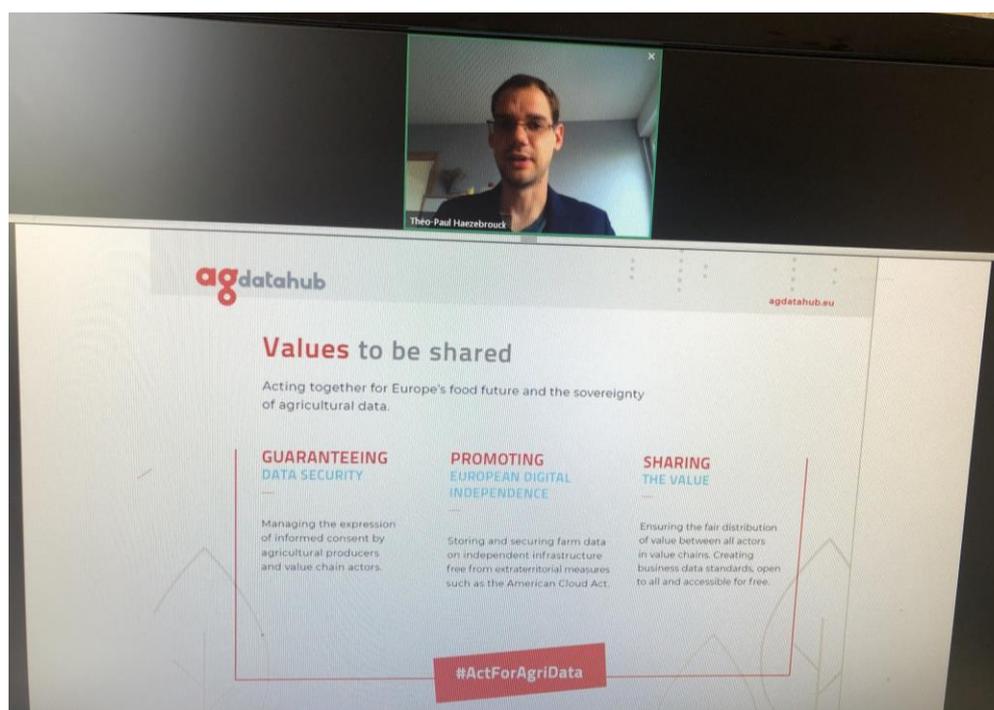


Figure 7. Excerpt from the presentation by Théo-Paul Haezebrouck, Agdatahub, Products and Services Manager.

One representative of the French public-private initiative AgDataHub [9] tells the experience of an operational infrastructure for data exchanges in the agri-food sector at national level.

Key messages:

- Agriculture is one of the sectors most affected by the digital transition. Facilitating the access to and use of agricultural data is crucial in attaining a sustainable and efficient agriculture.
- The objective is to create value to farmers, food industry and consumers by meeting the needs of all of them
- Two main pain points are addressed:
  - Providing a shared (decentralized) technological infrastructure to send and receive data in an industrial, secure and standardised manner, while respecting the consent of the farmers (when needed). Use cases supported encompass open data, data exchange for private partnerships or commercial exchanges, etc. all across the food chain.
  - Agri-consent
  - Lead a collective reflection on the informed consent of agricultural producers to reach a consensus on farmer consent governance, in the respect of the European Code of Conduct and the French label Data-Agri [10]. This will lead to operational tools to manage the farmer consent and allow him to have an overview on all given consents in the solutions ecosystems.
- Access and use rules over the data, as well as the management of consent, can be done through simple interfaces: api-agro, agri-consent.
- Rely on a network of partners all over the territory, close to the actors on the ground, for promoting and integrating solutions based on data sharing.
- Identity of the stakeholders (farmers, solutions providers, data providers, ...) is a new challenge to be taken account to increase trust and security in the digital agricultural ecosystem.

### 5.4.3 Spain

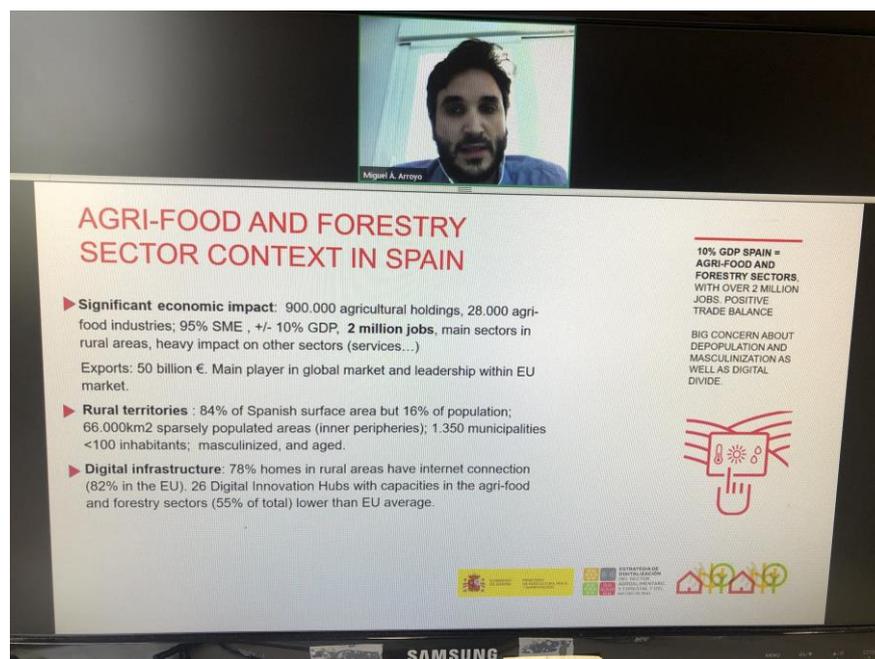


Figure 8. Excerpt of the presentation by Miguel Ángel Arroyo-Alcaraz. Spanish Ministry of Agriculture, Fisheries and Food, Sub-Directorate General of Innovation and Digitalisation

#### Key messages:

- Agri-food and forestry sector have a significant economic impact in Spanish economy, reaching 10% GDP.
- Digital technologies are seen as an essential element towards agri-food sustainability. In particular, the Spanish Administration is developing guidelines for digital and data sharing aspects. In 2019 released the National Digitisation Strategy for the Agri-food and Forestry Sector and Rural Areas [11]. This strategy is starting to be implemented currently according to a 2019-2020 action plan [12].
- Three main elements in the national digitisation strategy:
  1. Narrow the digital gap
  2. Foster data use both by public administration and private actors
  3. Boost business development and business models
- Regarding objective 2 (foster data use) a number of actions are being put in place, such as:
  - Dissemination of the Code of Conduct in the ecosystem
  - Promote open data in the Public Administration through the creation of an open data MAPA (Spanish Ministry of Food and Agriculture, Fisheries and Food) catalog, and advance harmonization of published data in order to increase its value
  - Boost adoption of digital farm logbooks
  - Foster the adoption of digital technologies for CAP monitoring with interoperable data
- Efforts are needed at all levels: EE, national, regional

## 5.5 Discussion

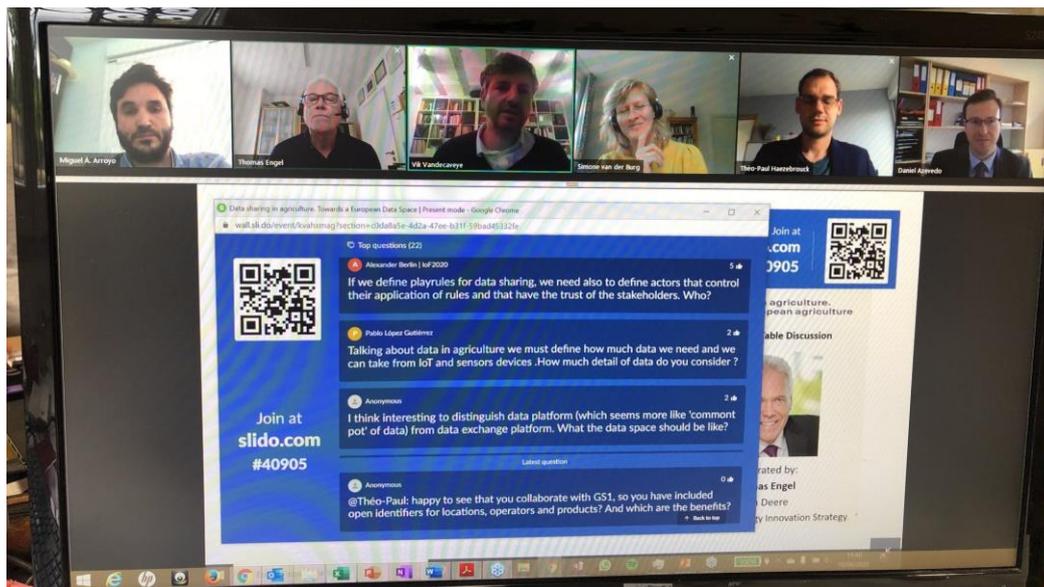


Figure 9. Roundtable discussion moderated by Thomas Engel. John Deere, Manager Technology Innovation Strategy (TE)

Question 1 (Alexander Berlin) If there are play rules, there is need of someone that controls that such rules are followed. Who should be?

- VV: certifications should help to check compliance with the rules.
- SvdB: It should be within the community. Interest in how Germany is approaching this element in GAIA-X.
- SB: It should be the ecosystem that should define these rules. Ongoing discussion currently with stakeholders from different subdomains
- TPH: We must clearly separate governance of data and governance of the tools
- MAAA: The focus on data governance must reflect the interest of farmers and set play rules fair for all.

Q2: Distinguishing ‘data platform’ from ‘data exchange platform’. How should the data space be like?

- VV: one platform will not suite everyone nor every application, so the existence of different platforms is and will be a reality. Same rules should be applied across all platforms
- TPH: Importance of interoperability in data exchange. The EU data space should integrate the approaches of eIDAS regarding identification
- DA: good connectivity is a key enabler in order to ensure data movement from one platform to another creating a highway

Q3: How important is data sovereignty to your farmers?

- DA: This has been the driving question behind the EU CoC. The interests and consent of farmers should not limit the usability of the data that is shared, but the farmers must have enough control on the data as the data sharing mechanisms are not yet fully understood.
  - TE: If you provide value to the farmer, fears of sharing data or having data on the cloud are reduced. The key is to ensure that farmers get their fair share of the value that is being created through their data. Trust is the essential building block.
  - SvdB: Importance of the meaning of “fair share”, which does not necessarily mean the same for everyone.
  - TPH: No clear answer, although the benefits are not always quantifiable in economic value

- DA: Value created by data sharing is not always economic. One example is traceability, where all parties gain. But farmers and agri-cooperatives must benefit from this.

Q4: Who is considered data originator? What benefit of data ownership is to be regulated? Any need to change current GDPR?

- SvdB:
  - ‘Data originator’ can be a misleading term. It potentially can be the farmer, the advisor (e.g. using a digital tool to generate data) or other actors, depending on the case.
  - ‘Data ownership’ can also be misleading. It is preferable that we use ‘data sovereignty’, because ownership brings along an “exclusivity” concept that does not apply to data. “Sovereignty”, instead, reflects much better the shared access element.

Q5: What is the sentiment among stakeholders regarding the willingness to participate in digitalisation and how much are they ready to investigate?

- DA: Willingness is there, but you need the EU framework that will enable investments to realise the transformation.
- TPH: Own experience is that there is a clear will, and actors and platforms are organizing themselves to interoperate.

Q6: Do you think the cover of internet in rural areas limits the implementation of digitisation. Is that possible in EU level a update of basic construction in such area?

- VV: It definitely has an adverse effect. But we also need to note that all over the world, Europe has the best telecommunications infrastructure. If we look at the statistics, only an estimated 10% of farmers is using an FMIS (farm management information systems, i.e. the main farming software package). This low percentage cannot be attributed to the lack of mobile coverage. There are other, more important factors to be addressed.

Q7: Do you see a window of opportunity for value driven agriculture systems, by for example including citizen/nature/true costs accounting NGOs as stakeholders?

- VV: This is a difficult question to answer in one paragraph, and my answer is strictly personal. The fact that agricultural policies are set at the European level and the fact that it uses the largest piece of the European Budget indicates its sensitivity. The main goal is to provide affordable food to everybody, regardless of country, etc. This is a basic right that Europe wants to protect, not only for the health of the people, but also for the peace that we are experiencing today. On the other hand, I believe that more data will allow tighter control of supply chains, avoiding waste and making food supply more efficient. Data is a tool to mitigate risk by managing variabilities. And this comes on top of the increased operational efficiencies in the field. Data is usually the first step. To measure is to know. Then it is up to the policy makers to turn it into something better for the farmers and the community. And with climate change already showing its effect on crop yields, facts to support the right decisions will be needed more than ever. This is where CAP and “true cost” come into play.

Q8 to Vik Vandecaveye: are you using IOTA distributed ledger technology?

- VV: This is under investigation and a new workgroup is under discussion.

## 6. ARCHITECTURES, STANDARDS AND IMPLEMENTATIONS

This section provides the notes from the presentations during the afternoon session of the workshop, focusing on technical elements of agri-food data spaces.

### 6.1 High-level distributed architectures for agriculture data sharing

AIOTI - Alliance for IoT Innovation



#### No “Data sharing” without “Data discovery” upfront

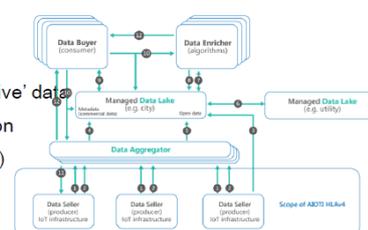
Covid crisis is an “eye opener”, and recovery is an opportunity for the sector to work together in common public interest.

##### Detected Problems:

- Platforms and the IoT sector failed upon its promise to deliver *crucial* ‘live’ data
- The rerouted sector fails to deliver on daily up-to-date data for mitigation
- No cross-platform data interoperability (to many overlapping standards)

##### Priorities:

- Focus on **data discovery** to unlock the markets
- Enable a fair and federated market information system



10 06 2020

Figure 10. Excerpt from the presentation by Tom de Block. Nearcom. AIOTI, chair of “distributed ledger technologies”

#### Key messages:

- AIOTI published recently a white paper entitled “IoT data marketplaces for the agri-food sector” [13] which proposes a High-Level Architecture (HLA) for enabling data sharing and data discovery throughout the food chain by all stakeholders. Actually the HLA had been proposed before in a more generic context of data marketplaces, not specific to agri-food.
- The COVID crisis has been an “eye opener”, and recovery is an opportunity for the agri-food sector to work together in common public interest.
- Detected problems:
  - Platforms and IoT solutions still cannot deliver crucial “live” data across the supply chain
  - The re-routed supply chain fails to deliver daily up-to-date data for mitigation
  - No real cross-platform data interoperability (to many overlapping standards)
- Priorities:
  - Focus on “data discovery” to unlock the markets
  - Enable a fair and federated market information system, based on the HLA.
- The HLA is distributed and centralizes only the metadata (in “data lakes”) needed to enable data discovery. This concept is central to the HLA, as “data sharing” is not possible without “data discovery”.

## 6.2 Practical implementation of data sharing in agriculture and lessons learned

This section focuses on two practical implementations that have been featured in the AIOTI paper [13], which can be mapped to the HLA.

### 6.2.1 The case of Gaiasense



Figure 11. Excerpt of the presentation by Nikos Kalatzis, Neuropublic, technical project manager.

- Gaiasense [14] is a commercial “Smart Farming as a Service” technological solution for irrigation, fertilization, and crop protection (application of pesticides).
- The smart farming infrastructure (IoT sensors, cloud platform, etc.) is fully operated by the service provider, so the users (farmers) do not need to make any investment to start using the service.
- Example of data sharing for crop protection. Some problems found, e.g. models need to be recalibrated for each geography. It would be really convenient to have access to data collected in different geographies, or to allow third party services to access data so as to apply their own models.
- Technical barriers found
  - Many standards, not interoperable, exist on the same application domain. Need to harmonize information models, vocabularies and APIs to achieve semantic interoperability.
  - Implementing standards in operational systems is not always seen as beneficial, since engineers are focusing their efforts on making systems resilient and operational 24/7, whereas interoperability enablers introduce additional complexity.
  - Data models and standards are usually based on complex structures (e.g. ontologies) which increase the volume of data that needs to be exchanged.
  - Data governance mechanisms, security and access control
- Possible solutions being explored

- Interoperability enablers based on FIWARE Orion Context Broker (Connecting Europe Facility) and NGSIv2 data model vocabularies.
- “Offline data translation” combined with “real time data sharing”.
- High-level architectures like the one proposed by AIOTI, but further technical elaboration of the HLA concept towards implementation is necessary.
- Standardisation initiatives: ETSI-NGSI-LD (Agriculture vocabulary), SAREF4AGRI, UN-eCrop, ISOBUS, AgGateway'sADAPT

## 6.2.2 The case of DJustConnect

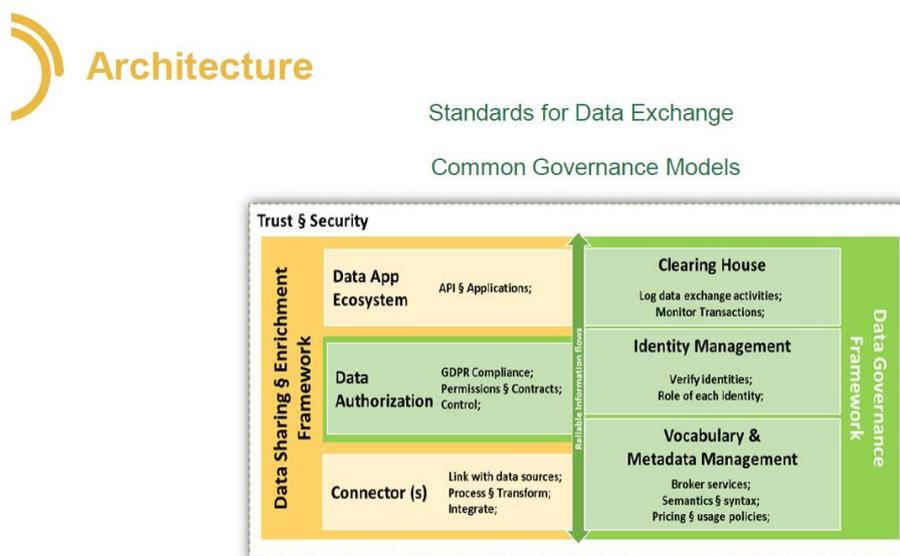


Figure 12. Excerpt of the presentation by Jurgen Vangeyte, ILVO, scientific director

### Key messages:

- DJustConnect [15] is a data sharing platform envisioned to support the digitisation of the Code of Conduct, developed by ILVO and other actors. The funding partners are cooperatives.
- Historic perspective on data sharing:
  - Level 1: sharing among a circle of trust
  - Level 2: first appearance of digital technology, still within a circle of trust
  - Level 3: cloud enters in
  - Level 4: sharing with untrusted players. Instabilities of this model can be compensated with by adding new pillars: infrastructure, respect, and trust
- Infrastructure:
  - Central element is the DataHub Cloud Platform, implementing data aggregators, data connectors, as well as data storage and analysis.
  - Service apps can be hosted on the platform or externally, but in any case the apps are developed by external parties.
  - ILVO member of International Data Spaces Association (IDSA) [16] since 2019
- Creating respect and trust
  - Code of Conduct as the basis
  - Farmers have a dashboard providing full control on what, how and to whom they share and allow access to their data (“data sovereignty”)

- Key technical elements: access control (identity management), metadata management (services, pricing, semantics...), monitoring and logging of activities/transactions.
- Fully operational platform - Roll-out 2019
  - First application built: digital auditing for milk quality, launched in Feb-2020, featuring 12 data providers and 4000 farmers as users.
  - Next goals: “soil passport”

### 6.3 Approaches for data sharing in current agriculture Large Scale Pilots

The current section focuses on the reference architectures for data sharing that are being developed in the two flagship H2020 projects on digital agriculture: ATLAS [17] and DEMETER [18].

#### 6.3.1 ATLAS project



Figure 13. Excerpt from the presentation by Stefan Rilling. Fraunhofer IAIS. ATLAS project coordinator

- Interoperability in digital agriculture becomes an essential requirement, as the landscape gets more and more heterogeneous with an increasing number of different machines and entities that must exchange information.
- ATLAS looks for interoperability solutions between agriculture machines, sensors and data processing services.
- ATLAS interoperability architecture: aligned with IDSA [16], minimizing centralized components
  - No central data hubs, no data silos
  - Data exchange is based on “connectors” (services)
- The high-level architecture has been designed according to concrete use cases collaborating with industry, SW developers and agriculture service providers
- Trust:
  - Each participant remains autonomous. Data providers retain full control over the data (“data sovereignty”)

- Applications and services with critical security/safety requirements can require certification. For example, apps to be installed on tractors and connecting to ISOBUS require AEF ISOBUS certification.
- ATLAS service mesh network
  - Each participant is autonomous. They run their own software and proprietary services. They connect through the ATLAS Service Registry (a centralised, trusted directory able to identify participants) and using ATLAS Data services
- Onboard or in-field computing capabilities are also provided. Of interest when there is lack of good connectivity or latency requirements are hard to be met.
  - ATLAS AppEngine for onboard/in-field computing devices. Allows to run different types of applications (real-time apps, jobs apps, utility apps, platooning apps)

### 6.3.2 DEMETER project

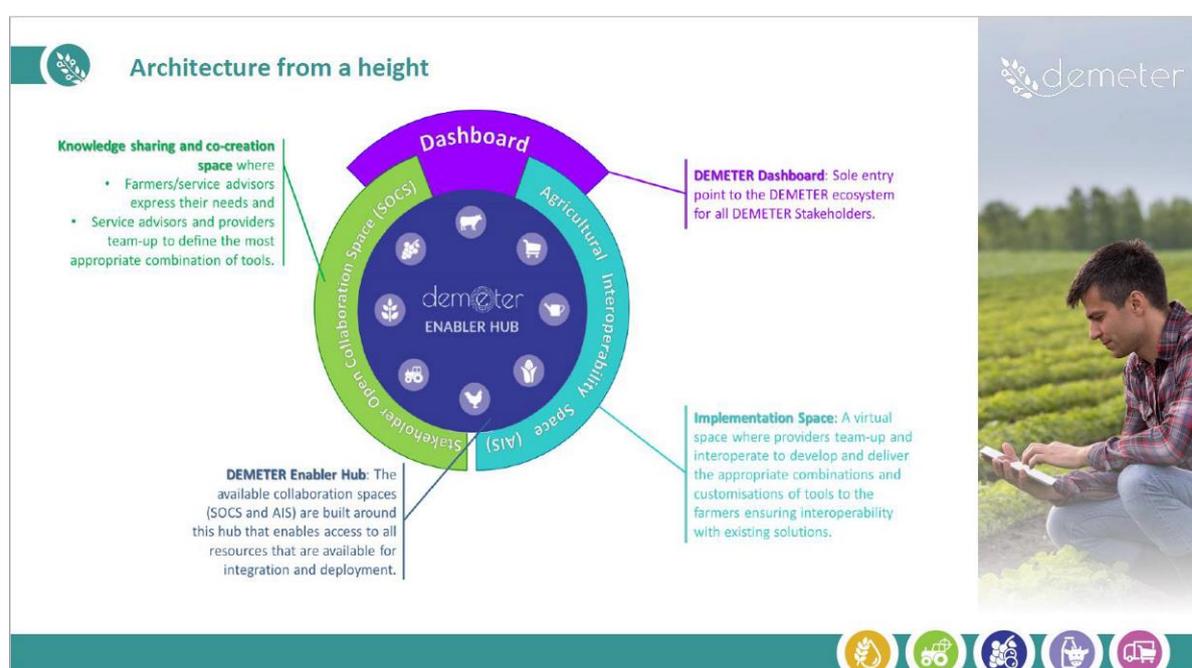


Figure 14. Excerpt of the presentation by Kevin Doolin. TSSG. DEMETER project coordinator

- DEMETER is a large-scale pilot involving 20 pilots in 15 Member States, involving different agri sectors: arable crops, fruit and vegetables, livestock, and cross-sectoral.
- DEMETER architecture is based on the concept of “enabler hub”, which provides the services that the stakeholders and farms will use. The DEMETER enabler hub will be the core of:
  - Stakeholders Open Collaboration Space (SOCS). It is a knowledge sharing and co-creation space for farmers and service advisors to define the most appropriate combination of tools
  - Agricultural Interoperability Space (AIS). It is a virtual space where providers interact to deliver the tools ensuring interoperability with existing solutions (for example, using ontologies from the agrifood domain).
- DEMETER Enablers are the resources needed to build the services
  - Core enablers: communication and networking, interoperability (functional and semantic), security

- Advanced enablers: decision support, performance monitoring, service management, visualization, etc.
- All DEMETER components have a wrapper compliant with an Agriculture Information Model (AIM) to ensure interoperability.
- The entry point to the DEMETER ecosystem by all stakeholders is done through the DEMETER dashboard, allowing to participate in the co-creation process and in the resource discovery and access.

## 6.4 Discussion

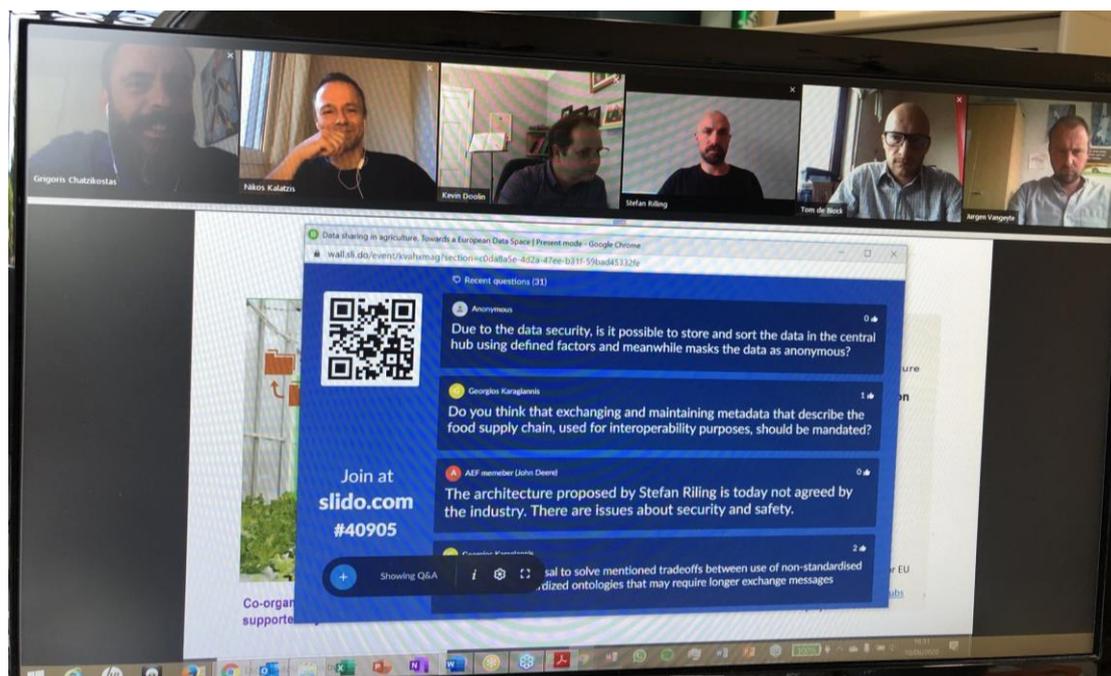


Figure 15. Roundtable discussion moderated by Grigoris Chatzikostas. Biosense Institute. Senior Advisor for EU Initiatives, Deputy Coordinator of SmartAgriHubs project.

Q1: Global economy will affect every country and sector. What are the technological risks that the farmers are assuming? What can your project offer to real life farmers to reduce technical risks over the next years?

- SR: One of the risks is the dependencies on your data platforms and the data exchange of the agriculture ecosystem. Reshape the process of your platform.
- KD: DEMETER offers different technology options. We are working with end-users on identifying barriers. Something encouraging is to confirm that farmers are willing to share data. Effective technology adoption is the key challenge.
- NK: Farm realities can vary much across Europe. In Greece or the Balkans, not many farmers are heavily digitalized. Investment capability is reduced in some regions, so a service model may fit better than commit to own investments.
- JV:
  - Agrees on the diversity in the degree of digitalization, with a majority of farmers being on the low part. Limited skills and limited investment capacity are key barriers.
  - One of our application is for helping with auditing. This type of applications that address a widespread pain point of many farmers are key to have many farmers landing. On the other hand, applications for variable rate spraying, for instance, are likely to not attract so much interest when they imply sharing data.

- TdB:
  - Stresses the importance of data discovery services to avoid data and farmers being left out, undiscovered
  - Proposes to do interoperability checks across ATLAS and DEMETER to create a EU agri data single market, which is welcomed by the coordinators of both projects. Stresses the idea that we must accept the co-existence of different platforms that will need to get inter-connected.
  - Regarding the recent COVID-19 crisis, although there were no major cases of food shortages, there were indeed a number of cases of food waste. This is possibly due to market actors overriding digital systems, operating instead outside them. We have faced a big shift to “local first”, which is not necessarily bad.

Q2: Critical mass vs. Trust: chicken and egg problem? How to tackle this?

- JV:
  - Trust grows locally. Working close to farming sector is key to gain their trust. A key strategy is to start with highly-demanded tools and applications (low hanging fruits) that will attract users in the initial stages.
- SR:
  - Disagrees on the importance of trust. Trust is of course needed, but it can sometimes be traded for the benefit received through critical mass. Example: Many people use Whatsapp while not trusting its owner Facebook. You are more likely to adopt a tool if it provides benefits to you. Trust should not be the most important factor.
- KD:
  - Farmers are willing to get into digitalization when they perceive they gain something back. Security is the most important element supporting trust.

Q3: Standardization. What happens when standards are developed but there are already existing systems that do not comply with those standards?

- NK:
  - We faced this issue over the last years. The most important thing is to have the system working first. You first develop without knowing what standard option will eventually succeed. Later on, you can take care of working on interoperability with standards.
- TdB:
  - We cannot avoid that we have overlapping platforms with different vocabularies. The OGC (Open Geospatial Consortium) tries to link the overlapping terms in the different standards. We allow the platforms to continue using the same standards but you can use a query with the checked vocabulary.

Q4: Post-project sustainability of ATLAS and DEMETER. How will the results of your projects endure?

- KD:
  - Our project is about putting many stakeholders and technology components together. Some industrial companies are important market actors that provide the channel for our work to eventually reach the market
  - Open Calls are a very good tool to ensure deployment beyond the project lifetime
- SR:
  - Agrees on the importance of Open Calls
  - Competence Centers are another important element for impact, as they are the adequate actors to present and demonstrate project results even beyond the project lifetime
  - Standardization is another important channel to ensure project impact beyond its lifetime

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Q5: Can the Code of Conduct for agricultural data sharing be standardized as a practice? Can there be one single standard for data sharing in the agricultural sector?

- TdB:
  - Not a single standard, but it's possible a common model. The model of the CoC can be perfectly implemented using AIOTI's HLA model. Our model is a blueprint flexible enough to implement the CoC.
- JV:
  - DjustConnect is a digital solution allowing to adequately implement the CoC. The farms are informed who are providing this data and who is using the data. Our system is built as a plug but honestly there are still technical challenges to be solved.

Q6: Data Security. How crucial is the security issue from the points of view of individual farmers and technology providers?

- TdB:
  - Distributed Ledger Technologies are facilitators of sustainable business models and can be elements to implement CoC agreements. However, data discovery will be the number one facilitator.
- NK:
  - Security has been an issue within the computational community for a while. Although technology solutions offer ample security and access control features, we often find that for farmers, what is important is to keep certain critical data away from the eyes of their competitors.

Q7 (Georgios Karagiannis): To Nikos; any proposal to solve mentioned trade-offs between use of non-standardised models and standardized ontologies that may require longer exchange messages?

- NK:
  - A critical issue is where to apply the interoperability mechanisms. In the case of gaiasense we are following an approach where:
    - We are not tampering the production system, the optimized solutions that are serving our customers are not altered.
    - We are applying “interoperability enablers” that plug on our production system. The “interoperability enablers” process and “translate” selected data that can potentially be shared with 3rd parties.
    - Translated data – compatible with the selected standard – are maintained on a dedicated server system which is ready to serve any requests on data sharing.

## 7. RESULTS OF THE QUESTIONNAIRE ON AGRICULTURE DATA SPACES

An online questionnaire was publicly launched one week before the webinar and remained open until the 17<sup>th</sup> of June, available through the following link: <http://www.agridataspace.eu/>

The questionnaire had 11 questions (see Appendix in Section 11) oriented to get insight from stakeholders that can help to further define the agriculture data spaces instrument.

There were 62 replies with respondents from different profiles as illustrated in the figure below.

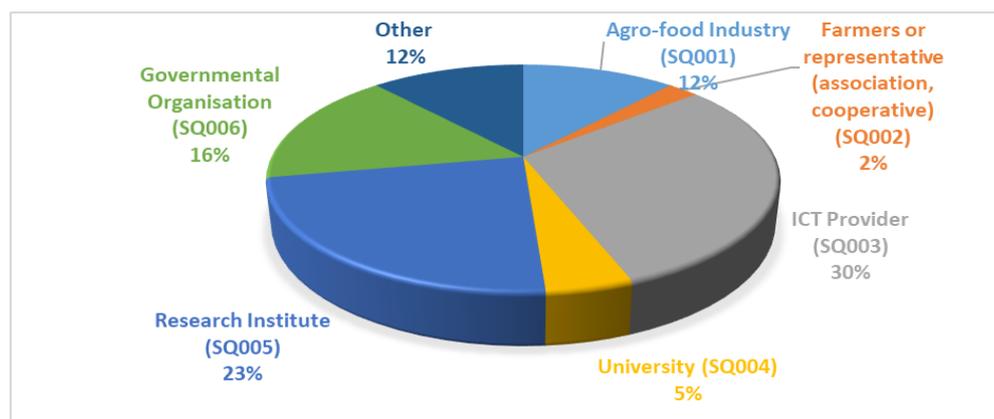


Figure 16: type of respondents to the questionnaire

The results are analysed in the following.

### Q2 - Barriers in the Agriculture sector. Which problems identified in the European data strategy are of a particular concern for the agriculture sector?

Regarding the main barriers perceived for the wide adoption of data sharing in agriculture (Figure 17), the lack of governance rules is identified as the most important concern, followed by the lack of technical infrastructures.

Other concerns include the lack of data interpretation/analysis (we have interesting data but we don't always know what to do with it), and the lack of a common data language between governments, NGOs and private sector.

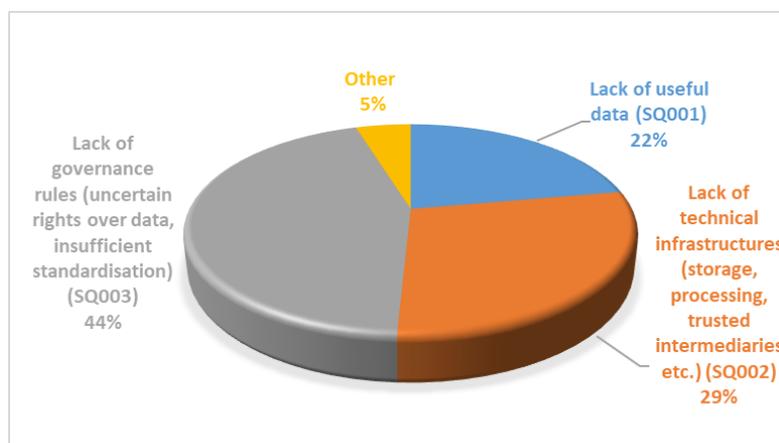


Figure 17: problems identified in the European Data Strategy which are of particular concern for the agriculture sector



### Q5 – Which sector should be the first to start sharing data at EU level?

Interestingly, when asked about the convenience to start implementing data sharing in some particular agri sub-sector, the majority of responses select the food supply chain instead of one specific sub-sector.

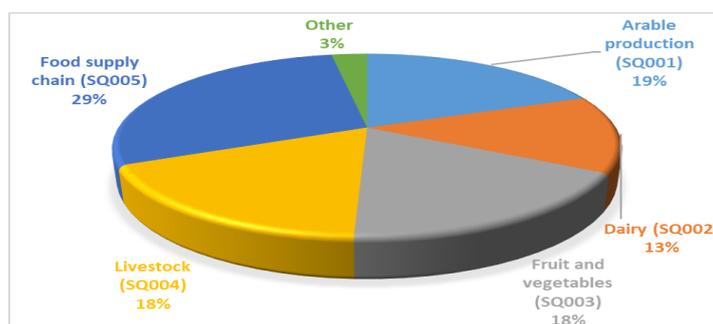


Figure 20: which sector should be the first to start sharing data at EU level?

The justification of the answer given to Q5 is requested in Q6. With regard to the selection of the supply chain, the following arguments are provided:

- We need urgently to make our food supply chain more agile. In the aim to optimize matching between production and demand from local to EU level. Covid crisis demonstrated the priority.
- The food chain is in the core of everything.
- All of them are necessary. We need to switch from silo-thinking to a systemic approach which considers all the agrifood sector at large, and also at cross-domain.
- Cross domain interaction is important rather than just one domain.
- It is the one that has a direct impact on users and therefore it will push the other sectors.
- Food supply chain due to need to examine business model.
- The food supply chain is the most important sector, as the recent COVID crisis has shown. In terms of agricultural production sectors, arable is an example of an appropriate sector.
- In the Spanish market, due to the COVID-19 it has become evident that it is very important to have collected all the data from the different agri-food sectors
- If we start building a pan-European data space, we should break silos and favor collaboration between economic sector (livestock and arable for example). It would be counter-productive for me to start with one.
- As the value of data sharing for a circular economy only fully unfolds if data from all parts of the value chain are available, there is no priority to be taken. Every sector has to move as quickly as possible.
- The food supply chain with retail has top-down rules in place where farmers and growers must oblige to with no real value in return. I think it would be beneficial for the food supply chain to be more transparent and share their data to further optimise price, demand, supply.
- The value of data is fully used if the whole ecosystem is involved.
- The entire value chain is quite automated, and a lot of data may already be available.
- All sectors are collecting data. Administrations hold valuable data for each of them as well.
- I don't think one sector should start before the others. Each sector has interesting data and work to do to start sharing it, even though some sectors are more advanced on the process.
- The collection of data from the entire food chain would ensure greater knowledge and traceability of local products which in turn would acquire greater value for the final consumer
- Strengthen position of farmers by connecting more with consumers
- Only if the information reaches the consumer, deeper information about the production is useful.

Regarding the arguments justifying the prioritisation of one specific sectors, we have the following:

- Farm production data are already collected by proprietary farm management systems. Part of these data could be made accessible. Most FMS are collecting data on arable production.
- Fruit and vegetables to aim at sustainability of production; and food supply chain to test the whole process
- Livestock due to GHG emissions.

- Arable production because there is a need to credibly know the amount of land that is actually useful for production. Food supply chain because we need to find out inefficiencies in the food value chain that are preventing all the agents to get the fair share for the role in the food production.
- Start with best practices of data sharing sectors: fisheries, GAP controls, collective agro-nature policies. Context could be biodiversity and F2F strategies combined with True Cost Accounting (for example new pilot project in the Netherlands).
- Due to long history of pooling data in those sectors
- The consumers are right now really concerned due to Covid19 crisis, so there is a big momentum to bring solutions in every product that is directly related to them, mainly where they are having some kind of impact due to the crisis. I believe these products are more than the others directly affected right now.

### Q7 - A European Data Space should be deployed (federated) on top of

As can be seen in the figure below, the answers to Q7 show a clear preference for deploying the European Data Space on top of existing infrastructures.

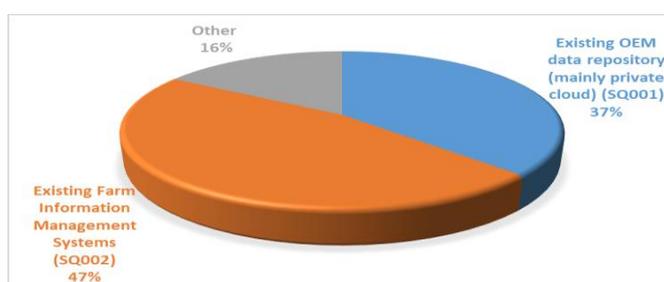


Figure 21: possible schemes to support the deployment of a European Data Space

The “other” approaches suggested are OpenData Portals, National and regional public systems, CAP monitoring data and supply chain tracking data (which sometimes are already open data for consumers and NGOs).

### Q8 - Which implementation options are most viable?

Regarding Q8, the answers (Figure 22) show a clear preference for a public-private distributed scheme.

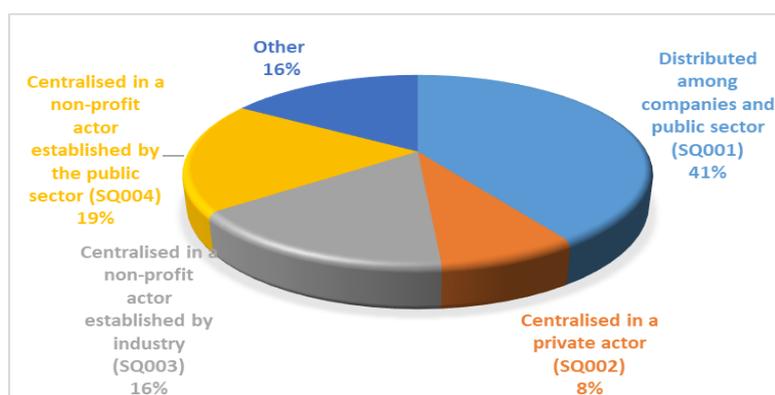


Figure 22: Most viable implementation options for the Data Space

Among the other approaches, we find out the following suggestions:

- Involve NGOs in the public-private partnership
- For the implementation by a non-profit actor, this should be agreed by the whole food chain actors
- For the implementation by private actors, add governance and control by national and regional non-profit actors.

### Q9 - Costs: what would setting up, deploying, and operating an agriculture data space cost?

Four intervals were provided: <10 M€, 10 to 20 M€, 20 to 30 M€, and > 30 M€. Figure 23 shows that the estimates are quite evenly distributed among the four intervals, but there is a slight preference in the medium-low interval (10 to 20 M€).

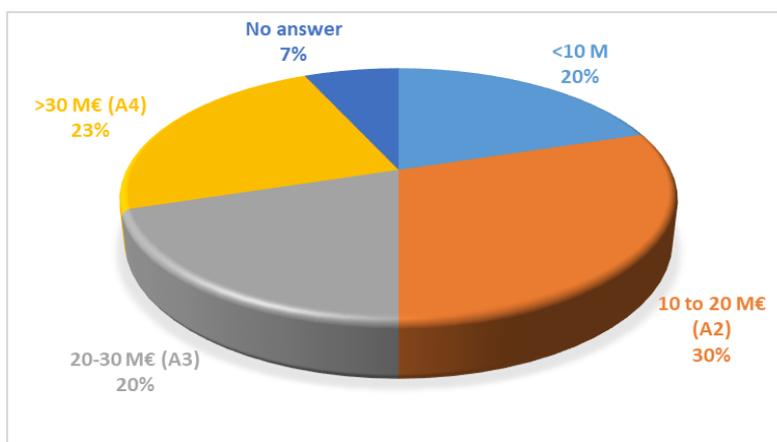


Figure 23: estimated costs of set up, deployment and operation of an Agriculture Data Space

It is more interesting to have a look to the (mostly qualitative) arguments provided in Q10 for the estimates, which are coherent with the answers provided to Q7, in the sense that the Agriculture Data Space should not be established from scratch but rather on top of existing infrastructure, thus lowering the costs. Indeed, a number of answers support this argument:

- Infrastructures and FMS already exist.
- There is plenty of open source technologies, that tackled adequately can provide the generic software basis. Infrastructure should be provided by public organisations and supported by financing mechanisms so that private sector can contribute to improve it.
- Leveraging on data intrinsic value, stakeholders should be interested in maintaining "their" part of the distributed infrastructure.
- We expect about 5M€ to set up the platform + 5M€ to buy/hire infrastructure and maintain it during 5 to 10 years.
- I have no idea on how to estimate. But if you think of it as a distributed infrastructure based on platforms that are already there, I guess the costs would drop.
- If the option is a federated and distributed system following other examples in tech industrial world (i.e., IDS) the amount of work to set up the system boils down to identification of sources and construction of middleware (connectors, etc.). From the technical point of view, it is quite simple. The cost can expand in function of the number of sources, but it is feasible to start from a simple and operable one and then grow gradually.
- Costs will highly depend on the public-private collaboration, on the capacity to integrate existing developments and to capitalise the results of existing projects.
- The technology is there, initiatives are running, work with what is out there already and don't start fully new things.

Some answers point in the direction of operations and side activities as the most important costs:

- This is a difficult question to answer but it would most likely be expensive in relation to staff
- I cannot estimate setting up costs, most important though is the costs for further development costs. Example: integrating IOF2020 in the Smart Agri Hubs. Single projects should include long term strategy including continuous evaluation, shared financial responsibility.
- It includes also many challenges linked to this implementation: standardisation, digital identity of the agricultural producers, habitation.

There are also arguments justifying a high cost:

- In total the necessary investments are high and should consider the resource of competitors in US and China. With funds of €600m+ for start-ups like Indigo Ag show that the private and public investments need to be decisive to really build infrastructural relevant players in Europe, ideally

through joint ventures of also competitors. Therefore, cartel law needs to be updated for the digital age.

### Q11 - Further considerations

About leveraging on experience and knowledge

- A data space on agriculture cannot ignore similar attempts in other vertical sectors. It has to take advantage of common elements, reference architectures, etc.
- There is previous work in other areas that can be leveraged and so avoid starting from zero.
- After more than 6 years working on agridata exchanges, issues isn't about technology but more about having a real strategy and implement it with clear governance in the different sectors. Pedagogy will be more helpful than building one other tool.
- I strongly believe in regional pilot projects like DjustConnect. To make that better, local initiatives should be supported with the back-bone de-centralized infrastructure to make collection of data possible, so that each region has its own ecosystem based on its needs but share a bigger background that enables the operations and allows sharing of insights, learnings and so on.
- National and sectorial approaches already exist, and I do think you should rely on them to favour dissemination on their ecosystem. SmartAgriHubs is doing a great work on federating DIH and CC, we should now connect the solutions providers and data re-users!
- I think an inclusive learning strategy with (local) government networks, private sector and agro and nature NGOs is the way forward.

About trust and governance

- Trust in data exchange must be created. There must be no disadvantage.
- The governance model MUST involve the farming/agriculture sector as a main actor with key decision capacities
- In order to govern our data sharing on future data sharing initiatives like data platforms, we need next to code of conducts or play rules also effective trustful control of actors if they play by the rules. These watchdogs need to be independent, ideally non-profit actors with a high local reputation on the national or regional level. This could be national or regional research institutes that should receive full insights into code of applications to make sure data is treated by the rules and investigate any complaints by actors in the network.

About business models

- An EU data space should support an ecosystem able to create new services for the farmers
- It would be useful if a business model for an agri-data space would allow for engagement with the private sector
- Focus on trust and the business model, at the moment it is very unclear for a lot of business if there is really value in the data for them.

Other

- Please consider the concept of naming authority
- It is important to develop a global data space.
- The public and private initiatives in the domain of data sharing should be more coordinated
- In order to deploy the full power of data, AI and data analysis technologies, open data is required to be able to squeeze out the full potential.

## 8. CONCLUSIONS

During the workshop, a wide consensus has been perceived in that the adoption of data sharing will bring a positive impact to the agri-food sector. A strong emphasis has been put on the creation of value and sharing of this value fairly among all the stakeholders of the food chain, in particular the farmers, but also the whole society. Hence, it is of paramount importance to involve all the stakeholders in the design of the European data space.

**Trust** is one of the key pillars to attract a critical mass of users and thus reaping benefit from data sharing. Trust must be considered from a wide perspective:

- Transparency and clear rules for data governance
- “Data sovereignty”, understood as the control to what, how and with whom the data is shared. It is interesting to note the shift in the concept from “data ownership” to “data sovereignty”.
- Certification schemes to ensure compliance with agreed rules
- Understand the value created by data sharing and its usefulness for the farmers, the food industry and the food chain as a whole, including the consumers.

**Compatibility and interoperability** is another key element. Creation of data silos must be avoided, as it goes against the idea of creating a thriving European single market for data.

- Strong recommendations to focus efforts in data interoperability mechanisms and adoption of standards.
- Accept the situation where different systems and platforms implementing different standards will co-exist. Hence, a serious effort must be made on enabling true interoperability among them.

**Access to data and services must be made simple.** Tools for enabling data sharing must be easy to use and as much automated as possible, yet keeping a high level of data protection

- Efforts must go in the direction of “**automating**” the **Code of Conduct**.
- Strong priority must be put on **facilitating** “**data discovery**”. Ensure that data from any stakeholder can be found and is easily available.

Focus of data sharing should be put from the beginning on the whole **supply chain**, rather than in specific agri-food subsectors, in order to foster as soon as possible agile cross-domain interaction, break down data silos, and facilitate the creation of a pan-European single market for agri-food data.

Technical implementations of agriculture data spaces should favour the **federation of existing systems** whenever possible rather than creating new ones completely from scratch. Strong preference in the technical implementation is for **distributed architectures** (rather than centralised ones) built on **public-private cooperation**. Public administration, not only private actors, should also play a role in data sharing and data use.

Overall, there are different work streams on agri-food data sharing at regional and national level in Europe, with varying degrees of maturity. Some of them are still in consultation/early phases whereas others are already implementing data exchange experiences involving different stakeholders. In this sense there is a big opportunity in **learning and growing from local/regional initiatives** towards the creation of a true European agriculture data space.

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## 10. APPENDIX – WORKSHOP PROGRAM

### Morning session – the framework for agriculture data sharing

<b>Welcome and Introduction</b>	
10:00-10:20	Luis Pérez-Freire. <a href="#">Gradiant</a> , Executive Director. <a href="#">AIOTI</a> , chair of WG06 “smart farming and food security” Joel Bacquet. European Commission. DG CONNECT Doris Marquardt. European Commission, DG AGRI
<b>Presentations</b>	
10:20-10:30	<b>Code of conduct for agricultural data sharing by contractual agreement</b> Daniel Azevedo. <a href="#">COPA-COGECA</a> , agricultural technology director.
10:30-10:40	<b>Societal relevance of data sharing: reflections beyond the Code of Conduct</b> Simone van der Burg. <a href="#">Wageningen University &amp; Research</a> . <a href="#">IoF2020</a> work package leader
10:40-10:50	<b>Strategy for full deployment of agricultural machinery data sharing</b> Vik Vandecaveye. <a href="#">European Agricultural Machinery Association</a> , chair project team “Digital Farming”. <a href="#">CNH Industrial</a> , Mgr Advanced Data Analysis and Application Development.
10:50-11:20	<b>National approaches to agriculture data sharing</b> Steffen Beerbaum, Joschua Möhring and Jürgen Stephan. <a href="#">German Ministry of Food and Agriculture</a> . Théo-Paul Haezebrouck. <a href="#">Agdatahub</a> , Products and Services Manager. Miguel Ángel Arroyo-Alcaraz. <a href="#">Spanish Ministry of Agriculture, Fisheries and Food</a> , Sub-Directorate General of Innovation and Digitalisation
<b>Roundtable discussion</b>	
11:20-12:05	<b>Moderated by</b> Thomas Engel. <a href="#">John Deere</a> , Manager Technology Innovation Strategy
<b>Closing of the morning session</b>	
12:05-12:15	Summary/wrap-up and closing

**Afternoon session – architectures, standards, and implementations**

<b>Welcome and Introduction</b>	
15:00-15:20	Luis Pérez-Freire. <a href="#">Gradiant</a> , executive director. <a href="#">AIOTI</a> , chair of WG06 “smart farming and food security” Joel Bacquet. European Commission. DG CONNECT Doris Marquardt. European Commission, DG AGRI
<b>Presentations</b>	
15:20-15:30	<b>High-level distributed architectures for agriculture data sharing</b> Tom de Block. Nearcom. <a href="#">AIOTI</a> , chair of “distributed ledger technologies”
15:30-15:50	<b>Practical implementation of data sharing in agriculture and lessons learned</b> The case of Gaiasense. Nikos Kalatzis, <a href="#">Neuropublic</a> , technical project manager. The case of DJustConnect. Jurgen Vangeyte, <a href="#">ILVO</a> , scientific director.
15:50-16:10	<b>Approaches for data sharing in current agriculture Large Scale Pilots</b> Stefan Rilling. <a href="#">Fraunhofer IAIS</a> . <a href="#">ATLAS</a> project coordinator Kevin Doolin. <a href="#">TSSG</a> . <a href="#">DEMETER</a> project coordinator
<b>Roundtable discussion</b>	
16:10-16:50	<b>Moderated by</b> Grigoris Chatzikostas. <a href="#">Biosense Institute</a> . Senior Advisor for EU Initiatives, Deputy Coordinator of <a href="#">SmartAgriHubs</a> project.
<b>Closing of the afternoon session</b>	
16:50-17:00	Summary/wrap-up and closing

# 11. APPENDIX – QUESTIONNAIRE ON AGRICULTURE DATA SPACES

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## Q1 - Tell us about your organisation

- Agro-food Industry
- Farmers or representative (association, cooperative)
- ICT Provider
- University
- Research Institute
- Governmental Organisation
- Other

## 1. Barriers in the Agriculture sector

### Q2 - Which problems identified in the European data strategy are of a particular concern for the agriculture sector?

- Lack of useful data
- Lack of technical infrastructures (storage, processing, trusted intermediaries etc.)
- Lack of governance rules (uncertain rights over data, insufficient standardisation)
- If other, please specify

### Q3 - What is the most urgent issue to tackle in order to leverage the potential of data in the European agriculture sector? (free text)

## 2. Scope of the Agriculture data space

### Q4 - What kind of data should be shared and made available to re-use through the EU data space?

- Farm production data (enabling benchmarking, regional and cross EU analysis),
- Public data like satellite and weather data
- Other (please specify)

### Q5 - Which sector should be the first to start sharing data at EU level?

- Arable production
- Dairy
- Fruit and vegetables
- Livestock
- Food supply chain
- Other (please specify)

### Q6 - Please justify your selection above (free text)

### Q7 - A European Data Space should be deployed (federated) on top of

- Existing OEM data repository (mainly private cloud)
- Existing Farm Information Management Systems
- Other (please specify)

### Q8 - Which implementation options are most viable?

- Distributed among companies and public sector
- Centralised in a private actor
- Centralised in a non-profit actor established by industry,

- Centralised in a non-profit actor established by the public sector,
- Other (please specify)

**Q9 - Costs: what would setting up, deploying, and operating an agriculture data space cost?**

- < 10 M€
- 10 to 20 M€
- 20-30 M€
- > 30M€

**Q10 - Further explanation on the costs estimation (free text)**

**Q11 - Further considerations (free text)**