AGRI DATASPACE

**Building a European framework
for the secure and trusted data space for agriculture**

D4.1 & D4.2: Roadmap for deployment and operating the data space for agriculture

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[1] R: Document, report; DEM: Demonstrator, pilot, prototype, plan designs; DEC: Websites, patents filing, press and media actions, videos, etc.; DATA: Data sets, microdata, etc; DMP: Data management plan; ETHICS: Deliverables related to ethics issues; SECURITY: Deliverables related to security issues; OTHER: Software, technical diagram, algorithms, models, etc.

[2] PU – Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page); SEN – Sensitive, limited under the conditions of the Grant Agreement; Classified R-UE/EU-R – EU RESTRICTED under the Commission Decision No2015/444; Classified C-UE/EU-C - EU CONFIDENTIAL under the Commission Decision No2015/444; Classified S-UE/EU-S – EU SECRET under the Commission Decision No2015/444

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AgriDataSpace Consortium

	Participant organisation name	Short name	Country
1	AGDATAHUB	ADH	FR
2	FOODSCALE HUB GREECE ASSOCIATION FOR ENTREPRENEURSHIP AND INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	FSH	EL
3	INSTYTUT CHEMII BIOORGANICZNEJ POLSKIEJ AKADEMII NAUK	PSNC	PL
4	UNIVERSIDAD DE LLEIDA	UdL	ES
5	EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK	EV ILVO	BE
6	FONDAZIONE BRUNO KESSLER	FBK	IT
7	VDI/VDE INNOVATION + TECHNIK GMBH	VDI/VDE-IT	DE
8	STIFTUNG FACHHOCHSCHULE OSNABRUCK	HSOS	DE
9	STICHTING WAGENINGEN RESEARCH	WR	NL
10	1001 LAKES OY	1001 Lakes	FI
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12	COMITE EUROPEEN DES GROUPEMENTS DE CONSTRUCTEURS DU MACHINISME AGRICOLE	CEMA	BE
13	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV	Fraunhofer	DE
14	AGRICULTURAL INDUSTRY ELECTRONICS FOUNDATION AEF	AEF	DE
15	FEDERATION NATIONALE DES SYNDICATS D'EXPLOITANTS AGRICOLES	FNSEA	FR

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List of Abbreviations, Acronyms, and Symbols	
AB	Advisory board
AIA	Artificial Intelligence Act
ADS	AgriDataSpace (project)
CAP	Common Agricultural Policy
CEADS	Common European Agricultural Data Space
CEDS	Common European Data Space
CSA	Coordination and Support Action
DA	Data Act
DCH	Data clearing house
DGA	Data Governance Act
DID	Decentralised identifier
DISP	Data intermediation service provider
DSA	Digital Services Act
DSI	Data Space Initiative
DSSC	Data Spaces Support Centre
EDC	Eclipse Dataspace Components
EDI	Electronic Data Interchange
EDIB	European Data Innovation Board
EDIC	European Digital Infrastructure Consortium
EDIH	European Digital Innovation Hub
EDWG	Eclipse Dataspace Working Group
EIF	European Interoperability Framework
EUCC	European Code of Conduct for Agricultural Data
FMIS	Farm management information system
GA	General assembly
GDPR	General Data Protection Regulation
IACS	Integrated administration and control system
IDSA	International Data Spaces Association

IPR	Intellectual property rights
MoU	Memorandum of Understanding
MS	Member State
MVP	Minimum viable product
NAO	Network administrative organisation
OIDC	OpenID Connect
PPP	Public-private partnership
RDF	Resource Description Framework
SHACL	Shapes Constraint Language
SME	Small and medium-sized enterprise
SSI	Self-sovereign identity
TEF	Testing and experimentation facility
WP	Work package
⭐	Symbol indicating a **recommendation** by the ADS project.
?	Symbol indicating an **open issue** identified by the ADS project.

Executive Summary

The European Commission, through its commitment to developing a Common European Agricultural Data Space (CEADS), is dedicated to unlocking the potential of data-driven value chains in agriculture and creating a transformative future for European agri-food stakeholders through the power of data. This initiative not only promotes business growth and ecosystem efficiency within the agricultural sector but also aims to create a cohesive network of data exchange by linking with data spaces from various industries.

Amidst the digital shift, data sharing initiatives are rapidly evolving to meet the demands of this new data-centric agricultural landscape. Regional, national, and international efforts are converging to enable and promote data sharing, and to provide cutting-edge services along the value chain.

Our project envisions the CEADS as a network of interoperable Data Space Initiatives (DSIs) that champion innovative value creation, operational efficiency, responsible data sharing, digital inclusivity, and cross-sector integration. Centring on a farmer-first, decentralised approach, the CEADS should aim to streamline access to data for all value chain participants. We recommend establishing clear guidelines and a robust framework to facilitate the integration of legal, business, technical, and governance aspects into CEADS.

This document presents a comprehensive and adaptable roadmap that defines a clear sequence of milestones and strategic actions for the step-by-step establishment and operation of the CEADS. The deployment roadmap outlines the key activities required in the preparatory and implementation stages, and provides guidance, alternatives, and highlights unresolved aspects related to establishing the CEADS. It also offers guidance for DSIs on how to become involved in the process.

Our recommendation is that during the implementation stage, the CEADS pilot will selectively bring onboard a limited number of organisations, establishing the foundational elements of CEADS. To streamline deployment efforts and prioritise interoperability among DSIs, a shared governance model should be functional already at this phase. The Minimum Viable Product (MVP) of the CEADS will be accompanied by the creation of a Network Administrative Organisation (NAO), a strategic step that will be fully implemented during the operational stage. This NAO serves as a foundational element to ensure the effective functioning and integration of the CEADS as it evolves.

Finally, we delineate the roadmap for operating the CEADS, showcasing the envisioned future where CEADS operates at its peak, with a solid infrastructure, active stakeholder participation, and a robust governance model that accommodates the diverse needs of the DSIs. Envisaged "use case first" principle not only ensures the CEADS's scalability but also amplifies its value for all stakeholders involved. The operational roadmap includes plans for infrastructure development, stakeholder engagement, and the establishment of governance structure. Furthermore, it highlights the significance and potential impacts on participating DSIs, illustrating the advantages of the CEADS through a series of practical use cases.

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1. Introduction

This document outlines a strategic roadmap to materialise the European agricultural data space from a conceptual framework into reality. Crafted within the scope of the **AgriDataSpace** (ADS) project that is a Coordination and Support Action (CSA) funded by the European Union, this roadmap supports the Digital Europe Programme's mission. The goal of the project is to explore how to build a European framework for the secure and trusted data space for agriculture.

This roadmap document reflects the vision and mission developed in our project and is described in more detail in the following chapter 1.3. The envisioned **Common European Agricultural Data Space** (CEADS) will consist of a federation of participating **Data Space Initiatives** (DSI) and we have analysed both levels: the **macro level (CEADS)** and the **micro level (DSI)**.

1.1. Context and DSSC

Our work directly builds on the work done by the **Data Spaces Support Centre** (DSSC). In the beginning of the project, we set out to map the landscape of data sharing initiatives in the EU agricultural domain. This work resulted in a list of 454 such initiatives of various kinds (listed in deliverable D1.1). From this diverse set of initiatives, we gradually began to focus specifically on initiatives that can be called by the DSSC term "data space initiative", which is described as "a collaborative project of a consortium or network of committed partners to initiate, develop and maintain a data space". It is important to note, however, that this is not a term all actors involved recognise or use to describe themselves or their activity. For the sake of simplicity, coherence with the DSSC, and general understandability, we nevertheless chose to use this term throughout this deliverable to describe the different initiatives that would participate in the CEADS.

This deliverable consists of two main parts that focus on the **deployment phase** and the **operational phase** of the CEADS. These two phases can be mapped against the development phases of DSIs identified by the DSSC as described below.
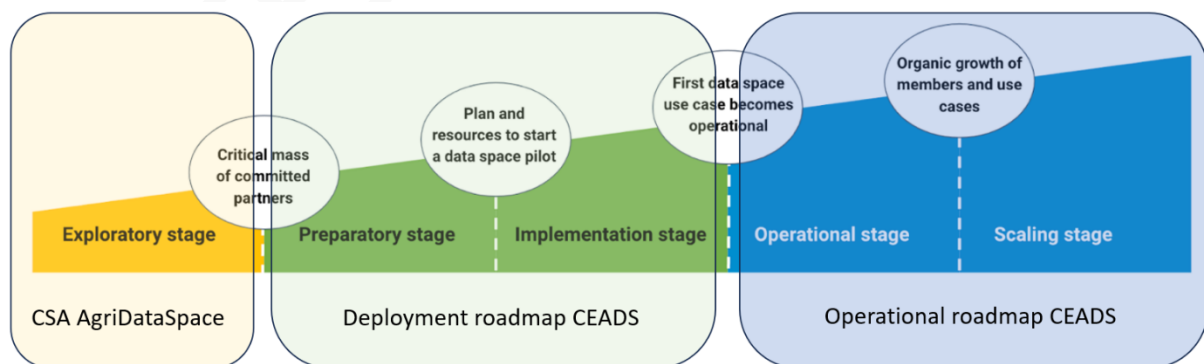
Figure 1: Development stages of DSIs.

These development stages have been described in more detail by the DSSC. These descriptions are included below as Table 1.

Table 1: DSSC descriptions of data space development stages.

Stage	Description
Exploratory stage	The development stage in which a data space initiative starts. Typically in this stage, a group of people starts to explore the interest, potential and viability of a data space. The exploratory activities may include, among others: identifying and attracting interested stakeholders, collecting requirements, discussing use cases or reviewing existing conventions or standards.
Preparatory stage	The stage in the life cycle of a data space initiative that starts when there is a critical mass of committed partners of data space initiative collaborating on the joint development of data space and data space use cases.
Implementation stage	The stage in the life cycle of a data space initiative that starts when there is a sufficiently detailed project plan, milestones, and resources (funding and other) for a data space pilot. The roles of the organisations involved in the data space pilot and the value created for each role are also clearly identified.
Operational stage	The stage in the life cycle of a data space initiative that starts when an initial tested implementation and governance framework of the data space exists, and the first data space use case becomes market-ready (with data flowing between data space members and use case providing the intended value)
Scaling stage	The stage in the life cycle of a data space initiative that starts when the data space has proven to gain new data space members and new data space use cases consistently and organically. It is adopted by a market as a viable solution and demonstrates sustainability and stability (financially and operationally). The data space can respond to market changes, adapt to them, and grow.

1.2. Reader's guide

Figure 2: Contents of this document.

The diagram in Figure 2 can be used as the reader's guide to this document.

Chapter 1 describes the vision and mission of the CEADS, introduces the expected value of the CEADS for stakeholders, summarises key considerations from business, governance, and technical viewpoints, and introduces the topic of interoperability between data spaces.

Chapter 2 focuses on describing the phases of deployment and related key tasks, and provides recommendations, possible alternatives and open issues related to this build-up phase of the CEADS. The **deployment roadmap** for the macro level (CEADS) is presented in chapter 2.3, and the implications of the planned deployment roadmap on the micro level (DSIs) are described as a **deployment guide** in chapter 2.4.

The goal of chapter 3 is to illustrate the desired end state of an operational CEADS: how could the agricultural data space work once fully functional. The description of the operational phase is in the form of an **operational roadmap** for the envisioned agricultural data space, divided into an operational roadmap for the macro level (CEADS) in chapter 3.2 and a description of considerations for the participating DSIs and stakeholder groups at the micro level, i.e. the **stakeholder perspectives** in chapter 3.3.

Chapter 4 includes description of the methodology used in developing the roadmap for CEADS, as well as a glossary of terms used in this deliverable that is synchronised with the latest EU regulation or the DSSC glossary (March 2024).

1.3. Project vision and mission

At the beginning of the project, ADS consortium developed a vision, which is used for the common understanding of the objectives and the expected results of the project among the consortium partners. The resulting vision was summarised in that initial stage as follows.

WHY = Purpose

We, the ADS project, strongly believe that there are big opportunities for new value creation and operational efficiencies for European agri-food stakeholders by exploiting the available data.

HOW = Process

We strive for a network of interoperable data spaces (Data Sharing Initiatives) with business models in the areas of data economy, responsible data sharing, digital inclusion, integrative artificial intelligence, and cross-sector integration. The decentralised approach will reduce complexity and provide an easy entry point for the stakeholders of the value chain. The interests of farmers will be the focus of this decentralised approach.

WHAT = Result

We will develop guidelines for a data space which can be easily adopted by companies and public bodies. We will define a set of procedures to explain and implement the legal, business, technical and governance issues. We will identify and recommend requirements for an organisation (the future CEADS) that will facilitate and monitor the adoption of these guidelines.

Source: Deliverable D2.1.

This document addresses the following parts of the ADS project plan:

Specific Objective 7: Develop a roadmap that compiles all requirements and needed actions into a comprehensive pathway towards implementation of the EU data space for agriculture.

Outcome #8: Develop a roadmap for the stepwise deployment of data space, including the identification of public and private data sets which are expected to contribute to the objectives of the data space.

The inputs from the WP1, WP2 and WP3 were analysed to identify the following objectives and subgoals for the roadmap:

Business Objective: To establish data spaces that enhance the European agricultural business ecosystems.

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- **Subgoal 1**: Integrate the activity with the upcoming EU member state driven European Digital Infrastructure Consortium (EDIC) and leverage synergies with both public and private business initiatives.
- **Subgoal 2**: Stimulate innovation in food and agriculture by providing a robust data infrastructure that enables data-driven decision-making.

Legal Objective: To ensure data spaces are fully compliant with the EU's evolving data strategy and existing legal frameworks, to complement the legal frameworks with fair ground rules and contractual structures for the data spaces, and to take into account agriculture domain specific considerations (e.g. the role of the farmer).

- **Subgoal 1**: Adapt to and incorporate emerging regulations such as the DGA, DSA, DA, and AIA into data space operations.
- **Subgoal 2**: Maintain adherence to regional and national laws, including GDPR, and integrate recognised contractual frameworks like *Sitra Rulebook for a fair data economy*.

Technical Objective: To create the CEADS that serves as a functional data sharing network with seamless interoperability.

- **Subgoal 1**: Align data space technology with EU-level initiatives and incorporate established technical building blocks from the DSSC blueprint.
- **Subgoal 2**: Facilitate cross-sector data sharing with other industries through initiatives like SEMIC and Gaia-X, and conform to the IDSA reference architecture.

Ethical Objective: To promote data sovereignty and support equitable data control, particularly for primary producers.

- **Subgoal 1**: Implement mechanisms that ensure data originators, primarily farmers, have control over their data usage.
- **Subgoal 2**: Develop ecosystems that discourage data monopolisation and strive to rebalance power differentials.

Organisational and Governance Objective: To manage data spaces that are operationally efficient, trusted, and align with broader EU governance initiatives.

- **Subgoal 1**: Contribute to the establishment and refinement of governance structures such as those proposed by the DSSC and IDSA.
- **Subgoal 2**: Achieve operational excellence in data space networks, ensuring they are trusted and can reliably interoperate with other data spaces.

1.4. Value for CEADS stakeholders

The CEADS initiative adds value to data providers, data consumers (users), and data intermediaries.

For the providers the user base will be increased for existing services (**economies of scale**): A data sharing initiative with services designed for a small (regional) user group will be able to offer the same service to a much bigger group. A fundamental advantage in digital business is

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the exploitation of network effects. This means that the value of a network increases proportionally to the square of the number of its nodes, i.e. the number of participating entities and their users. The CEADS will create a much larger network that can be leveraged much better through these network effects.

On the other hand, existing services can be complemented with other existing services or new services to a more complete offering (**economies of scope**). Users will have easy access to a much more complete spectrum of data-related services. The CEADS will lead to a more integrated agriculture related industry in Europe and thus serves goals of a common European market.
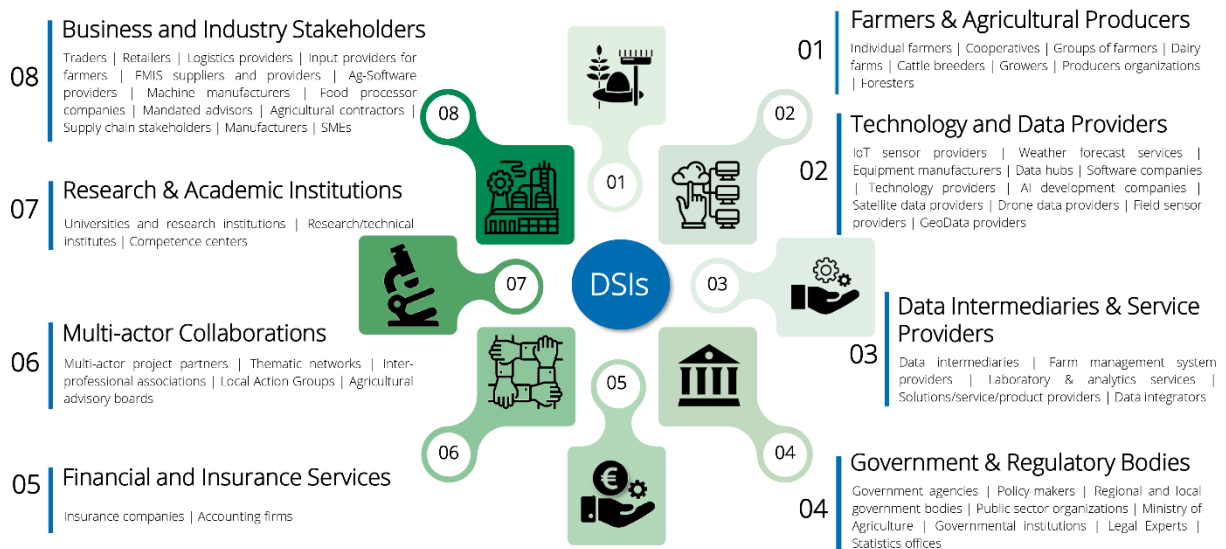
Figure 3: Stakeholder groups of the CEADS.

This rationale holds for each of the eight individual stakeholder groups that are relevant for the creation of the CEADS, and which are depicted in Figure 3 above. In more detail, these stakeholders can benefit from the increased data sharing and utilisation provided by the CEADS in a multitude of ways:

- **Farmers and Agricultural Producers**: Gain access to the tools and insights necessary for data-informed decisions that enhance operational efficiency. Support for precision agriculture techniques helps to mitigate risks and drives the adoption of sustainable, competitive farming practices.
- **Technology and Data Providers:** Discover new avenues for market expansion and product differentiation. Capitalise on data monetisation and forge strategic partnerships, accelerating innovative product development within the agri-tech sector.
- **Data Intermediaries and Service Providers**: Secure access to agricultural data enables the delivery of value-added services such as advanced analytics and market intelligence, opening monetisation avenues and fostering trust within the agricultural ecosystem.
- **Government and Regulatory Bodies**: Leverage data for crafting evidence-based policies, ensuring regulatory oversight, optimising resource distribution, and promoting

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market fairness. Support research, innovation, and public-private collaborations, enhancing emergency responses and bolstering trust with stakeholders.

- **Financial and Insurance Services:** Utilise precise data for better risk evaluation, creating tailored financial products and encouraging sustainable agricultural practices. Innovate in credit scoring and portfolio diversification and strengthen partnerships across the agricultural value chain.
- **Multi-actor Collaborations:** Foster a culture of innovation and interoperability, mitigate risks, and enhance supply chain efficiency. Uphold market competitiveness, ensure regulatory adherence, and cultivate trust and transparency across sectors.
- **Research and Academic Institutions:** Access to rich data sets encourages cross-disciplinary research and the pursuit of sustainable agricultural methodologies. Promote academic partnerships and contribute to the establishment of industry benchmarks and best practices.
- **Business and Industry Stakeholders:** Collaborate closely with producers to optimise machinery performance and anticipate maintenance needs. Enhance supply chain robustness, align with market demands, adhere to industry standards, drive food innovation, and engage in sustainability efforts, thereby earning consumer confidence through greater transparency.

As a cluster on macro level, the CEADS will be a very powerful cooperation partner to other Common European Data Spaces (CEDS) due to its increased value through network effects and a more complete service offering along the whole value chain.

A major design decision when conceptualising the CEADS is that it will not replace DSIs or stand in competition with them. It will act rather as an overarching frame that only adds value and does not transform existing businesses.

1.5. Legal framework

1.5.1. Context

Legal experts within the ADS project have analysed the legal framework established through the European Data Strategy, particularly focusing on the General Data Protection Regulation (GDPR), the Data Act (DA) and the Data Governance Act (DGA). The approach involved interpreting these overarching legal texts and proposing concrete applications of their legal principles within the CEADS, as documented in deliverable D2.2. This legal framework serves as the foundation for implementing CEADS governance, business models, and technical implications.

This section provides an interpretation of the legal framework, outlining its implications for stakeholders in the agricultural sector and its associated limitations. We present key elements that must be addressed to achieve practical and meaningful application of these legal texts.

The project recommendations must consider the following contextual elements derived from the legal texts:

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- Data could be held by private entities such as machinery firms, cooperatives, and farms, as well as by public bodies.
- Agricultural data sets could have varying levels of exposure, including open data, data shared for public research purposes, public policy assessment (G2G or B2G), or business purposes (B2G or G2B), and data shared between enterprises (B2B).
- Confidentiality is necessary for sensitive data from farms or manufacturers, which may include personal identifiers or information related to trade secrets.

1.5.2. Interpretation guidelines for the DA and the DGA

The agricultural sector needs common interpretation guidelines for the application of the DA and the DGA.

One of the key features of the Data Act is its protection against unfair contractual terms, and model contractual terms recommended by the Commission aim to help parties establish contracts on fair terms. In addition to the information that the Data Act will enforce into contractual terms, it could be beneficial to foster trust in the agricultural sector by specifying:

- that it is the responsibility of the data holder to make the data available,
- how the user may request that the data be shared with a third party,
- the duration of the agreement and the end of data sharing,
- the trade secret holder user's right to lodge a complaint.

The following additional guidelines aim at preventing different interpretations regarding agriculture data set sharing, as seen with the GDPR or trade secret directive:

- It is possible to have multiple data holders for the same set of data generated by a connected service or product (e.g., a cooperative and the provider of the connected service).
- Legal dual identity is possible (e.g., a cooperative could be both a data holder and user of a connected service).
- In the case of dual identity, an enterprise first fulfils its obligations as a data holder.
- Ensure that the DA could be extended to all agriculture data sets by specifying that the DA rules could apply to any connected service related to connected products including agricultural machinery (cf. Recital 14 of the DA).
- Through a set of technical and organisational measures, ensure the confidentiality of agriculture data sets containing sensitive information (at the European level).
- To model these principles as contractual terms could be useful to incorporate them when dealing with agriculture data sets.
- Creating agricultural data spaces with direct involvement of public bodies can be beneficial. This ensures that data intermediation services, defined in the DGA, are part of G2B, B2G, or G2G data flows, expanding beyond just B2B data exchanges.
- Specific rules could be established for G2B interactions at the European level. For instance, public bodies could be required to inform users, as defined in the DA, when transferring their data to governmental bodies or businesses in the governance sector.

1.5.3. Personal data in agriculture

Approach to personal data requires special attention in the agricultural domain. When identifying relevant personal identifier data (respectively sensitive data), the "bottom-up" approach considers the context and the specific use case, often referring to existing case law for guidance. This approach involves starting from specific instances or cases and building upwards, towards a general understanding or solution, and is deemed more suitable for addressing diverse use cases within the agricultural sector. There exists heterogeneity in how agricultural data will be treated from the personal data viewpoint, resulting in a lack of interoperability due to differences in methodologies and standards. For instance, cattle identity number could be considered as personal identifier regarding the member state interpretation of the GDPR.

In contrast, the "top-down" approach involves starting from a broad or overarching perspective and then working downwards to address specific details or instances. At the EU level, relevant personal identifier data is identified in a systematic manner, considering the broader regulatory framework and standards.

However, there is a notable lack of a standardised method for classifying personal identifier data, leading to challenges in consistency and coherence. Further stakeholder consultation and input from legal experts may be necessary to address this issue. Once a standardised classification for personal identifier data is established, it can facilitate harmonisation in the treatment of agricultural data across different national DSIs, thereby enhancing interoperability.

As the open-data directive identified data sets of public interest such as meteorological data, Earth and environmental observation data, statistical data, data concerning companies and their shareholders or mobility data, the European Commission could focus on specific items from agriculture data sets that should be considered as sensitive regarding sovereignty at the personal, enterprise or member state level. For instance, the scale at which satellite data is considered personal information is defined in an implementing act[3].

An overview of the case law or jurisdictional interpretation already given by the application of the GDPR, and the trade-secret directive could be helpful to identify several types of information that could be considered sensitive in agricultural data.

All those requirements are submitted to facilitate the inclusion and involvement of farmers into the digital agrifood sector. At this stage, these requirements, both legal and operational, do not consider the cost of compliance by the actor.

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[3] Annex 1 of Commission Implementing Regulation 2023/138 of 21 December 2022, laying down a list of specific high-value data sets and the arrangements for their publication and re-use, 2023

1.5.4. Operational advice regarding the European legislative framework

To ensure application of European regulation related to data sharing, and considering the specificity of the agricultural sector, several actions could be supported, such as:

- defining the role of a data coordinator (at the MS level),
- Implementing a centralised consent management system (at the MS level),
- establishing digital farm identity deployment (at the MS level),
- standardising agricultural data sets, including those necessary for calculating carbon footprints (at the MS or European level),
- identifying sensitive data within agricultural data sets (such as trade secrets and personal information).

Further discussion on the implementation of the legal framework for the CEADS can be found in sections 2.2 and 3.2.3.2 in this document.

1.6. Business and governance model considerations

The below recommendations are the summary of deliverable D2.1.

Governance recommendations

A. CEADS should not act as a central data intermediary. Each of the analysed DSIs represents an own data ecosystem with a unique set of (key) stakeholders and unique set of challenges that have to be addressed to successfully operate a DSI, be it regionally specific regulation, technical interoperability, or gaining the trust of the ecosystem stakeholders. A centralized entity will not be able to provide services with a comparable quality and reliability and incorporate all locally important aspects.

B. CEADS is a facilitator for DSI collaborations. Many interviewed DSIs already plan to collaborate across borders and across parts of the same value-chains for a free flow of data and a maximum of added value for all. There are already successful collaborations ongoing and plans to extend these inter-DSI collaborations were reported. There is a strong value proposition in a pan-European initiative to coordinate and support DSI-collaborations and joint the individual efforts.

C. CEADS should involve Member States, particularly data coordinators, who are responsible for ensuring compliance, handling complaints, conducting regulatory investigations and imposing sanctions for violations and resolve disputes.

D. CEADS should grow its governance iteratively. A DSI's governance grows alongside its business model and its user base, following the changing needs of the DSI's key stakeholders. The same logic should apply to CEADS, as umbrella organisation.

E. The operating organisation should be credibly neutrally positioned in the market. Representatives of all important sectors: e.g. from diary, livestock to agricultural

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machinery should be able to have their voice heard in decision-making. Business practices of the CEADS should be transparent to its members.

F. CEADS should offer interoperability support for DSI's data sharing governance. The biggest challenges for inter DSI-collaboration lie in the interoperability of their respective data exchange services. The most advanced inter DSI-collaborations reported that they develop their services against the specifications of the Gaia-X framework. However, even within this concise and well-accepted framework, there are a lot of remaining issues for making DSI interoperability work in concrete cases, e.g., when joining or combining data catalogues or service registries.

G. CEADS' operations should be independent of dominant market players and public authorities. Even though the European commission will indirectly benefit from a free flow of agricultural data across agricultural stakeholders and will also be able to indirectly access this data as part of legally required documentation, a direct involvement or direct data access would put CEADS perceived trustworthiness at risk and should thus be avoided.

H. CEADS should facilitate on-boarding of early-stage DSIs from an economic perspective with best practices from mature DSIs with training and tutoring.

⭐ Business model recommendations

A. CEADS should offer a hybrid business model, incorporating elements from a Data Marketplace and Open Data Policy business models.

B. The CEADS, adopting a public-private governance scheme, will act as a trusted facilitator of cooperation, bringing together different DSIs Initiatives on a secure and trusted data space where they can connect and share data utilising interoperability mechanisms.

C. CEADS should act as a trusted facilitator of cooperation, bringing together different DSIs on a secure platform under a Multi-Stakeholder Governance scheme where the various DSIs can connect and share data utilising interoperability mechanisms.

D. The CEADS should embrace an Open Data Policy, following a freemium revenue model, allowing certain data sets to be freely shared to encourage the development of innovative products and services but also provide mechanisms for increasing data sharing between the DSIs, creating an extra revenue stream for them.

E. CEADS business model should strike a balance between commercial viability through increased data sharing and contributing to the wider ecosystem by encouraging open data collaboration.

F. Transactions and their billing/monetisation will be carried out on DSI level. The CEADS will generate revenue through a fee, billed added services or other funding mechanisms.

1.7. Technical considerations

The below recommendations are a summary of deliverables D3.1, D3.2 and D3.3.

⭐ Technical recommendations

A. The CEADS proposes initial building blocks that help in the process of transferring data across administrative boundaries of participating DSIs while ensuring data-sovereignty of the stakeholders.

B. Technical guidelines pave the way to an incremental approach to the implementation of the CEADS, and guide interested actors to start engaging in data sharing initiatives with little effort and reduced risk of losing control over the data they share.

C. Existing data space reference architectures provide a foundation for offering services that enhance trust and secure data exchange. As there continues to be multiple parallel developments on-going around the concept of data spaces and the activity is increasing, it is imperative that the mapping and monitoring of technical solutions continues. Alignment with the upcoming **blueprints** (e.g. DSSC Blueprint 1.5), **architectures** (e.g. the IDSA reference architecture model IDS RAM 5.0) and **technical building blocks** (e.g. Gaia-X, SIMPL, EDC or FIWARE) remains an important task in the deployment and operations of the CEADS.

D. Technical considerations need to ensure that a business-driven data exchange can be supported by the CEADS.

E. Trusted exchange of data, specially across DSIs, becomes feasible when the necessary key software components are mature and ready for wide deployment, such as federated identity management, federated data and services catalogues or data space connectors.

F. For the macro level connectivity of different DSIs, a common European agreed upon trust anchor needs to be established to connect the DSIs or cluster of DSIs.

G. Architectural building blocks are reported within a Data Plane, with components that help to lower the existing boundaries in exchanging data, and within a Control Plane, with components that have more to do with establishing a trusted environment and a proper data governance framework.

H. The aim is to be as compliant as possible with the emerging Dataspace Protocol (DSP) that defines a standardised set of mandatory and optional functionality for the control plane and the data plane.

I. Interoperability between different types of data space connectors needs to be addressed to ensure seamless communication across systems.

J. Data control guarantees can be provided by data use policy enforcement mechanisms or virtual "data rooms" implemented using techniques like "compute-to-data".

K. In order for the CEADS to be adopted by existing initiatives, it should support common publish-subscribe protocols such as MQTT, request-response protocols such as REST and some file transfer protocols such as SFTP or Cloud Storage APIs.

L. The design and implementation of a supporting component for consent and permission management should be connection with the deployment of the CEADS.

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M. A component implementing a consent control dashboard should integrate with consent and permission management.

N. We advocate for the adoption of a common identity format, such as Verifiable Credentials (VCs), as proposed by Gaia-X for to ensure interoperability and trust across the CEADS. But we also recognize the current diversity in identity technologies, including both centralized (e.g., eID, OAuth2) and decentralized (e.g., DIDs, verifiable credentials) systems. Therefore, at the start the CEADS should embrace technological plurality and support integration with various technologies to ensure broad accessibility and usability. This approach will answer to the immediate needs of stakeholders while organizing a gradual alignment with the Common Identity Standard.

O. In the agricultural domain, there is a plethora of existing standards and practices. The CEADS should facilitate semantic and technical interoperability for the integration of sector-specific data models and formats. A selection of mapping tools, best practices and representative mapping exercises based on recommended ontologies and vocabularies will be adequately supported by the CEADS. Moreover, the CEADS will be also providing the mechanisms for the emergence and maintenance of an ecosystem of relevant semantic mappings among existing data sources and reference ontologies and vocabularies.

P. DSIs should use/adopt agreed common information model/vocabulary, or lingua franca, defining the data elements relevant to agriculture applications along with their associated semantics/meaning for information exchange. In this, it is recommended to leverage existing standards, whenever possible, particularly in the form of ontologies or other semantic artifacts, which provide application-independent specification of a domain or area of interest, and which can be easily extended/adapted to specific needs. Activities like AIM and Agroportal shall be closely taken into account.

Q. The use of a common vocabulary for Data, Services and Offerings descriptions is crucial if individual data spaces are to be federated and made available across them. A common vocabulary like the one provided by the Gaia-X Trust Framework, which is based on the RDF data model and serializable using associate standards like JSON-LD, facilitates the maintenance of federated catalogues.

R. Following a "Pay-as-you-go" approach to semantic mapping lowers data sharing barriers by delaying the mapping effort to when it is needed.

S. Technical implementation path for data spaces is going to be rather evolutionary in the coming years, with progressive steps being driven by standardisation, new innovations and emerging market needs and requirements.

T. The future CEADS should implement an extensive versioning strategy that includes mechanisms and processes for ensuring data and interface compatibility over time. This strategy should encompass multiple building blocks, acknowledging that backward compatibility extends beyond a single component of the CEADS.

U. Trials should be incentivised on attaching control plane mechanisms to existing DSIs, and bridging or translating between control plane mechanisms.

V. The policy makers should support, and industry and academia should emphasize, initiatives that create bridges / alignment between the large initiatives and technologies, e.g., by means of standardization / harmonization like the DSSC and

ISO TC 347 standardization initiative or the development of bridging/translation technologies.

1.8. Interoperability between data spaces

Different levels of interoperability between systems can be described using the **European Interoperability Framework** (EIF) as specified by the European Union, which is applicable to all digital services and is an integral element of the **interoperability-by-design** paradigm.

We apply this generic framework in the context of data spaces. In our project, we have considered legal interoperability and organisational interoperability (governance and business aspects) in WP2. Semantic and technical interoperability to interconnect multiple data spaces are considered as part of WP3. Our approach takes into consideration aspects of **intra** data space interoperability (within a data space) and **inter** data space interoperability (across data spaces).
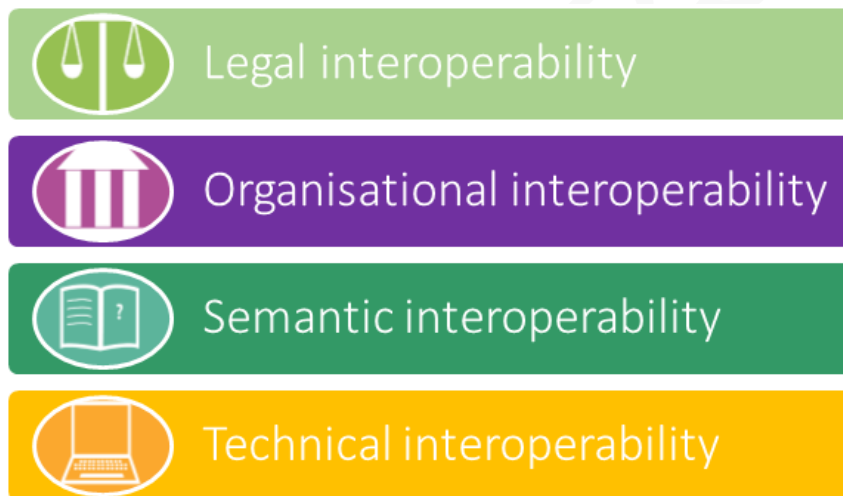
Figure 4: European Interoperability Framework.

Just like individual DSIs must interoperate between each other to form a functional data space, so the CEADS itself must be designed in a way that allows for its future interoperation with other data spaces, such as health or tourism data spaces. In this way, entirely new kinds of value can be created from data sharing for diverse stakeholders.

This document describes an approach that seeks to be as ready as possible to accommodate the interoperability recommendations expected from the European Data Innovation Board (EDIB) in the form of Guidelines for common European data spaces and as mandated in the DGA (Article 30, paragraph h). As part of this process, it is recommended that the CEADS deployment phase especially liaise actively with the DSSC to inform the upcoming guidelines and prepare for their practical implementation.

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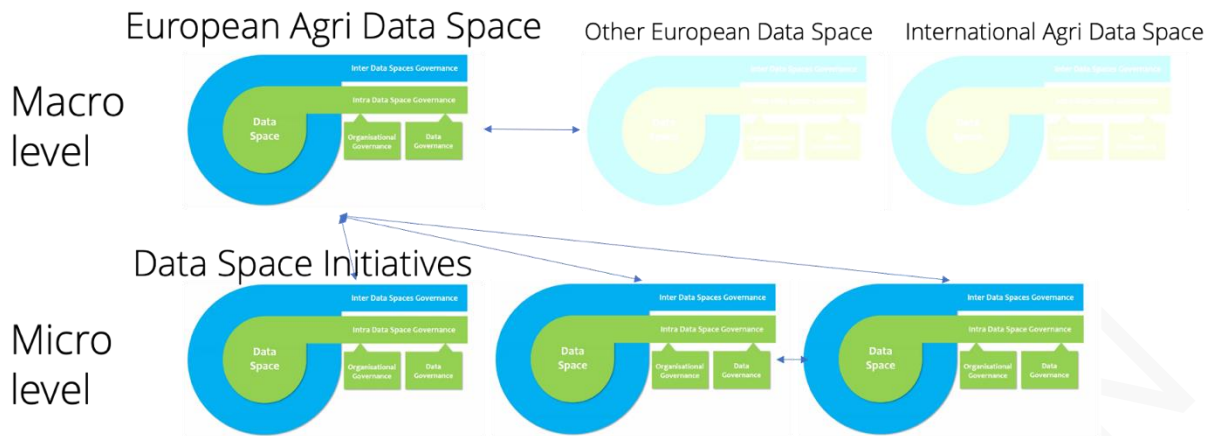
Figure 5: Envisioned structure of the CEADS and its relationship with other data spaces.

1.9. Illustrative use cases for the CEADS

To illustrate how the CEADS will impact the agricultural sector, we have selected four examples that are used in the deployment and operational sections of this roadmap to provide more context and depth to the roadmap.

Table 2: Use cases examples.

Perspective	Use case	Description
Farmer	National data sharing initiative	eDwin, a Polish national data platform designed for farmers, offers a range of services for stakeholders like farmers, advisors, and public administration, including a virtual farm application, pest management support, and meteorological data dissemination. Currently, farmers deal with multiple apps and manual data entry. With CEADS the need for manual processes will decrease, allowing for more efficient data use and service integration.
Industry	Digital twins as logical centralised storage	Digital twins centralise data and functions within distributed data spaces, offering a simplifying interface that enhances interoperability. They provide descriptive data about a physical asset, but also act as interactive entities allowing manipulation and scenario testing through cognitive computing. Hosting on established cloud platforms or future independent data hubs, they can support a broad range of agricultural processes, drawing data from diverse systems that cross administrative boundaries. This underscores the importance of interoperable data access to feed AI

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		algorithms, making digital twins highly relevant for the CEADS.
Government	Monitoring agro-environmental performance	This Dutch sustainable agriculture initiative employs standardised KPI calculations driven by unified data from various sectors. This requires data protection protocols, EU-compliant data sovereignty support, efficient data connectors for minimal data exchange, and tools for monetising data. Additionally, the use case highlights the importance of developing interconnected semantic data models, establishing formal M&E governance, and creating avenues for an existing national initiative to be expanded to the EU level by integrating with the CEADS.
Data intermediary network	Interconnected Data Intermediation Service Providers (DISPs)	This use case, which connects existing DISPs in Belgium, France and Finland, demonstrates that many data space initiatives are already forming at the regional level. They are implementing existing reference architectures, which lay the groundwork for building a robust, scalable, and federated data space. They demonstrate the practical implementation of governance, legal, organisational, and technical elements essential for the operation in a unified CEADS. This grassroots-level activity complements the top-down approach of defining a reference architecture for CEADS, illustrating a dynamic interplay between local initiatives cooperating and an overarching European architecture to guide them.

These use cases were selected as they illustrate the advantages of the CEADS for different stakeholder groups. All four use cases were introduced also in deliverable D3.2 to contextualize the technical requirements and mapping of generic data space technical building blocks with the specificities of the agricultural sector.

We emphasise that these examples do not represent a pre-selection of desired use cases for the CEADS, but rather they are included for illustrative purposes only.

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2. Roadmap for the deployment of the CEADS

2.1. Introduction

The objective of this chapter is to provide a realistic and concrete strategic plan for the deployment of CEADS. The roadmap for the deployment of the CEADS is a key element of the ADS project that consolidates the propositions outlined in WP2 and WP3 into actionable steps. It addresses the project's Specific Objective 7, to develop a roadmap that compiles all requirements and needed actions into a comprehensive pathway towards implementation of the CEADS by structuring the data space's deployment phase with milestones and strategy for action.

Upon perusing this section, readers can anticipate acquiring following key takeaways:

- **CEADS deployment roadmap at the Macro level:** A detailed compilation of essential recommendations on the four axes – Governance, Business Model, Legal and Technical architecture – for the first stages of deployment of the CEADS. This section will focus on the Macro level. (Section 2.2)
- **Deployment guide for DSIs at the Micro level:** How to effectively guide the DSIs to comply to the CEADS requirements and setup its first use cases. (Section 2.3)
- **Timeline for the Orchestration of Data Space Deployment:** Phased approach and strategic sequencing of activities, providing a roadmap for the systematic development and launch of the CEADS. (Section 2.4)
- **Key Aspects to Be Discussed Before Deployment:** Addressing critical issues, anticipating challenges, and establishing a foundation for informed decision-making. (Section 2.5)

As outlined in chapter 1, both chapters 2 and 3 – dedicated to the deployment and operating roadmaps respectively – are divided in two layers: the macro and the micro level. The macro level concerns on the first-hand organisations that are willing to invest in the development of the CEADS. The project's work on the multistakeholder governance and business model framework revealed the necessity for a public entity to finance the deployment phase. The micro level section details how DSIs can join the CEADS. To interconnect with other DSIs, they will have a comply to a minimum set of rules to join the CEADS.

In short, this chapter presents the deployment roadmap, outlines the CEADS roll-out plan and implementation process based on a holistic vision for the CEADS that emcompasses overarching concepts related to governance, technical infrastructure, legal parameters, ethical considerations, and a robust business framework.

2.1.1. Audience

This chapter is crafted with specific audiences in mind, catering to the diverse stakeholders who play crucial roles in shaping and leveraging the CEADS. The targeted audience includes, in no particular order:

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- **Agricultural Sector Entities - Current and Prospective DSI Participants and Users:** Engaging with current and potential participants in the agricultural sector, this chapter is crafted for entities considering becoming DSIs or envisioning themselves as future users of the CEADS. It provides relevant information to guide their understanding of the opportunities and benefits within the CEADS.
- **Industry Partners and Decision-Makers:** Addressing the needs and perspectives of industry partners and decision-makers, insights provided here aim to facilitate informed choices and strategic planning within the dynamic agricultural landscape.
- **EU Commission:** With an understanding of the Commission's critical influence, this portion is specifically designed to align with the thought processes of EU decision-makers and policymakers. It underscores how the CEADS deployment can complement and enhance broader EU strategies and initiatives in the realm of agricultural data and innovation**.**
- **EU Bodies and National Public Authorities:** Recognising the diverse array of public authorities at the EU and national levels, this chapter aims to provide a clear overview of the CEADS, facilitating a comprehensive understanding of its structure, potential impacts, and strategic importance to public governance.

2.1.2. Sequencing

By "deployment phase" we here refer to what the DSSC have labelled the preparatory and implementation stages combined (see Figure 6 below). These two stages, represented in green, will set up the foundations of the CEADS. The end of the deployment phase will be indicated by the release of the Minimum Viable Product (MVP) of the CEADS.
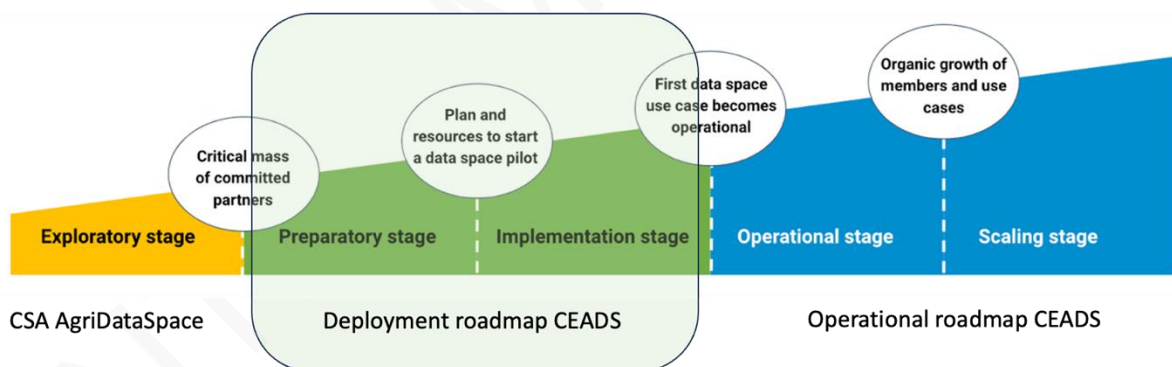
Figure 6: Deployment phase of a data space initiative.

The chronological layout of the roadmap is crucial, especially for the deployment phase. The project analysis outlines the various sequences required for constructing the CEADS in a feasible manner. This process integrates feedback from the stakeholder community and experiences from consortium members, ensuring as realistic a plan as possible regarding user adoption, capacity building, scalability, and long-term sustainability.

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2.1.2.1. Preparatory stage

The CEADS preparatory stage commences when a critical mass of dedicated partners and a foundational group of DSIs unite to co-develop a federated data space and its inaugural use cases. Key activities in this stage include:

- selection of initial DSIs and corresponding micro-level adjustments,
- identification and selection of pertinent use cases,
- development and enforcement of a shared governance framework,
- selection and preparation of essential technical building blocks,
- regular updates to the roadmap reflecting the latest developments in the world of data spaces and the agricultural domain, including the DSSC blueprint and other assets.

2.1.2.2. Implementation stage

The CEADS enters the implementation stage when a comprehensive project plan, complete with detailed milestones and allocated resources, both financial and otherwise, is established for CEADS piloting. This stage also involves a clear definition of each organisation's role within the CEADS pilot and the value generated for each participant. Critical actions in this phase cover:

- finalising the governance framework and preparations for the NAO,
- establishing guidelines for the onboarding of new DSIs, setting the stage for growth,
- building out the technical infrastructure using the chosen building blocks,
- conducting tests with selected use cases,
- securing initial funding for the operational phase.

The output of this stage is a minimum viable CEADS setup.

2.1.3. MVP scenarios

The MVP to be developed as part of the CEADS deployment roadmap is intended to facilitate data exchange among stakeholders in Europe in a secured and trusted way. We identified the DSIs and the use cases as key elements of this deployment phase to test and validate the first design of the CEADS.

The following section outlines potential scenarios for the core functionalities required by CEADS to enable these data exchanges. The scenarios are constructed based on the technical feasibility afforded by the interoperability of data catalogues and identities. The scenarios can be adjusted during the agricultural data space deployment project to meet the evolution of the technical architecture requirements and the use cases concrete needs.

2.1.3.1. MVP Scenario 1: Interoperability of data catalogue
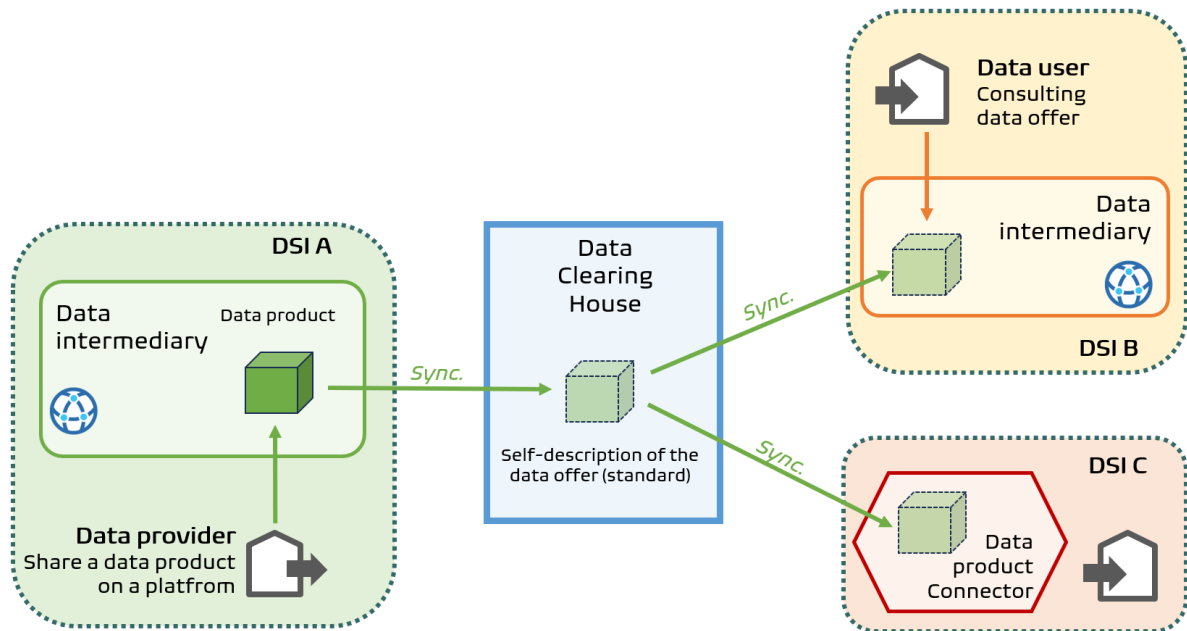
Figure 7: Data catalogue interoperability.

In this envisioned framework, users can seamlessly access a comprehensive data offering across the EU through a single DSI. Leveraging the interoperability of the data catalogue, authorised data offerings can synchronise their listings with a centralised data clearing house (DCH). Once synchronised, these descriptions become visible across the data catalogues of all participating DSIs within the CEADS.

It must be underscored, though, that this synchronisation pertains only to the data offerings' descriptions. Actual data exchanges, which often require explicit permissions from data rights holders, necessitate processes beyond the catalogue interoperability. This ensures the protection of data rights and the observance of necessary permissions for data access and usage.

2.1.3.2. MVP Scenario 2: Interoperability of identity
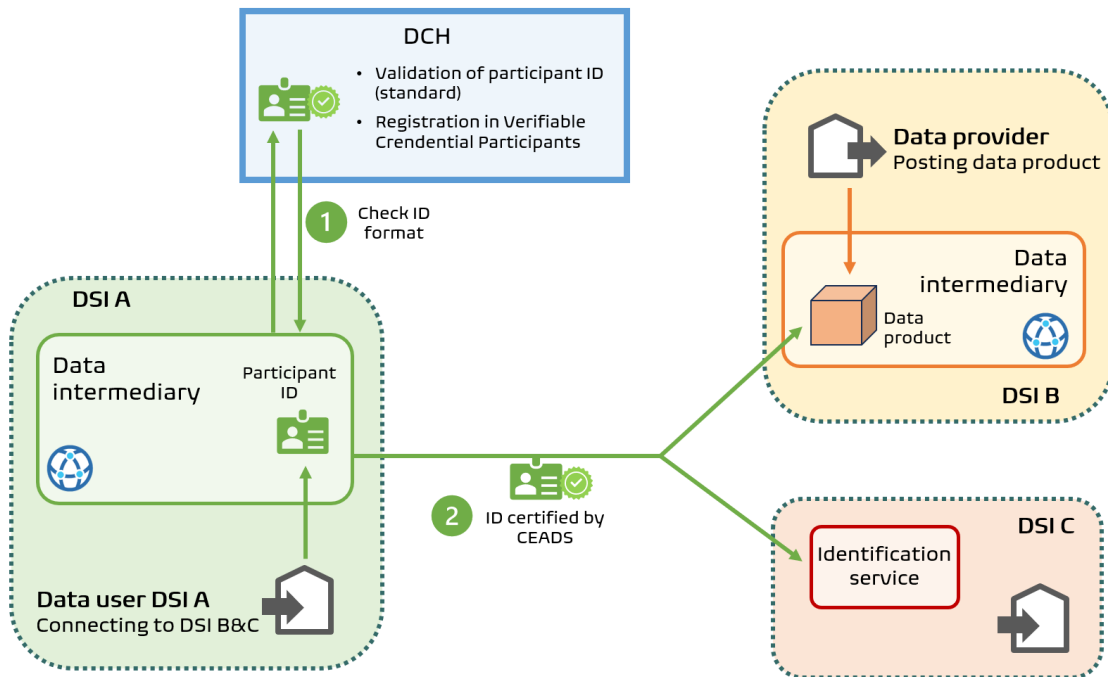
Figure 8: Interoperability of identity.

Data users can seamlessly gain access to DSIs across borders, thanks to the interoperability feature of identity management within the CEADS framework. Initially, a user is authenticated by a local DSI, which then issues a participant identity that conforms to CEADS format. This new identity undergoes validation by the DCH, which officially registers the user as a CEADS participant. Subsequently, the verified participant gains the ability to access various DSIs within the CEADS and can enter into data exchange agreements with data providers.

In this framework, the responsibility of ensuring the authenticity of a participant's identity lies with the originating DSI. The DCHs are tasked with confirming that the identities meet CEADS specifications but depend on the DSIs to authenticate the actual credentials of the participants.

2.1.3.3. MVP Scenario 3: Permission check

When a data user affiliated with one DSI seeks access to data held by another DSI, the request is routed to the data provider — in this case, the farmer — for consent to share the data. This process of obtaining permission is facilitated by two foundational technical building blocks that serve as basic services within the Minimum Viable Product (MVP): the interoperable data catalogues and identities.

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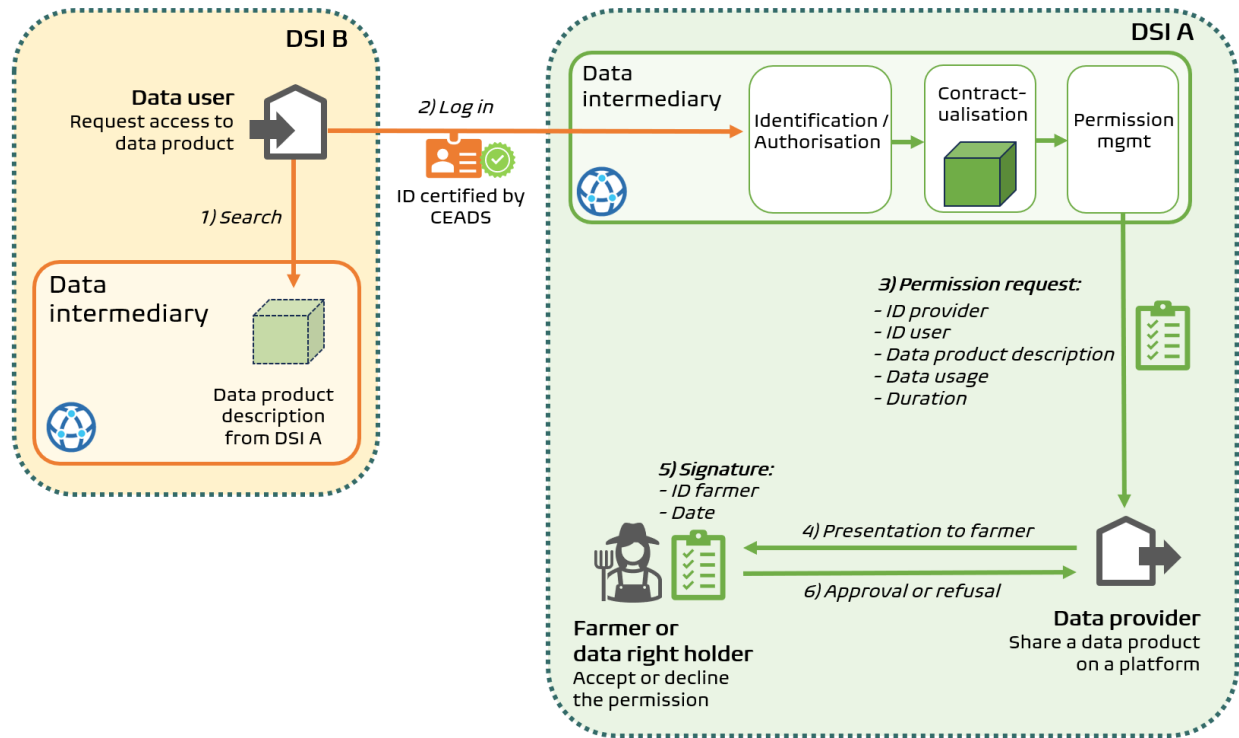
Figure 9: Permission verification process.

In this example, the permission is defined by the following parameters:

1. Identity of the data provider
2. Identity of the data user
3. Data offer description
4. Data usage
5. Duration
6. Identity of the farmer
7. Effective date

Only the data usage is not well defined from this list of criteria. It is a key parameter that needs to be clear for the farmers to be able to give his permission.

These three MVP scenarios share a common technical architecture composed of DSIs and DCHs. Implementing the scenarios will result in the following impacts.

- **Technological impacts**: this interoperability requires the use of DCHs to check the compliance of the data description and identity and the synchronisation the information with other DSI. Adjustments are needed for the DSI to display the data offer description and IDs under the right format and for the synchronisation mechanism with a DCH.
- **Revenue model impact**: If DSIs require a fee for access to their platform (such as licensing or transaction fees), it is necessary to redistribute a portion of the transaction value to the DSI providing the data product. Without redistribution, there is a risk of having DSIs with empty catalogues that rely on the catalogues of other DSIs for their value.

- **Operational impact**: DSIs need to implement special features to display and managed data products coming from another DSI. The user journey needs to be improved to bring more value to the CEADS participants.

In summary, the establishment of interoperability among various DSIs is pivotal for enhancing cross-country data exchange. This interoperability may impact the business models of DSIs, particularly those that rely on licensing revenue. It necessitates the adoption of a value redistribution mechanism to compensate the DSI that provides the data product. Additionally, it is imperative that this value redistribution also benefits the farmers or agricultural organisations contributing data, as this will incentivise them to participate in data sharing activities.

To ensure an equitable distribution of value from data exchanges, the deployment of sophisticated DCHs, inspired by the financial market model, could be an effective strategy. Furthermore, standardising the format used in data sharing agreements could include specific clauses that dictate the terms of value distribution, thereby safeguarding the interests of all parties involved in the data exchange process.

2.2. Legal strategies for the CEADS

During the deployment stage, we recommend following the legal strategies that are outlined by Ines Hartël[4] to address data management with differing degrees of enforceability, particularly considering the DGA and the DA's guidance on B2B and B2G data relations, which complement the GDPR. These are 1) Self-regulation using an EU Code of Conduct (voluntary soft law), 2) Regulated self-regulation with specific stipulations from the European Parliament, and 3) A binding legal framework (regulation) to protect farmers' and other agriculture stakeholders' data rights.

Table 3: Legal strategies

Recommendation / Risk	Deployment Action
Usage control: farmers can define policies limiting the uses of their data once it is shared.	Implement rich data use policies that allow farmers, or associations they delegate data control to, to automate consent management.
	Introduce user-friendly tools (e.g. consent dashboard) to reduce the time farmers invest in providing consent. Teach farmers about setting usage policies.
	Guide service providers on implementing usage controls.

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[4] Härtel I (2020) Report on the topic of "European Guidance and Rules for Agricultural Data" (European Agricultural Data Governance)

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Mechanisms used to ensure privacy and control are properly communicated to farmers so trust can be built.	Involve local organisations (especially advisors). Implement a communication strategy.
Advisors are fundamental in the short and medium term for digitalisation and information collection.	New jobs for advisors that do not require a degree in agronomy might appear, roles devoted to assisting during the process.
Distinguishing between personal and non-personal data remains crucial.	Encourage harmonisation in GDPR application to help to make a distinction between personal and non-personal data to enhance interoperability.
Profit sharing, IPR, trade secrets, and sensitive data were seen as crucial points for consideration when developing data spaces.	Establish reference contractual agreements that account for profit sharing, IPR, and the handling of sensitive data.
Open data licence.	Propose an open data license backed by a certification mark and a dedicated public interest organisation.
Long-term growth of the data space requires a high level of participation and collaboration and intensive knowledge exchange by people with different perspectives and expertise.	Reflection on the characteristics of the communities that form part of the digital platforms, both off and online, and how these are intrinsically motivated and attribute meaning to data and information.
Updated EUCC can be a valuable resource for various DSI to consistently apply the DGA and DA, particularly concerning the roles of different legal entities that facilitate data exchange.	Determine how the updated EUCC will align with the DA and any potential future related acts.
Organisation responsible for determining how to coordinate these various legal tools (GDPR, DA, DGA, EUCC) will play a central role in ensuring that agricultural data exchange complies with the legal framework.	Designate an organisation to coordinate the array of legal instruments to ensure compliance in agricultural data exchanges.
Consider that various EU member states are making progress in implementing the European Data Strategy.	Recognise the advancements made by EU member states, especially regarding the enforcement of national competent authorities.

2.3. Macro level: CEADS deployment roadmap

2.3.1. A common governance framework

2.3.1.1. The vision

"From a shared governance to a network administrative organisation (NAO)"

The deliverable D2.1 presents recommendations of the governance models to implement for the CEADS. The target organisation for the governance under an EU-based legal entity and composed of several bodies is also detailed, and this work forms the basis for the governance deployment in this roadmap.

This section describes the steps that lead to the implementation of the target governance model in the MVP CEADS, which is the product of the deployment phase.

The CEADS aims to facilitate data exchange between stakeholders of the agricultural sector, but it will not be a data intermediary in the sense of the DGA's data intermediation service provider (DISP). The DGA Article 12, paragraph f, requires that any DISP ensures that the procedure for access to its service is fair, transparent, and non-discriminatory. Even if CEADS will not be a DISP, this principle of fair, transparent, and non-discriminatory access should likewise be implemented in CEADS' organisational governance in the following ways for the different governance bodies.

2.3.1.1.1 Governance layers

The DSSC Blueprint differentiates two central building blocks for "intra data space governance", or governance inside a data space, which are also two of the three layers of the governance framework for the CEADS:

- **Organisational governance** consists of rules, roles, processes and structures of the operating organisation, its organisational bodies, its position in the ecosystem and the involvement of participants and other stakeholders.
- **Data sharing governance** consists of rules, roles, processes, and structures for effective and reliable data sharing across the members of the CEADS.

These layers apply to both levels of governance: the micro level (DSI) and the macro level (CEADS). The analysis of governance schemes in existing DSIs (deliverable D2.1, Section 4.1) presents how the layers of governance are implemented on the DSI level and reveals the range of possible implementations.

Note: The layer "Governance of collaborations" regarding collaborations for the governance scheme between data spaces, or "inter data space governance" will not be a in scope of the deployment of the roadmap. Indeed, the effort will focus on defining a clear governance for the participants of the CEADS to work together.

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2.3.1.1.2 Target organisational structure

The organisational governance of the CEADS will define the organisation and relationship between actors of the data space. We have identified the three types of organisations below to structure the governance of the CEADS.

Shared Governance

Leading Organisation (LO)

Network Administrative Organisation (NAO)

◯ = Actor in the network
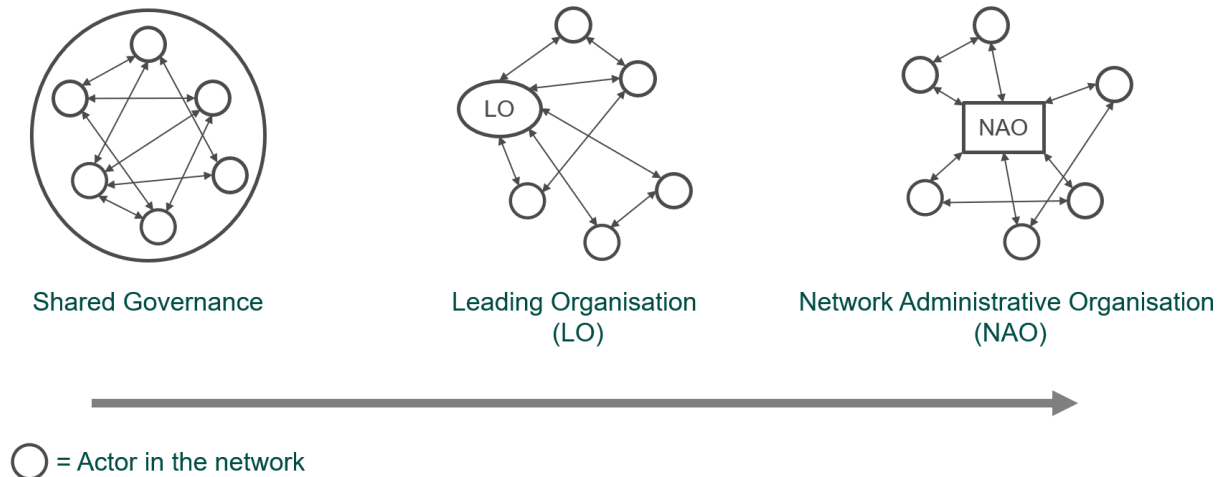
Figure 10: Possible forms of organisation the CEADS.

⭐ The governance models analysis in the deliverable D2.1 based on the inventory of the DSIs, interviews and grey literature has identified the **Network Administrative Organisation (NAO) as the most suitable for the CEADS.**

The main argument relies on the neutrality of the NAO that can include governance body representative of the different aspects of the agricultural sector. Even if the CEADS will not be a DGA-recognised DISP itself, establishing a new, separate legal entity for the CEADS helps in aligning with the DGA requirements, which we consider good practice even if not legally applicable in the case of the CEADS, that DISPs must be separate legal persons (Article 12, paragraph a). The neutrality and independence of CEADS will be significantly shaped by the choice of its founding members, which is crucial for its credibility within the agricultural sector's evolving DSI landscape.

To ensure the multi-stakeholder nature of the CEADS and to enhance its legitimacy and acceptance, it is proposed that existing DSIs become members of the organisation. This involvement will not only provide them with a stake in the governance but also ensure that the development of CEADS benefits from the full spectrum of expertise across the agricultural domain. The form of organisation can be anything from a non-profit association or foundation to a limited liability company or cooperative, each with its own interests and compatible with the general objectives of CEADS.

2.3.1.2. Preparatory stage: Governance recommendations

The implementation of the NAO is complex, and many decisions still need to be taken to enforce this type of governance organisation. Another difficulty to consider is the moving environment in terms of legislation and the emergence of technical standards.

For these reasons, we recommend starting the CEADS with a shared governance between lighthouse DSIs. The shared governance will eventually evolve to a NAO. The deployment roadmap of the CEADS will cover the implementation of a shared governance and the establishment of the NAO components. The operation of the NAO will be discussed as part of the operational roadmap (Chapter 3).

2.3.1.2.1 Organisation: a temporary shared governance

The preparatory stage of this deployment roadmap will be conducted during the agricultural data space deployment project. At the start of the project, the objective is to implement a simple governance model to allow quick implementation of the key use cases. The CEADS would be under a pilot phase, that allow testing and validating of the different components of the data space.

We recommend establishing a shared governance between lighthouse DSIs involved in the implementation project. The shared governance will be supervised by the European Commission as a neutral party and sponsor of the implementation project.

The shared governance is a simplified governance model with no distinct governance bodies. It will rely on an agreement between parties. We recommend following the four concepts for the definition of the agreement.

1. **Partnership**: develop mechanisms to involve every DSI of the pilot.
2. **Equity**: no DSI in the pilot is more significant than the other. The consensus approach recommended as a decision-making process.
3. **Accountability**: every member included in the decision-making process is accountable for the views they expressed.
4. **Ownership**: each DSI member take ownership of their actions. It distributes every action's responsibility among each member.

2.3.1.2.2 Selection of participants

The deployment roadmap consists in setting up and testing the first pieces of the CEADS. The conclusions of the project analysis and feedback from the consultation process emphasis the heterogeneity of the European agriculture landscape and the importance of local organisations

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to promote and initiate changes. We propose a decentralise CEADS that takes the shape of a network of DSIs.
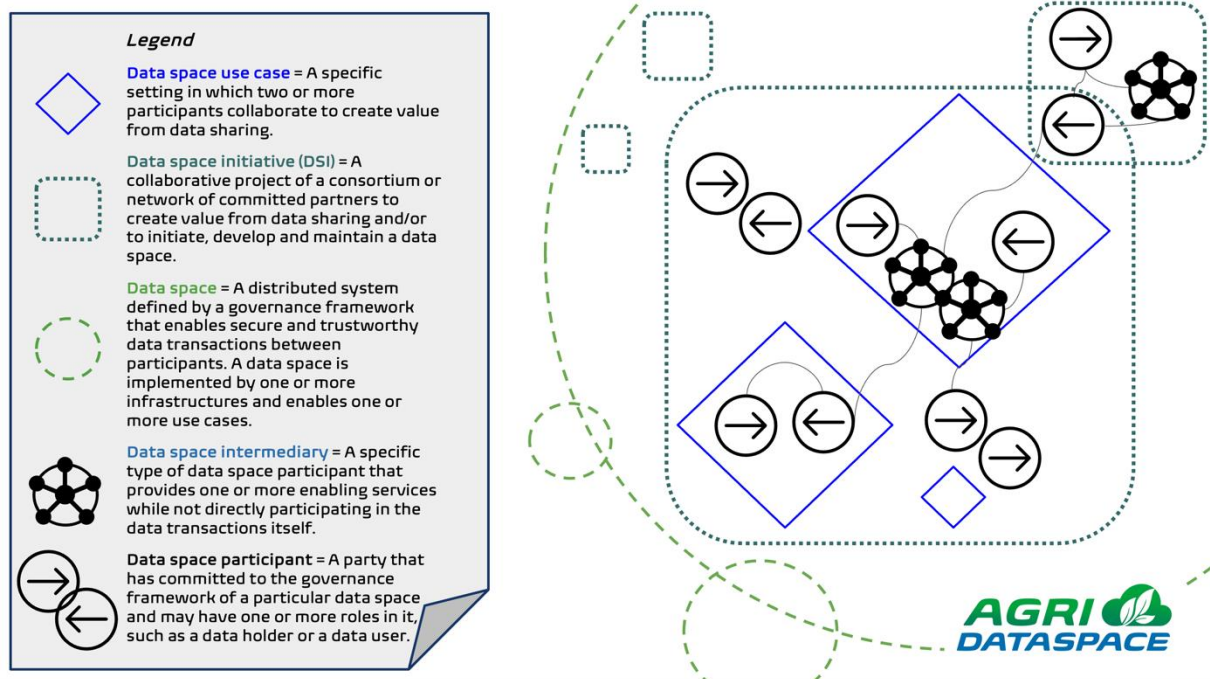
Figure 11: Key concepts of a data space.

We differentiate DSIs from data space intermediaries (as defined in the DSSC glossary, including DGA DISPs). While the data space intermediary is a unique organisation providing enabling service for data space participants, DSIs are composed by several organisations including data space participants and data space intermediary.

The selection of lighthouse DSIs has been identified as a key element for the success of the CEADS. They will be the first nodes of the network and demonstrate the interest and feasibility for the creation of the data space.

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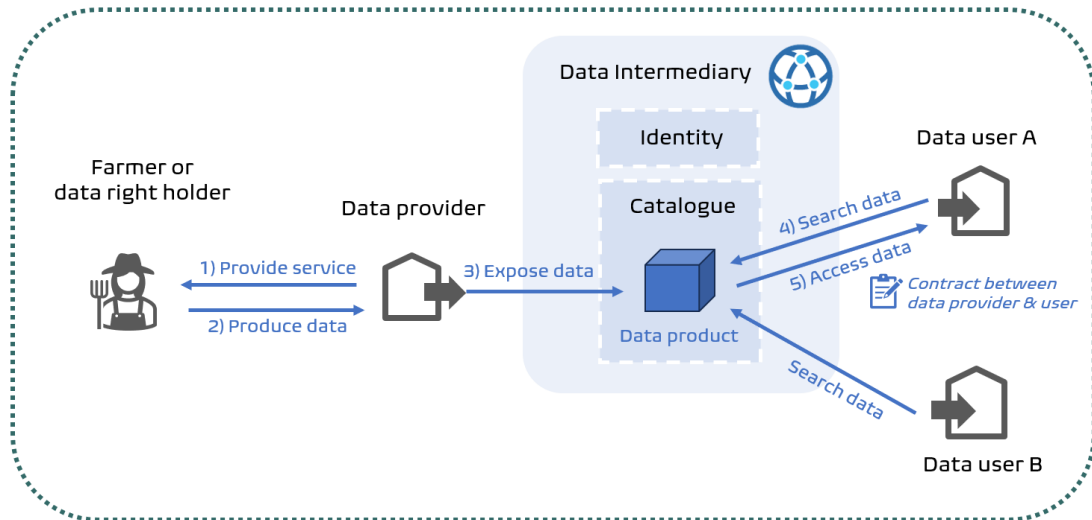
Figure 12: Example of centralised DSI.
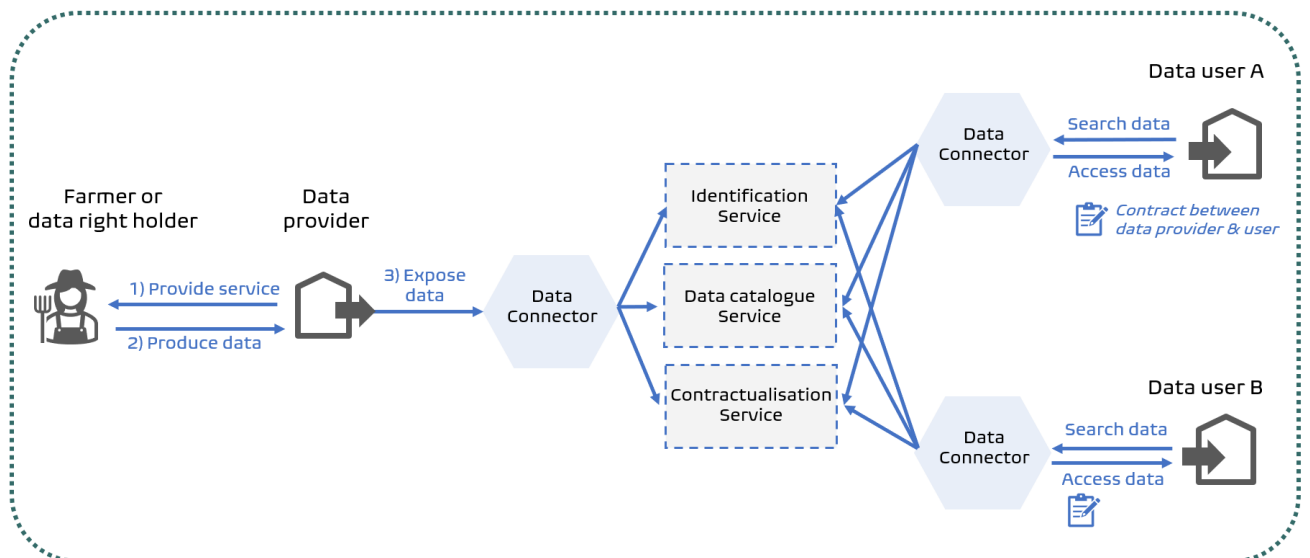
Figure 13: Example of decentralised DSI.

The lighthouse DSIs will be selected during the preparation stage and will appear in the CEADS implementation call. They must follow a list of criteria to ensure the representativity of the agricultural sector. We recommend meeting the following criteria:

- **geographical representation**: the lighthouse DSIs must cover different regions in Europe,
- **neutrality**: DSIs will have a role of intermediary and must ensure neutrality regarding their interaction with data providers and users,
- **compliance**: commitment to comply to the CEADS expectations on the technical level (data catalogue, identity, permission management, etc.) but also on other dimensions – governance, business and legal.

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The lighthouse DSIs can be selected from the mapping realised in deliverable D1.1 of the ADS project. The list is not exhaustive, and DSIs not mentioned in the mapping can also play the role of lighthouse DSI in the agricultural data space deployment project if they meet the selection criteria.

A list of lighthouse DSIs will be suggested in the agricultural data space deployment project by the consortium candidate. This list will be adjusted if needed and validated by the European Commission in charge of the call. The preparation stage of the roadmap will focus on the definition of use cases with the selected lighthouse DSIs.

2.3.1.2.3 Advisory Board (AB) for the shared governance

The temporary shared governance that will be implemented between the DSIs, for the pilot of the CEADS, will need external indicators to ensure that the deployment is going in the right direction. An additional group will be required to overlook the deployment and provide recommendation when necessary.

We recommend creating an AB for the agricultural data space deployment project with an extend task of supervising the deployment of the use cases. The AB can include members outside the project consortium. The representativeness of the AB members will be essential to ensure the interests of all stakeholders of the agricultural sector.

MS representatives, as well as the European Commission representatives, can play a key role as active members of the AB to ensure the CEADS pilots meet the European and national data strategies.

2.3.1.2.4 Role of MS representatives

MSs should play an essential role in the agricultural data space deployment project. Facilitating the "Business to Government" and "Farmer to Government" relationships are part of the key objectives of the future CEADS. In addition, national authorities have already started to implement a data strategy for the valorisation of data. The coordination of the CEADS deployment actions with EU members data strategy ensured.

We have identified several options for the MS representatives to be involved in the CEADS deployment roadmap:

- **AgriFood EDIC**: an EDIC is a legal framework aiding MSs to set up and implement multi-country projects (MCPs). MSs hold the majority of votes in the members' assembly, which gives them a decisive role in the governance of each EDIC. The AgriFood EDIC can have decisive role in the agricultural data space deployment project.
- **Advisory role**: MSs can have an advisory role through the AB, as described in the section above, or a group dedicated to MS representatives.
- **DSI**: MSs can be active participants of the CEADS by providing a compliant DSI that will be used to exchange data. We encourage them to be part of the key use cases that will be developed in the implementation stage.

⭐ **MVP of the organisation mode**

During the implementation stage, the data space pilot will selectively bring onboard a limited number of organisations, establishing the foundational elements of the CEADS. To streamline deployment efforts and prioritise interoperability among DSIs, we strongly recommend adopting a shared governance model at this phase.

The MVP of the data space will be accompanied by the creation of a NAO in a strategic step that will be fully implemented during the operational stage. This NAO serves as a foundational element to ensure the effective functioning and integration of the CEADS as it evolves.

⭐ **Creation of a legal structure**

To determine the optimal legal structure for facilitating data exchange among cross-border DSIs, a phased approach is recommended:

- Begin by establishing shared governance between DSIs, employing agile methodologies to remain flexible and responsive. This strategy will allow for incremental development, enabling to start on a smaller scale and expand based on learned experiences.
- A pivotal factor is forging a Public-Private Partnership (PPP). Effective governance will hinge on the collaboration of a select group of dedicated and impartial members from both the public and private sectors, ensuring balanced representation and decision-making.
- In the preliminary phase of CEADS's rollout, an external body such as the European Commission could oversee operations, potentially through EU-funded projects, before the establishment of a NAO.

Upon conclusion of the implementation stage, a legal entity will have been established, inclusive of the stakeholders already engaged. The subsequent operational stage is dedicated to orchestrating the functionality of this newly created NAO in the MVP.

2.3.1.2.5 Additional rules

The legal texts, especially the DA and the DGA, are very important to set up foundations of data exchange. However, limitations have been emphasised in deliverable D2.2 with the analysis of

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the current legal framework. Improvements are already being discussed for the updated version of these legal texts.

In the meantime, the CEADS governance has the possibility to enforce data exchange principal that are not present in the legal text yet, or that would be agriculture-specific. The identification of these additional rules and their modalities of application must be discussed during the preparation stage and tested and validated through the use cases during the implementation stage.

We have identified the following topics to be considered and regulated by additional rules to the legal framework:

- **Farm data lock-in situation.** The scope of the DA does not cover the entire spectrum of agricultural data, as a significant portion may consist of data not generated using connected products. For example, digital bonds for fertiliser and feed may not be portable and could be directly transferred into a farm management information system (FMIS). The farmer may need to manually record this data into their FMIS, and such manually recorded data may not be protected by the DA.
- **Fragmentation of agricultural data sets and exclusive data exchange agreements.**
  o Identifying the standardisation of the ADS project as a key element that could be enhanced through a delegated act.
  o Requiring a unique digital identity, especially for farms, to facilitate the transfer.
  o Enabling data intermediary services to facilitate data portability by ensuring user authorisation.
- **Farmers' lack of trust in digital technologies** due to ambiguities regarding the possible consequences of sharing data, especially in their data could be publicly available.
  o Governance infrastructure responsible for agriculture domain data exchange should include representatives of farmers.
  o Clearly indicate that any DCH or data space intermediary service supported by public funding or majority-held by the public sector does not hold farm-level agricultural data.

2.3.1.2.6 Redistribution of value to farmers

To ensure fair value redistribution to farmers within data spaces, CEADS should promote the following six principles and practices.

1. **Data Rights**: Affirm farmers' rights over their data, allowing them control and decision-making power regarding its use.
2. **Transparent Agreements**: Forge clear data sharing contracts that delineate usage terms, access rights, and fair compensation for farmers.
3. **Benefit Sharing**: Create systems where farmers receive tangible benefits, such as a share of profits or enhanced agricultural insights.
4. **Farmer Empowerment**: Educate farmers on data management and negotiate better terms within data spaces.

5. **Legal Advocacy**: Support policies that protect farmers' data rights and promote equitable compensation.
6. **Governance Participation**: Include farmers in data space governance, ensuring their interests are safeguarded.

By concentrating on these areas, data spaces can become more equitable, granting farmers rightful compensation and influence over the use and benefits of their data.

2.3.1.3. Implementation stage: Governance recommendations

2.3.1.3.1 Preparing the NAO for the MVP

The implementation stage of the roadmap will prepare the foundations of the MVP. The preparation of the NAO must be planned to transition from the shared governance. The proposition for the organisation of the NAO is described in the Figure 7 above. The objective is to create the components of the NAO and define the clear roles of the governance bodies. However, this NAO will be starting functioning only during the operational stage.

The first step consists in creating the legal entity in charge of the governance of the CEADS. There are several possible types of organisations for the legal entity. As described in the deliverable D2.1, The three most suitable options are listed down below:

1. **Nonprofit Organisation, Association, or Foundation**: Nonprofit organisations are often formed for purposes that benefit the public or a specific community, and they may have a mission aligned with promoting data sharing and collaboration in the agricultural sector. It is advantageous that nonprofits enjoy certain tax benefits, may be eligible for grants and donations, and are often perceived as mission-driven entities with a higher degree of perceived neutrality within the relevant stakeholder group. On the other hand, nonprofits must comply with specific regulations governing their tax-exempt status, and their activities are generally restricted to furthering their relatively fixes stated mission. While eligible for grants and donations, nonprofits may also face challenges in generating enough revenue through traditional business activities in the long run.
2. **Limited Liability Company (LLC) or other type of private company**: An LLC (or other type) is a flexible form that combines characteristics of a corporation and a partnership. It provides limited liability to its members, flexibility in management and a taxation structure best suitable for generating revenues. If an LLC is chosen as legal form for CEADS administration, it would be advisable to set it up in a way that guarantees the perceived neutrality of CEADS, such as getting a non-profit/not-for-profit status, a representative shareholder structure (across regions and sectors) or a company statute that guarantees neutrality.
3. **Cooperative**: Cooperatives are owned and operated by their members, who share in the profits and benefits. In the context of data sharing, a cooperative structure could involve collaborative efforts among various stakeholders in the agricultural sector. Members have a direct stake in the organisation, fostering a sense of ownership and collaboration. Furthermore, trust within the organisation is strengthened by the more consensus-oriented decision-making processes but further development can be also slowed down

by it. Therefore, it requires careful governance and decision-making processes to accommodate the diverse interests of members.

We recommend choosing the type of legal entity during the implementation stage of the deployment roadmap. Indeed, the preparation stage prior to the implementation will bring new elements that might influence the choice of the legal entity. In addition, the legal framework is still undergoing changes, and these might influence the decision.

2.3.1.3.2 Definition of the governance bodies

The ADS project proposes the structure the organisational governance of the CEADS as follows.
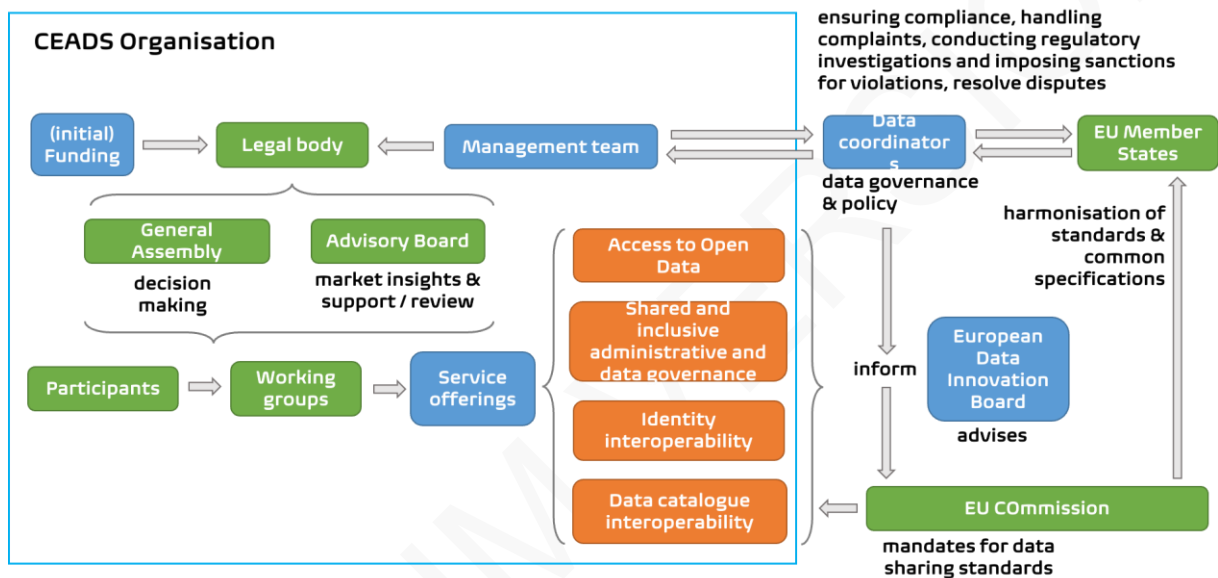
Figure 14: Overview on the organisational structure of the CEADS.

During the implementation stage, the objective is to create and define the role of the different bodies that will be part of the CEADS governance NAO. This governance structure will not be operational at this stage. This work will create an organisational structure that will be operated at the during the Operational roadmap.

We propose the following roles, which are further described in section 3.2.8.2 of the document:

- **Participation**: Should be open to any DSI or organisation interested in the services provided by CEADS.
- **General assembly (GA)**: Initially, only EU-based DSIs established the original CEADS entity to define rules and values of the EU that are attractive to and extend to international companies, DSIs and SMEs. The rules for membership should be elaborated as part of the evolutionary process in the relevant working group, e.g. on the basis of neutrality, openness and focus on value creation for farmers. DSIs financed and operated by the public sector can be shareholders of CEADS.

- The **Advisory Board (AB)** (as well as possible sub-units) should be led by representatives of the GA but be open to representatives of all members as well as representatives of non-member organisations of the value chain, from suppliers to farmers and agricultural companies up to public sector. As part of the evolutionary process, rules ensuring the equal representation of all stakeholders in the agricultural sector should be implemented.
- **Management team**: is responsible for the organisation and set up of the working groups, support of the GA and the AB. In addition to the internal organisation, the management team is responsible for the communication with the data coordinators that are appointed by the Member States
- The **Working groups** should be led by representatives of the GA DSIs. The working groups should be open to representatives of other members or external organisations (e.g., to machine manufacturers for a working group on handling machine data or to representatives of standardisation organisations or DSIs from other sectors) if this fits the purpose of the working group. Initial topics for the working groups include **interoperability recommendations** for identity management, data catalogues, legal contractual agreements and business models. A **compatibility grid** for the participant DSIs will allow for an efficient search and comparison of service offerings and corresponding interoperability testing, which will facilitate data sharing and the provision of **data-based services** between the member DSIs.

2.3.2. Towards a sustainable business model

The ways to finance an organisation focused on enabling data sharing between existing initiatives in the agricultural sector depend on its legal structure, mission, and objectives. Therefore, the alignment of governance and business model development is a crucial part of setting up the CEADS organisation should be both serve the needs of the users.

The final objective of the CEADS is to find a balance between costs of the infrastructure and the revenue of the services provided to the participants. However, the deployment roadmap will focus on the initial investments that will help implementing the CEADS.

2.3.2.1. Preparatory: Business model recommendations

2.3.2.1.1 Financing the deployment of the CEADS

Several financing options commonly used by organisations have been explored in deliverable D2.1, particularly those in the nonprofit or for-profit social enterprise space:

- Grants and donations
- Membership fees
- Corporate partnerships or sponsorships
- Revenue for CEADS services

The consultation process with project stakeholders and Members States representatives revealed that an **initial investment from the EU will be necessary early stage of the CEADS** for the deployment of the basic building blocks. Indeed, the consultation of MS representatives

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also showed a difficulty to finance the future CEADS at the national level, and a European effort would be necessary.

The objective of the deployment roadmap will be to achieve an MVP, that means to implement a minimum level of services necessary to create interoperability between existing solutions.

The initial founding for the early stage of the CEADS will be provided by the European commission through the agricultural data space deployment project, with a budget of 8 million euros for a 36-month duration.

2.3.2.1.2 Selection of key use cases

> ⭐ The project recommends capitalising on existing DSIs by **financing small scale interoperability use cases to set up the foundations of the CEADS**. This approach will enable the concept of interoperability to be put into practice. The small-scale deployment will reduce the complexity, validate the design of the CEADS and bring more flexibility in the realisation. As the CEADS is the federation of DSIs, it would be easier to scale up a tested and validated model by onboarding new participants.

The deployment of the CEADS focuses on the implementation of use cases. This approach has been identified as the most realistic to create the foundations of the data space. There are several benefits linked to this approach that are listed below.

- Demonstration of the value in data exchange (change of paradigm).
- Agility in the implementation.
- Adapted to the network architecture.
- Minimise risks.

The lighthouse DSIs will be actors for the implementation of the use cases. The list of key use cases will be defined and finalised during the preparation stage of the deployment roadmap. We recommend the following criteria to select the use cases.

- Involve all the profile of stakeholders of the agricultural sector.
- Involve farmers as active participants in the dissemination of farm data.
- Involve different branches of the agricultural sector (animal breeding, crop production, perennial production, etc.).
- Demonstrate the value of data exchange across MS borders.
- Illustrate B2B, B2G, and specifically business-to-farmer interactions.
- Promote environmentally sustainable practices.
- Test the technical architecture as recommended in the project deliverable D3.2 - Reference Architecture.

The ADS project focuses the analysis on the specificities of the agriculture sector. However, the following agricultural data space deployment project will extend the scope along the whole value chain by covering the agriculture and the food sector. The consultation process with the

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stakeholders and the business model analysis on existing DSIs revealed examples of uses cases. Among them, we have identified the most common:

- **Environmental scoring**: collection and exchange of farm practices data along the value chain to assess the environmental footprint.
- **Farm tools interoperability**: improve interoperability of digital tools at the farm level (machinery, FMIS, sensors, etc.).
- **Permission management tools for farmers**: implementation of a cross border user-friendly permission management tool for farmers.
- **Digitalisation of EU Common Agricultural Policy (CAP) declarations at national level**: lower the administrative burden for farmers the automation of CAP data exchange directly from FMIS by giving full control to the farmers over the use of his data (permission management).
- **Logistic chain optimisation**: exchange information between partners along the value chain to improve the logistic chain.
- **Algorithm-as-a-Service**: a service provider (e.g., FMIS) shares farm data under conditions to a third party that processes the data. The result of the processed data is sent back to the data provider.

Naturally, the implementation of use cases requires the active participation of stakeholders (SMEs, cooperatives, agribusinesses, etc.). The preparation stage of the roadmap will start with the identification of stakeholders for the implementation of use cases. We recommend using the list of criteria and the examples above as a guideline for the definition of the use cases. However, the detailed use cases, including the partners (DSI, data provider, data user, farmers), the data flow and the technical architecture must be defined in collaboration with the stakeholders.

The equitable distribution of value to farmers can be achieved through financial means or through the provision of services. It is incumbent upon service providers to evaluate the worth of the data and ensure fair compensation is awarded to the farmers. Governance bodies overseeing the CEADS could also have the authority to impose a stipulated minimum proportion of value redistribution that farmers must receive. This would be determined in accordance with a standardized grid that can be used to benchmark the value of data.

The following illustrations aim to depict various business cases through concrete examples. The intention is not to provide an exhaustive list of use cases but rather to illustrate the benefits of the CEADS through practical scenarios.

2.3.2.1.3 Interoperability of identities for farmers

There are different types of identities, as described in Figure 15. First the legal person identity that refers to the farm level. Then we find the natural person who work for the farm and the series of assets, also attached to the farm. If we can identify each person and component, it become easy to define the relationships between these identities. For instance, the farmer can have access to the FMIS, to not their employee. The farmer can also delegate to his employee the consent and permission management of data exchange at the farm level. An efficient

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management of identity can secure the flow of information at the farm level, but also facilitate the dissemination through the CEADS by controlling the assets.
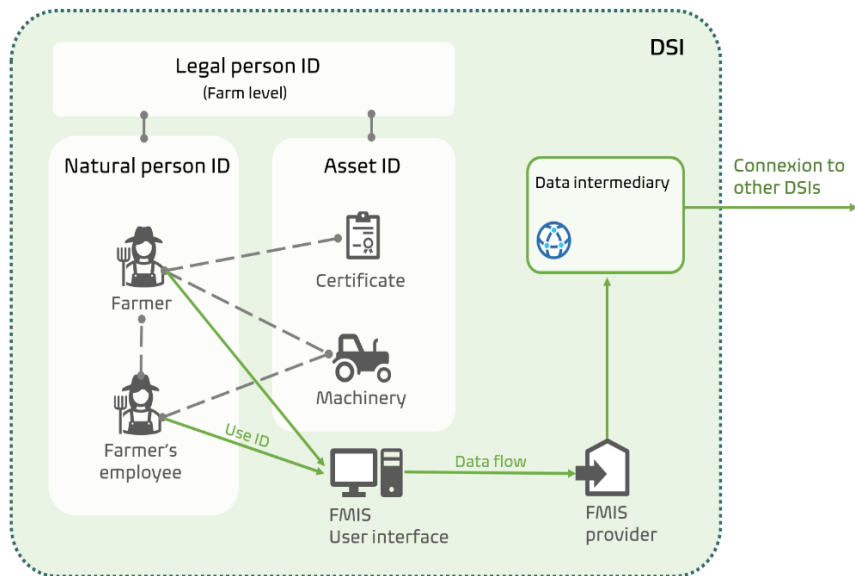
Figure 15: Interoperability of farmer IDs.

2.3.2.1.4 Integrated Administration and Control System (IACS)
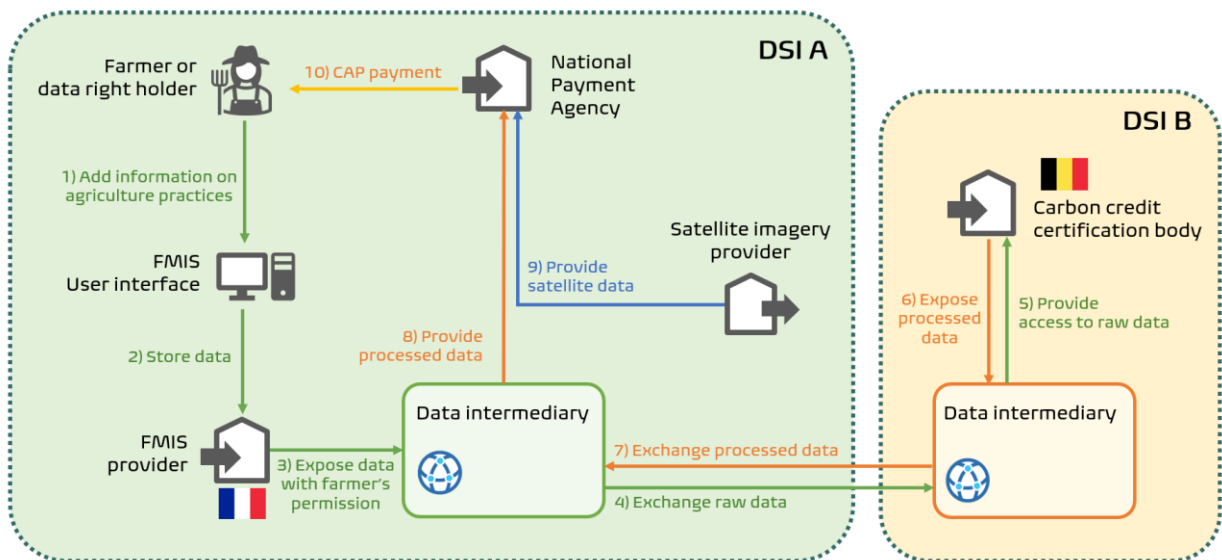
Figure 16: Integrated administration and control system.

The use case in Figure 16 presents a possible scenario to source data from the FMIS to a national payment agency. This could serve as an example of B2G interaction that offers advantages to farmers by alleviating administrative burdens. This data slow presents also the benefits of reducing the number of interventions from agricultural controllers. The data exchange between participants is possible thanks to clear contractual terms certified by the data

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intermediary. Data intermediaries help to secure data exchange in this example, but other architectures are possible with the use of a data space connectors in the case of decentralised IDs. The interoperability of identity and data product allows the operation of data exchange between two DSIs in the CEADS framework.

The Horizon Europe NIVA project[5] described a series of relevant use cases based on IACS, that should be explored for the selection of key use cases.

2.3.2.1.5 Definition of a business model compatibility grid

The charging model should be not for profit, but strive for cost coverage, as DSIs with this principle will be participants or even shareholders. High profits and margins won't be tolerated, as they might conflict with the principles of participating DSIs and will be a hurdle for participation.

The CEADS business models will rely on network effect created by the number of participants, which is the foundation of the multi-sided business models. The CEADS will offer complementary service to the DSI to help with cross border interoperability and creating the trust environment.

⭐ **Business interoperability grid**

Diversity of business models presents a complex challenge in the creation of the CEADS. To address this, we must first understand and classify the business models of DSIs. We propose the development of a **business model compatibility grid**, which will use the following parameters to categorise and facilitate interoperability among DSIs:

- Business models:
  - Data monetisation
  - Data marketplace
  - Software-as-a-Service (SaaS)
  - Industrial and data platforms
  - Technical enablers
  - Open data policy
- Revenue models:
  - Free-to-all
  - Freemium
  - Licensing
  - Sponsorship / Branded advertisement
  - Demand Oriented
  - Barter system

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[5] https://www.niva4cap.eu/use-cases/

> - o Other
> - Type of organisation: private / public / both
> - Legal form: Nonprofit Organisation, Association, Foundation, Private company, Cooperative, Other.
> - Profit oriented: yes / no
> - Geography: country(ies)
>
> The implementation of a comprehensive and consistent framework to delineate DSI business models is crucial. The business model compatibility grid, informed by these criteria, will serve as an essential instrument for navigating the interoperability challenges within the varied data space ecosystem.

Data value is very difficult to assess. Many factors must be considered to give a evaluate the data value: user needs, data quality, data frequency, etc. We encourage synergies between European project, for instance with the Data4Food2030 project[6] which is working specifically on the data economy for food system models.

2.3.2.2. Implementation stage: Business model recommendations

2.3.2.2.1 Asymmetry of power

A key challenge in creating a data space like CEADS is the diversity of its users, including data providers, recipients, and farmers. This diversity reflects an inherent power imbalance among stakeholders in the agricultural sector.

The CEADS aims to operate data exchange between all the existing actors of the sector. It means the data space must facilitate the creation of B2B, B2G and business-to-farmers relationship. The CEADS must also meet the EU values by providing a trustworthy and secure environment.

To ensure its success, the CEADS must prioritise transparency, empowering farmers as the primary data originators. Clarity about data exchanges, collectors, usage, and access duration is vital, alongside the farmer's ability to withdraw consent at any time. These safeguards are crucial to protect farmers from potential data misuse and are encapsulated in the EUCC and other deliverables. While some DSIs have begun to implement consent and permission systems for farmers, these can be complex and costly, lacking clear value or standardisation, and may not fully address national or regional requirements.

Moreover, the system must prevent any form of coercion, ensuring that companies do not force farmers to provide data access as a contract precondition. Although the CEADS allows farmers to give informed and revocable consent, it doesn't fully shield them from external pressures.

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[6] https://data4food2030.eu/

Ensuring that data usage terms are respected and determining the repercussions of contract violations remain complex issues to be addressed.

⭐ We recommend implementing an advanced consent and permission management system in the DSIs to give farmers more transparency and control over the use of their data. These mechanisms should be aligned with agreed practices like the EUCC and DA, increasing trust by guaranteeing that those sharing data remain in control and sovereign. This is especially true for the weakest players, mainly the farmers.

We have identified the priority actions to address during the CEADS deployment:

- Define the content of permission for the CEADS
- Provide guidelines for the implementation of a permission management system
- Offer stakeholders mutualisation of data exchange and authorisation management services at the DSI level

⭐ The proposed CEADS multi-stakeholder governance model offers solutions to mitigate power imbalances. One of the proposed recommendations involves regulating the impact of major corporations by restricting their presence to the governing board. This measure aims to guarantee that smaller entities and individuals have an equal say, thus maintaining fairness and ensuring the CEADS is representative of all participants. Beyond the regulatory aspect, this measure appears important to us to stimulate the economy around data exchanges by involving all stakeholders in the agricultural sector.

2.3.2.2.2 Communication towards farmers

Farmers are often the primary source of agricultural data and hold the rights to this information. Their involvement is crucial to the successful deployment of the CEADS. The consultation process with stakeholders and Member State representatives has highlighted the importance of direct and transparent communication with farmers. Gaining their trust is fundamental and begins with clear explanations of the control mechanisms within CEADS and the benefits they stand to gain.

Traditional agricultural organisations play a pivotal role in this communication process due to their established relationships with farmers. They serve as a bridge in two key areas.

1. **Data collection**: These organisations provide various services to farmers, during which they collect data that could be valuable to the CEADS.
2. **Education on data sharing**: They have the capacity to educate farmers about their data rights and the tools available to manage and control their data effectively.

To further support the dissemination of information and facilitate local engagement, the Digital Innovation Hub (DIH) network is recommended as a valuable resource. DIHs can act as a

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conduit, ensuring that information about CEADS reaches farmers and local agricultural actors, thus fostering an environment of informed participation and trust in the data space.

⭐ Raising awareness among farmers about their right over their data is a priority for the CEADS deployment. It is a prerequisite to empower farmers and give them clear explanations about the permission management mechanisms. It is only after trusting the CEADS and finding an interest than farmers can be inclined to share their data.

We recommend especially involving local organisations for pedagogy towards farmers and relying on transparency over the use the data by using an easy-to-use permission management system.

2.3.2.2.3 Design financing mechanism for the operational CEADS

The implementation of use cases will help to clarify the role of the different participant and the CEADS value for them. In parallel to the use cases deployment, an analysis should be realised to propose realistic financing mechanism for the CEADS at the operational stage.

We recommend running interviews among the use cases with actors at the different levels: data provider, data user, data intermediary, DSI, etc. The objective will be to complete the work initiated in the task 2.2 in the business model proposition for the CEADS and design the concrete business model based on the evaluation of the infrastructure costs, and the revenue generated from services.

In addition, this implementation stage will be the opportunity to test and validate the compatibility grid of business model that has been design at the preparation stage.

2.3.3. Deployment of technical building blocks

2.3.3.1. Requirements for the agricultural sector

2.3.3.1.1 Maturity in Information Technologies and Data within the Agricultural sector

The agricultural sector is highly fragmented and heterogeneous. The food production depends directly on the farm's environment: geographical localisation, climate, soil, etc. Many innovations in this sector are focusing on the use of data to monitor the environment by using sensors and models to help farmers in their decision making.

The number of digital services for agriculture is growing since the past ten years. However, we are still observing a very important heterogeneity in terms of adoption of digital service by farmers. The partners, such as cooperative and SME, directly in contact with the farmers, do not have deployment an advanced IT infrastructure for their day-to-day operations.

Experiences collected from the inventory of DSI synthesised in the ADS project deliverable D1.1 shows that a major difficulty in creating a data sharing ecosystem is related to the lack of maturity regarding data management and IT systems. For instance, providing a data offers

through an API requires first to identify the valuable data, organise, and harmonise the data between actors and develop a dedicated API.

The design of the CEADS will only work if agricultural organisations, such as cooperatives and SMEs, can join the data space. It is essential to take this reality into consideration if we want to avoid only international organisation and academic research centres to be part of the CEADS.

> ⭐ DSIs and particularly data space intermediaries can play a key role in supporting and onboarding the agricultural players by offering connecting services to the CEADS. The intermediary services would take charge of implementing the technological component necessary for compliance and exchanging data on the CEADS.

2.3.3.1.2 Importance of consent and permission management for farmers

As mentioned in the previous sections, farmers' profiles are a specificity of the agricultural sector. They are at the very centre of the food production chain and must be include in the data exchanged.

The technical architecture of the CEADS must consider a building block dedicated to the consent and permission management. Attention is brought to this topic because this feature has not been identified as a key building in other sector and might appear under-represented in other generic data space architecture.

In practice, existing organisations from the agricultural sector already have implemented permission management systems for farmers. There are different technologies involved for the deployment of such systems, for instance for the identification of the parties, the encryption and storage of the permission, the check of the information authenticity, etc. These technologies have been described in deliverable D3.3 in the Technology Canvas.

Also, the permission itself can take many forms. They usually contain:

- a description of the data,
- the recipient of the data,
- the use made of the data (process, traceability, implementation in FMIS, etc.)
- a duration for the use of the data

The format of each element of a permission are not following any existing standard and it is the responsibility of the DSI or the data provider of the consent or permission to define a format. This aspect must be taken into consideration if the CEADS plans to exchange consent and permission between DSIs.

However, with the CEADS architecture based on a federation of DSIs, each DSI is responsible of collecting the permissions from its users and an interoperability between DSIs is not required on this aspect for the MVP.

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⭐ We recommend CEADS to provide technological building blocks that facilitate the implementation and the operation of permission management for farmers. However, we have not identified the interoperability of consent and permission between DSIs to be crucial within the scope of the MVP. Each DSI will oversee enforcing the permission check as described in the CEADS governance framework.

Our recommendations are as follows.

- Provide technical recommendations for DSIs and data intermediary for the implementation of a compliant permission management system
- Provide a dashboard for farmer to manage their permissions
- Explore consent automation mechanisms, in a logic of compliance-as-a-code that can be tested in the use cases

A possible alternative for data space participants is to join the CEADS without using data space intermediary services. It would require the implementation of the technical components in each of the data participants information system to meet the minimum level of compliance defined to exchange data in the CEADS.

The use cases that will be implemented in the deployment phase can explore the implementation of a rich data use policies that allow farmers, or associations they delegate data control.

2.3.3.2. Building Trust between DSIs

The CEADS aims to connect existing or new DSIs with each other. An important challenge relies on creating various levels of interoperability in a heterogeneous environment. The DSIs must have the liberty to choose their technology and DSI architecture.

The technical interoperability is required at many levels to operate a data exchange between ecosystem participants. Two main layers have been identified:

- **Control plane**: technologies allowing the visibility of the data products and the contractualisation between a data provider and a data recipient.
- **Data plane**: focus on the semantic interoperability of the data itself. Ontologies, standards and data formats specific to the agricultural sector has been identified to facilitate the interoperability. The farmer's consent and permission management are also included in the data plane.
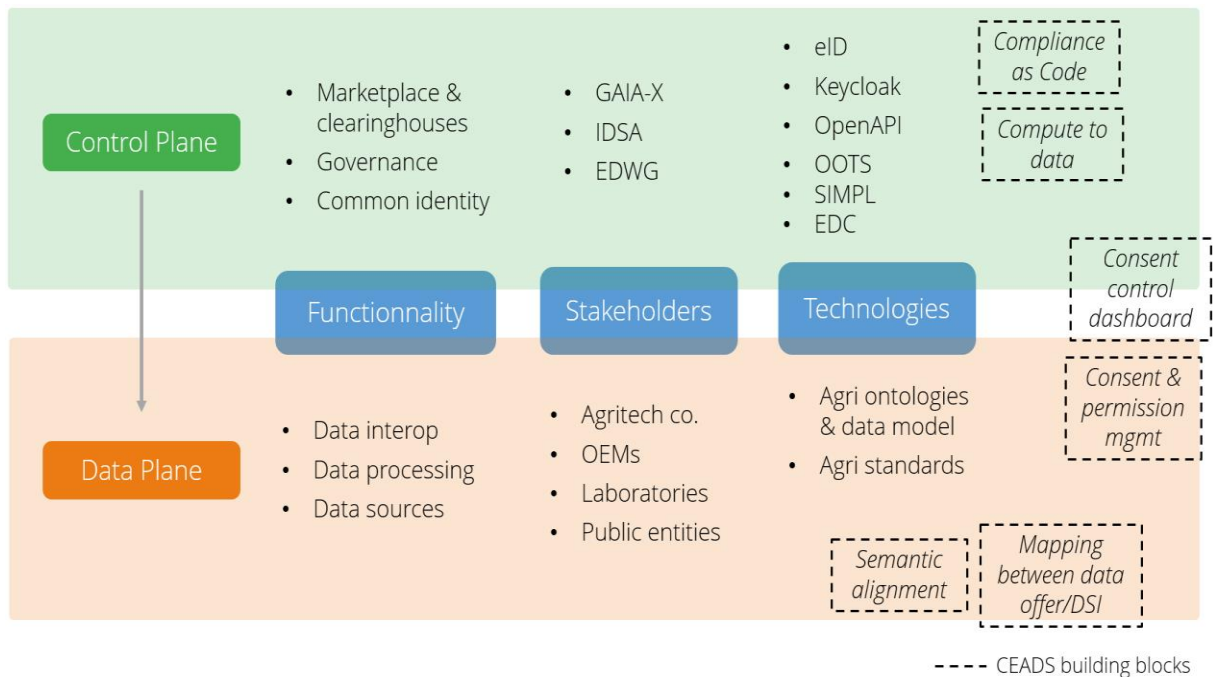
Figure 17: Control plane and data plane in data exchange.

⭐ We recommend focusing the roadmap deployment of the MVP on the Control Plane building blocks. The control plane covers all the steps from the diffusion of a data offer to the contractualization between a data provider and a data holder. The interoperability of data product descriptions and identity are the two minimum service necessary to realise a data exchange at the EU level.

2.3.3.2.1 A decentralised architecture

Incorporating technical data space building blocks into a common agricultural data space as defined by the DSSC Blueprint involves establishing a cohesive infrastructure that facilitates interoperability, data sovereignty and trust, and value creation from data.

The diversity of technologies and architectures implemented across Europe has led the ADS project to the decision to construct a decentralised architecture for the CEADS.

Each DSI has the freedom to implement its own technological solutions and can participate in the CEADS as long as it meets the minimum level of requirements for trust. To facilitate exchanges between DSIs, additional structures such as DCHs may be implemented at the CEADS level to verify the technical compliance of participants.

The illustration below presents a possible decentralised CEADS architecture:

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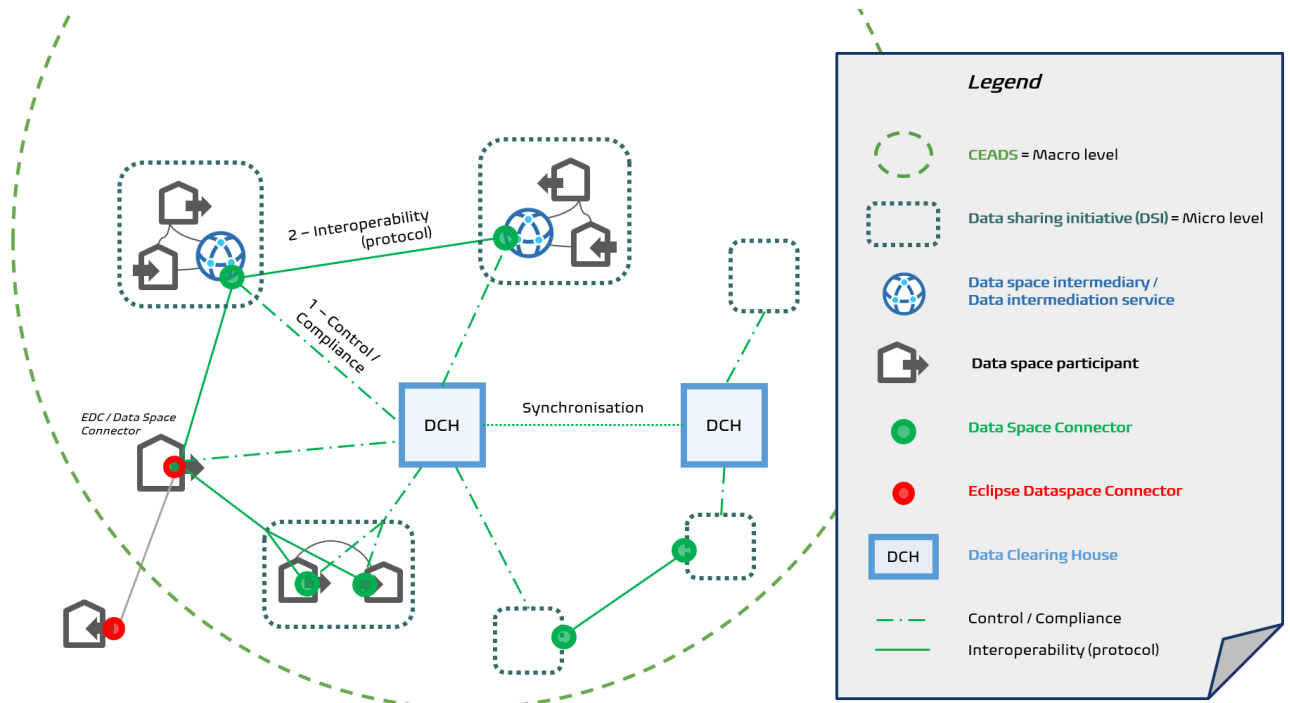
Figure 18: CEADS participants and their interactions.

The illustration above represents the main participants of the CEADS and their interactions with each other. The DCHs play an important role in this architecture. They check the compliance of the data space participants and provide standards for identity and data catalogue. Other service can be provided by DCH, for instance regarding data usage agreement or data processing, but only interoperability of data catalogue and identity will be required for the MVP. In this scenario, the CEADS can be composed of several DCH provided by private or public actors. These DCH must comply with the same standards and will communicate with each other. establishing a connection with a DCH is necessary to verify their compliance with CEADS requirements.

2.3.3.3. Preparatory stage: Technical recommendations

2.3.3.3.1 Focus on the control plane

Common standards are necessary to perform data exchange between heterogeneous DSIs. The DSSC is defining a blueprint for a generic data space that includes existing solutions for the implementation of a control plane. These technologies are generic and cross sectoral, which will facilitate the interoperability of the CEADS with other data space later on.

Among the list of services provided by the CEADS, two are directly related to the implementation of technology standard:

- **Interoperability of identity.** A key element to build trust in the data space. The solution recommended for the CEADS to implement a service to recognise and authenticate national identity. The authentication process is performed by a DCH that will provide a verifiable credential (VC) to certify the user's identity at the EU level. The parties exchanging data will be identified with this new common CEADS identifier and not with

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the national identifier. As an example, Gaia-X is developing a trust framework incorporating decentralised identifiers (DIDs), and this is a strong candidate technology for the CEADS MVP phase.
- **Interoperability of data catalogues.** A common metadata standard can be defined to describe a data product, and it is used to build an EU data catalogue. For example, the Data Catalog Vocabulary (DCAT) by W3C and data catalogue tools defined in Gaia-X are relevant building block candidates in this context.

On the other hand, data quality is very difficult to implement at large scale. It is impossible to define the common data format to be used for the exchange, because it depends on the user needs. The following elements can be deployed to characterise the data based on existing references.

- Guidelines will be given to the data provider to align their data product on existing documented formats and vocabularies.
- User working groups can be organised on the topic of data quality and semantic interoperability.
- Visualisation tools are already implemented in DSI to give an overview of the content of the data product (filling rate of data on each row and column, thermal map of filling density of your data set, column name with data format (data, text, boolean, etc.) and percentage of validated data).
- Rating system can be implemented for data recipient to assess a data product after usage.

2.3.3.3.2 Selection of technical building blocks

The preparatory stage will focus on selecting the building blocks to be implemented in the use cases. A generic list of technical building blocks has already been identified in the DSSC Blueprint and tailored to the CEADS in deliverables D3.2 and D3.3 of the ADS project.

Figure 19: DSSC Blueprint technical building blocks.

Various technologies are available to fulfil the expected services of each building block. For example, identification solutions for participants could be implemented using Self-Sovereign Identity (SSI) or OpenID Connect (OIDC). This section aims to choose the technologies to be tested and implemented in the use cases.

⭐ We recommend using the Technology Canvas in the D3.3 of the ADS project for the selection of technologies to test in the preparatory stage and integrate into the use cases in the implementation stage.

2.3.3.4. Implementation stage: Technical recommendations

After selecting and testing CEADS technologies during the preparatory stage, the implementation stage will concentrate on deploying these technologies in real-world scenarios. This phase is critical for validating the decentralised approach of the CEADS.

Implementation efforts must be closely monitored to document challenges encountered and identify requirements for scaling up the CEADS from its MVP to an operational data space.

2.4. Micro level: Deployment guide for DSIs

2.4.1. Governance of the DSIs

2.4.1.1. Preparatory stage: Governance description

The DSIs involved in the agricultural data space deployment project will be active in the implementation of use cases. Each DSI will have their own organisational and data sharing governance that must be well described for the use cases.

The work done in the ADS project through the mapping of the DSI landscape (deliverable D1.1) and their governance analysis (deliverable D2.1) can be reused for characterisation of the DSI governance models.

⭐ We recommend that each DSI keep its own governance models. The CEADS pilot and MVP will compose with this heterogeneity to build a decentralised data space.

2.4.1.1.1 Enforcement of the CEADS shared governance agreement

During the initial phase of CEADS, a shared governance agreement will be proposed to DSIs to foster collaboration. This agreement will adhere to the legal framework established by the DGA and DA, and include additional regulations to promote trust, transparency, and respect for farmers' rights.

The preparatory stage presents an opportunity for DSIs to prepare a methodology ensuring their alignment with the shared governance models of CEADS.

DSIs will actively contribute to defining this shared governance model for CEADS, enabling them to address any challenges or inconsistencies encountered during its implementation.

2.4.1.2. Implementation stage: Governance recommendations from DSIs

2.4.1.2.1 Application of the CEADS shared governance

DSIs will execute key use cases as part of the CEADS pilot, adhering to their governance principles to facilitate data exchange while complying with the CEADS governance framework.

This phase presents an opportunity to practically test the application of governance principles, particularly concerning the collaboration among various data sharing governance systems within each DSI.

Feedback from participants will be crucial for refining the governance framework for the operational roadmap.

2.4.1.2.2 DSIs perspective on the NAO

The implementation phase will precede the operational roadmap, aiming to scale up the CEADS. As highlighted in earlier in this chapter, and based on deliverable D2.1 regarding the analysis of governance models, we propose the establishment of a NAO as the legal entity responsible for data space governance. This organisation will be made of various bodies, each with specific roles and responsibilities.

During this stage of the roadmap, the focus will be on establishing the NAO and defining the roles of the governance bodies. Insights gained from the application of shared governance through use cases will be instrumental in shaping the NAO.

Given their significant role at both the macro and micro levels, feedback from DSIs will be crucial in preparing for the establishment of the NAO.

2.4.2. Business models for data exchange

2.4.2.1. Preparatory stage: use case definition

2.4.2.1.1 Use case identification

The use case criteria have been enumerated to establish representative and relevant data exchanges for the agricultural sector. Additionally, scenarios illustrating possibilities of data exchange between parties have been presented. While these elements serve as useful guidelines for defining use cases, a comprehensive preparatory phase is still required by DSIs to transition from a conceptual approach to tangible data flows.

The preparatory stage aims to identify the actors involved, the specific data to be exchanged, and how this data will be leveraged. DSIs play a pivotal role, given their existing user ecosystems. We anticipate active engagement from DSIs in constructing practical use cases.

2.4.2.1.2 Methodology for stakeholder engagement

DSIs are committed to serving stakeholders within the agricultural sector. The use cases being developed in the agricultural data space deployment project necessitate the engagement of stakeholders to provide data and demonstrate the value of data exchange through real-world business cases.

DSIs will have a key role to play in engaging their user ecosystems to define the use cases. This process will require active participation from stakeholders over an extended period.

This preparatory stage presents an opportunity for DSIs to establish a methodology for engaging stakeholders as part of the agricultural data space deployment project.

2.4.2.1.3 Business models description for the compatibility grid

CEADS will focus on developing a compatibility grid for business models. To create this grid effectively, participation from DSIs is essential to provide insights into their respective business models and opportunities for collaboration.

We suggest leveraging the analysis conducted in the ADS project, specifically in deliverable D2.1 on business models. This deliverable already contains valuable information and a structured format for presenting DSI business models, making it a valuable resource for this endeavour.

2.4.2.2. Implementation stage: use case coordination

2.4.2.2.1 Contact with project stakeholders

The DSIs will oversee the implementation of the identified use cases from the preparatory stage. They will serve as the primary liaison with stakeholders, ensuring consistent communication to share information about the CEADS initiative and gather feedback.

The consultation process conducted in the ADS project highlighted the importance of effectively communicating the challenges and opportunities of data exchange to farmers. These communication efforts can be initiated through the use cases and expanded further in the operational roadmap.

Regular feedback from stakeholders and farmers will be instrumental in refining the use cases as we progress, as well as in delineating the business value for each actor within the value chain.

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2.4.2.2.2 Role of DIHs

The DIHs[7] implemented in the Horizon project SmartAgriHub are a European network of support organisations. They aim to make businesses more competitive by speeding up the development and uptake of digital innovations. They provide these services close to the end-users ("at working distance") and thereby cater to the needs of agricultural producers and food processors in a specific region.

We recommend relying on this existing network of local organisations, based on public-private partnerships for innovation, to support the implementation of uses through their services of community building lobbying, brokerage, knowledge sharing and advocacy.

The DIHs could also be involved in the identification of specific stakeholders for the key use cases.

2.4.2.2.3 Feedback on the business compatibility grid

This stage will be used to test, refine, and validate the design of the compatibility grid established during the preparatory stage. The use cases will operationalise the conceptual framework of the compatibility grid for business models.

Once more, feedback from DSIs during the implementation of use cases will be crucial to validate the decentralised approach of the CEADS, comprised of organisations with diverse business models.

2.4.3. Technological compliance

2.4.3.1. Preparatory stage: selection of technologies

2.4.3.1.1 Control plane

To build trust in the data space, the ADS project has prioritised the establishment of the control plane components for the deployment of the CEADS.

To align with CEADS requirements, each DSI will need to integrate the necessary building blocks to achieve the minimum level of trust expected. Compliance will enable the interoperability of data catalogues and identities across DSIs.

During the preparatory stage, DSIs will conduct a diagnostic of their technical components and develop a methodology for implementing additional technologies. The deliverable D3.3 Technical Canvas will serve as a reference document for technology selection.

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[7] https://www.smartagrihubs.eu/project/hubs

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It is imperative to carefully synchronise the timeline for identifying and implementing control plane technologies with the implementation of use cases. Any delays in implementing trust technologies at the DSI level may impact the timeline for business use cases.

2.4.3.1.2 Data plane

In parallel, attention will also be directed towards data plane technologies associated with the actual data exchange. While the initial focus will be on control plane components for the first phase of CEADS deployment, it's crucial to outline the data plane technologies involved in the use cases. The comprehensibility and reusability of exchanged data are directly influenced by the description of data sets, including their format, ontologies, and so forth.

The preparatory stage must serve to identify and test existing technologies for semantic interoperability. Given the close relationship between data exchange and use cases, DSIs will play a pivotal role in implementing best practices related to data description and sensitivity tailored to their specific use case.

2.4.3.2. Implementation stage: testing the technologies

2.4.3.2.1 Implementing technologies

The DSIs will be responsible for implementing the technological building blocks that enable the two levels of interoperability described below and testing them through real-world use cases.

The decentralised architecture of the CEADS implies that technical building blocks must be implemented at the DSI level. As key actors of the CEADS, the lighthouse DSIs will need to implement the core technical component to be compliant with the data space requirements and create an interoperability between DSIs.

We have defined two technical services among the list of services provided by the MVP:

- interoperability of catalogue, and
- interoperability of identity.

First, the **interoperability of catalogue** is required to be able to share the list of data offers available between DSIs. A DSI providing data offers needs to respect a common format for the self-description of the offers. All data offers will be described with the under the same format, enabling data offers from different sources to be displayed in a single data catalogue. At the DSI level, the interoperability of catalogue implies transforming the metadata of the data offer to ensure compliance to the CEADS. The self-description of the offering respect an existing schema (e.g., an ontology based on the Resource Description Framework (RDF) graph model or/and shape graph based on W3C's Shapes Constraint Language SHACL) and usually include a title and a description of the data: the issuer, the condition to access, etc.

In addition, DSIs must be able to manage data offers from different sources with the integration in their data catalogue. From a data user perspective, the objective is to display in one place all the data offers available at the EU scale.

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Then, the **interoperability of identity** is necessary to identify the users of the DSIs at the EU scale. The user identities will be required at different levels of a data transaction.

1. Between data provider and data user: the contractualization between a data provider and a data user implies the identification of both parties.
2. Consent and permission management for farmers (or other type of data originator): the farmers identity must be certified to guarantee the authenticity of the permission.

The DSIs have a role a trusted third party that certify the authenticity of its users to the CEADS. If compliant, each DSI is approved by the CEADS as a trusted organisation that certifies the authenticity of the users. There are several ways for the DSI to authenticate its users, but only one way to present these identities to the CEADS. Following the same principle of the data offering, a self-description of the identities will be required at the data space level.

2.4.3.2.2 Onboarding guide for new DSI

As early participants in CEADS, DSIs will need to document the process of achieving the minimum level of technological compliance. Feedback and recommendations on the implementation of the building blocks will provide valuable insights for drafting a guide for onboarding new DSIs.

The guideline's objective is to streamline the onboarding process for new participants to CEADS. A compilation of information based on DSI feedback will be initiated during the implementation stage and further refined in the following Operational roadmap.

3. Roadmap for operating the CEADS

3.1. Objective of this roadmap

The objectives of this chapter are to provide a realistic and concrete strategic plan on how the data space for agriculture will be operated and maintained. It also includes support related to all the elements needed for operating the data space: business, legal, organisational, technical, skills. The roadmap will emphasise the dynamic nature of the data space landscape, as there will be continuous changes in regulation and governance structures, as well as a continuous evolution of technical data space building blocks.
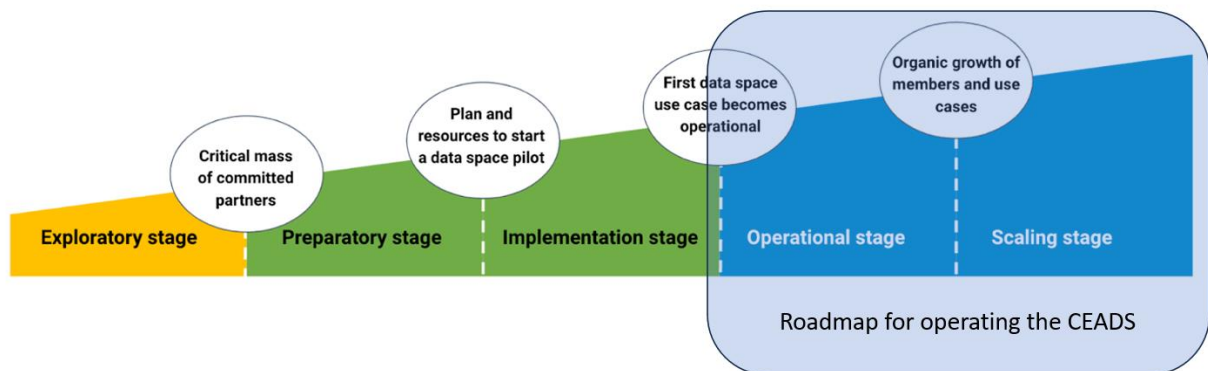
Figure 20: Operational stage of a data space initiative.

The deployment roadmap of the CEADS, which can be found in chapter 2, discusses the preparatory and implementation phase, and proposes milestones to come to a minimum viable product. The roadmap for operating the CEADS, which is described in this chapter, covers the next two steps: the operational and scaling stage, as a two-tiered operational roadmap:

1. **Macro Level**: This level outlines the strategic actions necessary for the CEADS to become fully operational and to successfully scale up. It includes plans for infrastructure development, stakeholder engagement, and the establishment of governance structures. In this part, the results of WPs 2 and 3, together with elements of the DSSC Blueprint set the stage. But the agri-specificities are added as an extra and crucial layer, resulting in certain decisions, extra features or open questions that require extra attention.

2. **Micro Level**: This level delves into the perspectives of stakeholder groups and of individual DSIs. It considers the needs and contributions of diverse stakeholder groups. It recognises the necessity for ongoing development and adaptation by the DSIs when the CEADS is fully operational. Finally, it gives some practical guidance to start using the CEADS as a DSI.

The intended audience for this part of the document includes industry partners, decision makers in business and governance, the EU Commission, public authorities, and participants in the agricultural sector who may become a DSI or future users of the data space.

The key insights that can be gleaned are summarised below.

1. **Dual-Level Roadmap:** There's a structured approach to developing the CEADS, which is organised on two levels: the macro level focuses on the CEADS as a whole, and the micro level focuses on the individual DSI perspectives.
2. **Phased Development:** The CEADS will be operational in distinct phases, following the deployment stages described in chapter 2, starting with a minimum viable product, and followed by the full operational stage and scaling stage.
3. **Strategic Actions:** The roadmap includes specific strategic actions required to operate and expand the CEADS, implying a need for careful planning and resource allocation.
4. **Stakeholder Engagement**: Input from various stakeholder groups is crucial, and the roadmap intends to incorporate perspectives from these groups to ensure the system meets a broad range of needs.
5. **Adaptability and Evolution**: The acknowledgment that the roadmap will need further development during the deployment phase suggests an iterative, responsive approach to the CEADS's growth.
6. **Insight into Current State**: The micro-level analysis provides insights into the current state of stakeholder input, indicating that the development process is informed by real-world feedback and is adaptable to change.

These insights underscore the importance of a flexible, multi-staged approach to developing a complex system like the CEADS, with continuous stakeholder involvement and an emphasis on adaptability.

3.2. Macro level: Roadmap for operating the CEADS

The roadmap for operating the CEADS builds on the MVP of the deployment roadmap, which will be a tested implementation of the infrastructure and the governance framework, done by the lighthouse DSIs.

In the operational stage, the first real use cases can start using the CEADS. Data can start flowing between CEADS participants and the use case in which they are active, which can provide the intended value by using services of the data space. This is also the phase where changes to the initially proposed technical implementation and governance framework are needed. The data space also needs to adapt to the context, be it the legal framework or business opportunities.

The scaling stage starts when the data space has proven to consistently and organically grow by adding new data space participants and new data space use cases. At this stage, the CEADS should be able to respond to market changes, adapt to them, and grow. The CEADS will be adopted by a market as a viable solution and demonstrate sustainability and stability, both financially and operationally. For the CEADS, it's crucial to consider the agri-specific aspects of data sharing, which have a big consequence on the roll out of this data space.

This roadmap serves as a conceptual idea and proposal, shaped by the current input and situation. It will undergo updates and enhancements throughout the implementation project, where it will be crucial to incorporate actual developments, a changing context, experience of pilot cases and more perspectives from various stakeholder groups.

3.2.1. Purpose and role of the operational CEADS

The CEADS will be created to facilitate more data sharing in Europe in the agricultural sector, of open as well as licensed data. There are great opportunities for new value creation and operational efficiencies for European agri-food stakeholders by exploiting available data. The value of the CEADS for all parties, including the governance authority, is created through the use cases. These use cases are driven by DSIs, that become CEADS participants once they start using CEADS services. Attracting new participants and supporting participants to develop use cases is therefore at the core of the operational CEADS.

The main roles the CEADS will take are:

- certification and monitoring of CEADS participants, and
- support for (new) participants, with specific attention to collaboration support.

New CEADS participants will get a certificate when they are compliant with the predetermined criteria (Chapter 3.2.4) for participants. There will be different levels of maturity for participants, which will also be monitored and acknowledged by the CEADS.

To ensure the onboarding of many new participants, a wide range of services are being provided:

- metadata catalogue presenting the data available through the different CEADS participants;
- DCH, or an alternative using, e.g., connectors, as verification nodes between the different CEADS participants;
- consent and ID management building blocks;
- onboarding support, and specifically support to achieve compliance of the different maturity levels on the control plane;
- collaboration support to help DSIs wanting to join the CEADS as well as existing participants who want to start and expand collaborations with other DSIs;
- support on how to finance data space initiatives;
- technical support on existing technical building blocks on the data plane;
- support for skills and training.

These services will be explained further in chapter 3.2.5.

The core principles the CEADS adheres to are:

- **Use case first**: the CEADS will develop itself based on a wide range of real use cases, with added value for the sector.
- **Bottom-up approach**: We want to ensure backwards compatibility, to support continuous operation of existing DSIs that want to participate, and to help developing the CEADS ecosystem. We need to avoid that existing DSIs that are willing to participate need to first undergo big changes or additional requirements. This is to ensure that the integration of the CEADS into the existing landscape is seamless and non-disruptive. There are many data sharing initiatives active in agriculture (see deliverable D1.1), which

is a big richness for the sector. There is a lot of motivation to make use of and expand interesting data sets in a collaborative way, using new technology. This gives the opportunity to build up the CEADS from the bottom-up. We propose a practical perspective on the process, adopting a bottom-up approach that starts with existing initiatives, collaborations, and technical developments.

- **Role of the farmer**: Although farmers won't be direct data space participants, their role cannot be underestimated. For most of the agricultural data, farmers are data rights holders. Without their consent to exchange data, there is no data flow. The link with the whole agrifood chain (farm-to-fork principle) is also very important.
- **Iterative improvement**: There will be a gradual improvement of the setup and services of the data space during the operationalisation and scaling stage.

3.2.2. Operationalisation plan

The roadmap for operating the CEADS builds further on the MVP of the deployment roadmap, which will be a tested implementation of the infrastructure and the governance framework. The Figure 21 depicts this operationalisation plan, including the results of the deployment roadmap (green), and milestones for the roadmap towards operationalisation (blue).
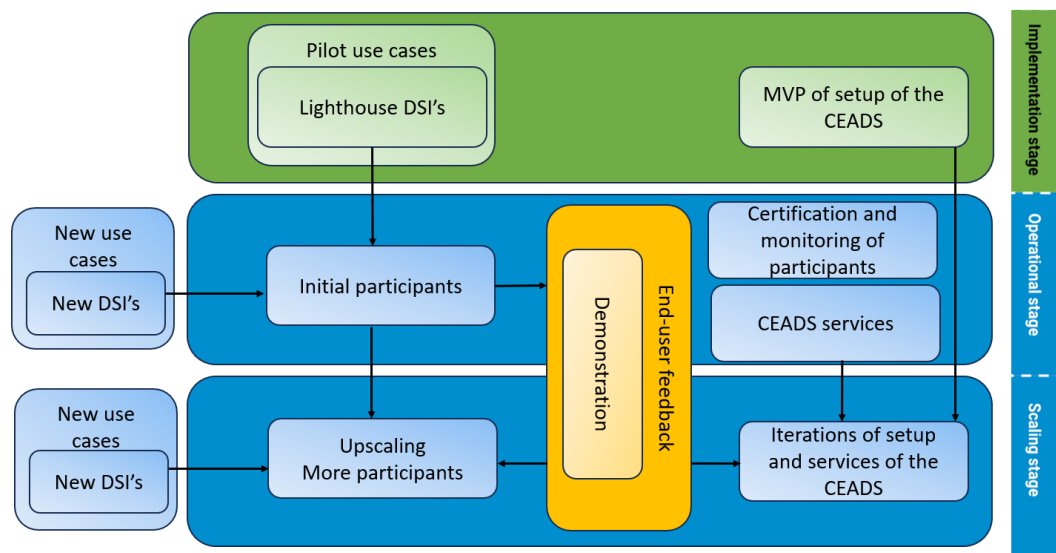
Figure 21: Operationalisation plan for the CEADS

In the implementation stage, a number of lighthouse DSIs will pilot the first propositions of the CEADS, applying them in a variety of use cases. At the end of the implementation stage, they will share their lessons learned. These lighthouse DSIs will become the initial participants of the CEADS. Their experiences will be documented and used in the operational stage.

In the operational stage, a "use case first" principle will be used. To attract and onboard new CEADS participants, we will start from value-driven use cases, implemented by existing DSIs. Since there is a very active and vibrant agricultural data sharing landscape in Europe (see deliverable D1.1), there are the initial use cases, defined and selected during the implementation phase (see chapter 2) and implemented by lighthouse DSIs. Those, together

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with new selected use cases, become the initial CEADS participants. These use cases will serve the further development in two ways.

1. From the start, there will be certification for CEADS participants, and monitoring of their maturity. There will also be support services, to help the onboarding of new DSIs, so they can implement their use case by virtue of the CEADS. The initial participants will implement with their use case the MVP that is the result of the deployment stage and therefore serve as a first test of its practical implementation. Feedback will be collected, but also extra needs will be revealed. CEADS can be adopted and continue the development in an iterative way. Improving the set-up and support of the CEADS will ensure more stability and sustainability, and adoption by the market.
2. Participants will start demonstrating the usefulness and added value of the CEADS for the end-users' agri-businesses and farmers through their use cases. Demonstrating real benefits will be crucial to attract extra use cases and participants and to be able to start up-scaling.

3.2.3. Possible scenarios

3.2.3.1. Technical scenarios

There are different possible scenarios for the operationalisation of the CEADS. In deliverable D3.3, four scenarios for the technical implementation at the macro level have been described. Which scenario will come into realisation doesn't depend only on available technology and choices made but is highly dependent on business opportunities and governance choices of existing or new DSIs that want to become CEADS participants.

The four technical scenarios that are summarised below, are described on the level of the control plane, that covers how the CEADS is governed. At this moment, we don't make a choice for one of the propositions but, based on the work in deliverable D3.3, describe its likelihood and effectiveness.

Scenario 1. Harmonised overall technology (very unlikely, very effective)

This scenario entails the migration of all DSIs to a unified technology stack. This consolidation streamlines operations and promotes consistency across the infrastructure.

This is a very unlikely scenario, since almost all DSIs would have to migrate to a new technology, which would be a big investment, without having enough clear added value. The added value of having a diversity in DSIs would also disappear, if they would all offer exactly the same services. At the same time, it would be a very effective way to shape the joint CEADS, as the same technology enables complete exchange.

Scenario 2. **Harmonised control plane mechanisms** (unlikely, effective)

In this scenario, all DSIs have the same mechanism on the control plane (e.g. ID and consent management), to easily connect with each other, using e.g. the same connector, clearing house or a combination of both systems. This means that the technology stack within the DSIs can be

heterogeneous, but they all agree to one technology to exchange identities, their data catalogue, etc.

This is an unlikely scenario as all DSIs would have to agree on one mechanism. Many DSIs are already working with a certain technology, so some have to invest and adapt, others do not. At the same time, it could be an effective scenario to implement the vision of a joint CEADS.

Scenario 3. Heterogeneous control plane mechanisms (likely, less effective)

In this scenario, the CEADS is not completely connected. A part of the core 454 data sharing initiatives that have been mapped in the agricultural data sharing landscape, would then work together in some clusters of connected DSIs. These defragmented clusters rise from the use of existing technologies, but also within ecosystems that are already (starting to get) connected. Often, they collaborate with a certain business case in mind, using a shared business model. Within these clusters, a choice for a specific technology would be made, enabling harmonised exchange within the clusters. In another cluster, the choice can be made for another technology, but with the consequence that these clusters cannot exchange data between them, not implementing the same control plane building blocks.

This is a likely scenario as only subsets of DSIs will connect with each other, based on existing evolutions and collaborations. This is a less effective scenario, as not all DSIs are automatically connected.

Scenario 4. Heterogeneous, but "bridged/translated" control plane mechanisms (likely, effective)

In this scenario, there are the same clusters of DSIs using each other's technologies for the control plane, but these mechanisms get connected by a bridging (translating) technology. This technology can for example bridge the ID management or create a meta-catalogue of the data in the CEADS.

There are two sub scenarios that relate to this bridging:

> a) Centralised bridging: bridging technology is provided by a centralised authority. This requires a low effort, but a central service provider is needed. This would mean IDs and data are registered in a central place.

> b) Decentralised bridging: every DSI installs the bridging technology separately. This sub scenario requires a higher effort, but the advantage is that there is no central authority needed. In this case data must be crawled from each other (EDC approach) or "pushed" by the DSIs to each other.

The first two scenarios are effective but are, at the moment, very unlikely. As discussed in deliverable D3.1, the vision for common data spaces in agriculture must take into consideration the existing high fragmentation in the agricultural data sharing landscape. This reflects the fact that the many solutions used by farmers were borne out of necessity, within confined administrative regions reflecting requirements, regulations and technology adoption readiness, sometimes very different across the whole European landscape. Taking this reality into account,

as well as the fact that the ADS proposes a seamless transition from the actual situation towards the beginning of the CEADS, choosing for one technology is not feasible.

If the choice depends on the lowest hurdle for DSIs to become CEADS participants, there should be an evolution over the years going through different scenarios.

- It seems probable that scenario 3 will be the reality at the start of the operational stage. DSIs are already using certain technologies like Gaia-X technologies or connector technologies from the IDSA framework, and collaborations between these technologies, often in demo environments, start to occur. These collaborations start from a will to join efforts and realise real data exchange across borders and existing ecosystems and are driven by real potential value. When developing these data space initiatives, discussions mainly focus on governance and business models, using a common technology as facilitator for the process. A probable evolution could be that clusters of similar technologies from the Gaia-X ecosystem emerge and, at the same time, clusters of DSIs that use the same connector technologies (among them EDC connectors) emerge.
- If the need and a business model between clusters occur, the step towards scenario 4 can be taken. At that moment, bridging technology will need to be developed and implemented. This connection of different technologies can already be seen. Various initiatives and companies providing technology for data spaces seek for bridging technologies. Examples for this are the iShare technology getting connected to the EDC ecosystem, or the Prometheus-X connectors that try to bridge between the Gaia-X ecosystem and the EDC technology landscape. A key differentiator for this evolution might be which technology stacks mature fastest, as those often get a higher adoption rate.
- In a later stage, if there would be a common preference towards one technology, it would be effective to evolve towards scenario 2. With 1 technology at a later stage, the hurdle becomes lower to join and collaborate. But this will depend highly on technological evolutions, preferences and collaborations, not only in the CEADS. Concerning scenario 2, currently, many technologies can fulfill the requirements for the agricultural sector and it cannot be foreseen that one technology stack becomes dominant. As an example, SIMPL open middleware software stack is currently being developed. One would expect that once many new DSIs adopt this open-source technology in the agricultural sector and in the agriculture-related data spaces (e.g. finance, green deal, energy), the SIMPL framework could become dominant offering a basis for a scenario 2. But this still would depend on existing DSIs to migrate to a new technology stack, which is a question of business model and return on invest for such a migration. Also here, the early provision of mature software components is a key to high adoption.

It is also possible that there will be an intermediary step between scenarios 3 and 4, at a moment bridging technology doesn't exist yet, but the need to exchange between clusters starts to appear. Some DSIs can start implementing technologies of two different clusters, at the moment when they feel the need to collaborate with DSIs using another technology.

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3.2.3.2. Legal scenarios

The implementation of the DA and DGA, have big consequences for the existing EUCC. After a period of implementation of the DGA and the DA, there will be more information to make an informed decision on the next steps to follow. Depending on the lessons learned of the lighthouse DSIs, on the work of the juridical experts of the CEADS on this topic, and on evolutions in the context, several scenarios can come into realisation. In deliverable D2.2, there is a broader description, starting from 3 possible alternatives, that can lead to the following 5 scenarios.

Scenario 1. DGA and DA replace the EUCC (rather negative perception, less effective)

In this scenario no update of the EUCC would be made, but potentially some terminology updates of the roles described in the current EUCC would be picked up in local codes of conduct.

This scenario entails that the grey zones in the DA and DGA, related to the agricultural sector, need to be clarified in court of justice, in case of unclarity or discussion by implementing them.

The current EUCC would not exist anymore, and the DGA and DA will be used as legal framework, without a specific European agricultural code. It might be replaced by different local Codes of Conduct, based on actual needs of DSIs, subsectors and/or stakeholders, including farmers. These new codes of conduct must consider the legal framework and the roles of actors within the DA.

This is an evolution that is already emerging here and there. For example, in the Netherlands, a practical example of addressing and anticipating the growing interest around data and ensuring ownership for growers can be seen through the introduction from BO Akkerbouw of the *Gedragscode Datagebruik Akkerbouw* (Code of Conduct on Data Use in Arable) in 2019. This code establishes a set of guidelines that all participating parties must adhere to. The aim is to give farmers assurance that the strategic use of data will work in their favour and mitigate potential risks. These initiatives should facilitate data sharing by lowering barriers and increasing trust.

The Member States could provide unique personal digital identifiers that could be used between governance bodies. However, there may not be legal incentives to obligate or facilitate their adoption in the agricultural domain. In this case, there is no guarantee that a unique digital identifier related to administration will facilitate data exchange.

This scenario is likely, since it is the most straightforward and least work-intensive trajectory. The DGA and DA provide a solid framework, but the specificities of the sector are not included. That is why most stakeholders have a rather negative or neutral perception towards this option. Business and industry stakeholders could be more positive since they will be able to use their existing systems. In this scenario, the specific roles in agricultural digital sector should relate to the roles defined in the DA and DGA. A lot of additional documentation, sector guidelines, trainings of all stakeholders to provide sectoral insights, etc would be needed. Also, farmers should be informed of the consequences of implementation of the DA and DGA and should be skilled to be able to get advantages and avoid negative impact of the regulation.

Scenario 2. EUCC updated with agreement on contractual clauses (rather neutral perception, less likely)

If the agricultural sector agrees to make an updated EUCC, specifiying agricultural data sharing practices regarding the DGA and DA, this can be done by including contractual clauses to be used by the different stakeholders. These model contracts should consider especially:

- The different actors' roles in a digital agricultural sector
- The specification of a data intermediation service role
- The legal dual identity, describing the fact that several data holders are possible
- That an enterprise first fulfils its obligations as a data holder
- The specification relationship with the data coordinator role
- The specification relationship with the EDIB

This will ensure that the adaptations of the DA and DGA provisions are in line with the sectoral needs.

This can be an interesting scenario, but finding a consensus on these contractual clauses can be complicated between the different stakeholder groups and their interests and needs. This consensus is needed, since a code of conduct remains non-legally binding, and should envisage to gather as much stakeholders as possible behind the same principles.

If an updated EUCC can put more emphasis on both public and private sectors, and include specifications linked to DA and DGA (confidentiality, more information on the articles on public emergencies, etc) this can improve the trust among stakeholders.

Scenario 3. EUCC updated for Data Space Initiatives (mostly positive perception, likely)

In this scenario, there is no general update of the existing EUCC, but a EUCC specifically for Data Space Initiatives can be made. This should encompass technical et organisational requirements such as:

- A unique digital farm identity
- A permission management system
- Extending the Data Act rules to data generated into connected services.

It is also an option to include elements that exceed the existing requirements of the DGA and DA but are essential to the CEADS. It could e.g. support the certification process for CEADS participants (see Chapter 3.2.4).

It is more likely that this EUCC comes into existence, because it is a way to describe some essential principles of the CEADS for its participants. It can be made and approved by the governance bodies of the CEADS, in which different stakeholder groups are represented, keeping the mission and vision of this data space in mind. Most of the stakeholder groups have a positive perception towards this scenario, since it makes the framework for the requirements for CEADS participants clear and can help to make the link with the DA and DGA and give organisations the assurance they follow the right principles. Business, industry and financial

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services will be neutral towards this, since this doesn't affect them in a great way. So finding a consensus will be a lot easier.

It could be that at the start of the CEADS operationalisation, the governance authority decides to go for this scenario. But this does not exclude that later on, scenario 2 can also be adopted.

Scenario 4. Delegated act with sectoral provisions (mostly strong positive perception, less likely)

This scenario describes the implementation of a delegated act with adaptation and inserting progressive tailor-made sectoral provisions based on sectoral needs. If this would be adopted, it should at least specify:

- Data intermediation services for G2G and G2B data exchange.
- A unique digital farm identity
- A permission management system
- The Extension of the Data Act rules to data generated into connected services.

A delegated act could clarify how the public sector can be more involved in data sharing and the CEADS. The harmonization of agricultural data spaces provided by a delegated act could also prevent differences in competitiveness between agricultural data spaces supported by public funding and those operating solely within the private sector.

This would be a scenario that is very well perceived by most of the agricultural stakeholder groups. Business and industry stakeholders could be less in favour of this option because they could find it to make their situation more complex. But another barrier is the conditions of the European Commission to allow the design of this type of act to be related to the interoperability within data spaces. If aspects of governance, standardisation and business compatibility are included, this can facilitate the DSI collaboration and connections with the CEADS. It can also make the competitiveness between There is also a possibility that a delegated act endorses an updated EUCC, which makes the link with scenarios 2 and 3.

Scenario 5. Delegated act on specific agdata sets (positive perception, less likely)

This scenario encompasses the adoption of a delegated act which identifies agricultural data sets with sensitive information and standardises data with a high level of interest. This type of delegated act should at least also specify:

- Identification of data from complex algorithms
- Identification of sensitive data or data related to trade secrets
- Identification of personal identifiers

Many hurdles identified for scenario 4 are similar. On top of that, not all stakeholder groups could have the same vision on what are sensitive data sets, making it complex to reach a consensus.

Which scenario will be adopted, will depend on lessons learned, context and work of experts on the topic during the deployment stage. It is possible that there is an evolution from one scenario

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into another, or that 2 scenarios develop in parallel. The CEADS, in collaboration with the European Data Innovation Board (EDIB), can play a central role in organising, coordinating, and implementing these different legal tools within the data ecosystem.

3.2.4. Participation criteria

The criteria to become a CEADS participant will be decided upon by the general assembly (further described in chapter 3.2.8.2.1), which will also give the certificate to new participants and do the monitoring of them.

As an organisation (data provider, data user, DISP) you can receive an official "CEADS participant certificate", which means you comply at least to the basic requirements of the CEADS. We propose to have different levels of maturity for CEADS participants, so organisations can enter easily, but grow and get support to do so, throughout the process. The certification according to maturity level can be used in the communication of participants to their clients and the agri-data ecosystem, and be used as a label to give trust, more clients and expand the business model.

The rules for participants should be elaborated as part of the evolutionary process in the relevant working group (as described in chapter 3.2.8.2.3), e.g., on the basis of neutrality, openness and focus on value creation for farmers.

We propose several maturity levels of being a CEADS participant: basic, growing and mature. A first proposal for the criteria for basic maturity should be part of the MVP at the end of the deployment stage. The criteria for more mature levels will be defined by the GA, with input from a working group and feedback of the AB. The maturity of a CEADS participant can be based on:

- level of compliance with the CEADS guidelines,
- data related services offered, and
- width of the ecosystem.

An example of maturity levels is described below.

Table 4: Possible maturity levels of CEADS participants.

Maturity level	Compliance with CEADS	Data related services	Ecosystem
Basic	Technical interoperability - Identity - Consent - Data sharing agreement	Facilitating technical data exchange At least one CEADS data source provided in the data catalogue, or used from the catalogue	Local ecosystem Around one specific use case for the CEADS
Growing	Interoperable business model	Also offering guidance for their clients (data providers, users, farmers, etc)	Covering several use cases in the CEADS

		Several CEADS data sources Business model active	Cross-border use case Cross-sector use case
Mature	Using CEADS building blocks on governance, business, legal and technical aspects	Also offering support on awareness, skills Financially sustainable	Exchange with other CEDS is possible

This framework needs to be further developed during the implementation phase. Inspiration can be taken from the DIH Capability Maturity Model[8] from SmartAgriHubs, and from input from potential CEADS participants and the different stakeholder groups. In any case, it should be aligned with the technical scenario that is being followed.

In this phase it will also be important to focus on having a concise understanding of the benefits, including access and other rights, that participants would receive as being part of the CEADS.

3.2.5. Development of CEADS services

3.2.5.1. Data catalogue presenting the data available through the different CEADS participants

This catalogue, a component further described in deliverable D3.2, facilitates efficient discovery of available data across the CEADS. Acting as a repository, it lists and describes data offerings from various participants, making it easier for users to find and access data from different sources within the data space. Key features include crawling and caching capabilities for tracking foreign catalogue offers and associated policies, a query interface, and support for distributed deployment topologies in its federated version. The data dashboard provides a user-friendly interface for monitoring and managing activities within the data space.

The catalogue can include available data, services, associated policies, and may feature a marketplace function. Or it will be a catalogue with only metadata. It will be publicly available to allow non-participating entities to understand the offerings.

The semantic alignment and mapping of the catalogue are crucial, with the usage of established data standards, reference ontologies, and vocabularies to ensure machine-readable data structures and facilitate data interoperability. Standards such as OGC, AgGateway ADAPT, GS1, ISOBUS, and reference ontologies like AGROVOC, AIM, SAREF, and Crop Ontology are

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[8] https://www.smartagrihubs.eu/Deliverables/pdfs/D4.2-DIH-Capability-Maturity-Model.v3.pdf

recommended for reliable parsing by machine algorithms, simplifying data exchange complexities.

3.2.5.2. CEADS Data Clearing House(s) (DCH)

A DCH serves as a verification node for ensuring objective and measurable trust among entities interested in data-sharing within the CEADS ecosystem. It is a mandatory go-to place for obtaining compliance and becoming part of the system. A DCH like Gaia-X's are nodes, operated by multiple market operators, and form a non-exclusive, interchangeable federation. They provide essential services of the data space framework, both mandatory and optional, to achieve compliance and facilitate onboarding for any adopter. DCHs play a crucial role in checking DSIs' compliance with data space standards and requirements, including the ability to produce VCs aligned with W3C standards and evidence for tracking data exchange and associated transactions. The list of services offered by DCHs can evolve to meet users' expectations. More on clearing houses like the one proposed by Gaia-X can be read in deliverable D3.2.

3.2.5.3. Consent and ID management

This building block is essential to incorporate specific agricultural guidelines from the EUCC, which initially operated on a voluntary basis but is now superseded by mandatory requirements outlined in the DA. Alongside access usage and policy control, which address consent management needs, considerations for managing the complexity and scalability issues of access policy control and enforcement are crucial. One potential solution is to retain data "on-premise" and allow potential data users, to access the data where it is stored, mitigating some challenges.

In the agricultural domain, there are unique stakeholder configurations involving data holders, rights holders, providers, recipients, and users, adding specific requirements to data space initiatives. This stems from the distinct roles of farmers as data rights holders. Consequently, dedicated and domain-specific elements for consent and permission management are necessary within the data space architecture. These permissions encompass both personal data, which can be regulated by consent, and non-personal data, for which transfer, and use is regulated by consent under the DA.

The CEADS will offer centralised and/or self-sovereign identity mechanisms. Centralised identity verification will be conducted by trusted authorities, known as trust anchors. It's also important to consider the potential role of dedicated data intermediaries.

3.2.5.4. Onboarding support

This support will help participants to achieve the compliance of the different maturity levels, mainly situated in the control plane.

The onboarding documentation is readily and publicly accessible to understand the necessary investments required for becoming a CEADS participant. To receive support, the first step is to become a participant, where options include:

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- presenting a conceptual idea,
- developing a use case initially and then connecting with an existing initiative, or
- creating a new initiative independently or seeking collaborators to join.

CEADS will assist DSIs by providing extensive documentation to streamline the onboarding process. This documentation will cover technical interoperability, identity management, consent management, and contractual compliance, accompanied by examples and best practices. Additionally, an onboarding support team will assist DSIs from their initial assessment to the successful launch of their use case within CEADS.

3.2.5.5. Collaboration support

This support is geared towards helping DSIs that want to join the data space, as well as existing participants, to start and expand collaborations with other data space participants. CEADS will extend assistance to the use case orchestrator and other participants in enhancing their cases, fostering synergies among them, and facilitating the involvement of all participants by ensuring equitable value distribution.

The identification and mapping of relevant data sharing initiatives gives a good overview of what is happening, which kind of indicatives exist, and how they work. By working in close interaction with the stakeholder community, including all MSs, a broad view of the current practices was gained. There is a vibrant community in the sector, active in data sharing initiatives. But in deliverable D2.1 is pointed out that most of them have little or no experience in collaboration with other initiatives. At the same time, many expressed interests in it, since these collaborations are relevant for their customers (being it data providers, users or farmers) that are often active in more than one region, country or vertical, or have to need to share data with adjacent sectors, relevant in the food system.

That is why we propose to work on the governance of collaboration specifically. The governance of collaborations are rules, processes and structures to build-up collaborations with other DSIs and data spaces. This aspect of governance isn't covered in the scope of the deployment roadmap, but lessons learned from the lighthouse DSIs will be gathered in the beginning of the operational stage. At the beginning of the operationalisation, there will be also a lot of exchange with other starting data spaces, to share lessons learned and good practices, and join efforts to work in an efficient, strong and more resilient way.

There are challenges for collaborating on the technical, legal and economic aspects of data sharing, so CEADS will develop services to support its participants in this. These services will consist of the following elements:

- documentation, guidelines and best practices on technical building blocks such as interfaces, connectors, data models, etc. and an overview of the actual use by DSIs of the existing technologies;
- guidelines on sharing of ID's and consents;
- vocabulary, semantics;
- templates for contractual agreements (to deal with certain discrepancies);

- compatibility grid, that is further explained in the section on the business model. This framework categorises common and valid DSI design options and assesses their interoperability.

When developing the services for the governance of collaborations, it is important to look back to the chapter on cross-border and cross-sectoral data exchange, described in deliverable D2.1, and to take into account the obstacles that have been collected during previous interviews, added with insights from the lighthouse DSIs.

One way to work on collaboration is to continue linking with relevant research lines of Horizon Europe and Digital Europe. The Partnership of Agriculture of Data, the EDIC on agriculture, the farm sustainability network, evolutions on IACS, INSPIRE, the agrifood testing and experimentation facility (TEF), the work in Data4Food2030, FoodDataQuest, SOSFood, Breadcrumbs, among other Horizon projects working on data spaces, etc., will be strongly connected with the evolution of the CEADS. The daily management needs to follow this up closely, so all these developments accumulate into the CEADS and make a real difference in the European agricultural landscape.

An important question is the participation of third (non-EU) countries. It needs to be defined what the relationship is between the CEADS and global / international actors and DSIs. For the participation of certain DSIs there will be a necessity to open the CEADS beyond Europe, because of the nature of their activities. Existing EU regulations that can affect this, such as the free flow of non-personal data regulations, need to be checked, and be juxtaposed with the concerns of the GA and AB. One of these concerns is that "big players" in the domain are global actors. It is important that the CEADS remains a neutral organisation, ensuring equitable and fair data sharing, stimulating data sharing in the benefit of all, including farmers and small players. There can be rules for certain countries, certain actors, possibly also specifically linked to certain governance roles of the CEADS.

On top of that, it is also important for the CEADS to build and sustain relevant links with global initiatives and international standards, to gain momentum and attract new participants and data sources.

Another question for the CEADS and other CEDS is how to work with participants of other European data spaces. Which mechanisms can be used to ensure trust between data spaces, so participants of different CEDS can use services and data sources across sectors. Are there limitations to the use of services of other CEDS, and should the same fees be paid when linking up with a new data space? In this, collaboration with, among others, the DSSC will be important. They focus on cooperation and establishing efficient links between different data spaces. The DSSC gathers information that is presented in working groups and tries to extract some high-level information and publishes it. The agricultural data space deployment action will continue to be involved in this process.

3.2.5.6. Support on financing data space initiatives

Once a year, the CEADS will launch a call for participation, supplemented by financial support for participants, open to both new entrants and those seeking to progress to higher maturity

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levels. Throughout this phase, CEADS' support plays a crucial role in assisting new participants and aiding existing members in advancing towards greater maturity levels.

If there are interesting calls, ways of collaboration and good practices on financing a DSI, these can be shared on the CEADS platform.

Additionally, guidance on revenue generation strategies for DSIs is available. In the analysis for the CEADs business model, a lot of existing business models of DSIs have been studied (deliverable D2.1) and can be used as a basis for this aspect of support.

3.2.5.7. Technical support on existing technical building blocks on the data plane

This building block includes ensuring interoperability of data product descriptions and identities and it involves defining related data policies and outlining the methods by which data products can be accessed.

To facilitate data interoperability, processing, and sourcing, it's crucial to have clear and sector-specific ontologies, data models, and standards, ensuring data transfer interoperability within the data plane, for instance, by utilising data collectors as outlined in deliverable D3.2. Furthermore, there's a need to fulfil control plane functionality for managing data sharing policies, including their establishment, implementation, and control, possibly utilising tools and platforms offered by various intermediaries.

CEADS will also provide mechanisms for establishing and maintaining an ecosystem of relevant semantic mappings among existing data sources and reference ontologies and vocabularies. This includes capabilities for tracking the data sharing process to ensure traceability.

Establishing a common trust framework involves aligning with the W3C VC data model for describing different entities.

Backward compatibility and integration are essential to ensure compatibility not only with previous versions of standards/mechanisms but also with various existing situations in the ecosystem. This ensures that the wealth of data produced thus far is not lost.

3.2.5.8. Skills and training

CEADS will provide assistance to the use case orchestrator and other participants in advancing their cases, fostering synergies among them, and ensuring the involvement of all participants by facilitating fair value sharing. That is why it is important to actively build skills from the people in existing DSIs, but also in organisations that are willing to or could join. All these materials should be provided in different languages to ensure inclusivity and accessibility across diverse European regions. This multilingual approach is fundamental to fostering a more collaborative and user-friendly CEADS environment. This will include the following.

- CEADS will offer a secure and interoperable **online platform**: a proposed online platform for CEADS should offer comprehensive documentation covering CEADS' mission, vision, and overall setup. A big part of the platform should be public. In this way, this documentation can serve as a practical resource for both participants and new initiatives seeking to join. The platform should include structured guidelines for DSIs,

outlining clear steps for onboarding, operating within, and exiting CEADS to ensure a seamless and standardised process for all participants. Part of the platform can be for participants only, with more specific guidance, information and access to training. This will cover technological aspects, governance framework establishment, business model implementation, and legal framework application.

- The support also includes a **helpdesk**, with people giving onboarding support.
- Existing cases will be asked to **share their experiences**. This can be done by sharing best practices, but also less positive experiences have their place. Patterns observed in unsuccessful cases aid in identifying challenges, needs, and scenarios to avoid. Sharing of practices is crucial for CEADS' continuous improvement, facilitated through the development and dissemination of rulebooks, templates, and technical documentation. These resources would act as valuable tools to guide participants, fostering a shared understanding and effective utilisation of the CEADS platform.
- There will be a **buddy program**, implemented though the annual call. This is especially important in the upscaling stage, where it's important to gain new data space participants and new data space use cases consistently and organically. To create a snowball effect and make use of existing relations between DSIs, we propose that existing CEADS participants can start working with a new or lower maturity participant and share experiences to help DSIs go more fluent through the process. Concretely, the lighthouse DSIs that piloted in the implementation phase, all propose a buddy DSI that has the intention to join the CEADS, chosen in mutual agreement. The objective is to share experiences and be a first contact point for CEADS related questions to become a member. Also, later on, other new members will be asked to join the buddy programme and propose a DSI from a lower maturity level as a buddy. Every member DSI that gets financial support is obliged to accompany a buddy of its choice. A small portion of the budget is foreseen for this. When choosing a buddy from a lower maturity level, a DSI that wants to become a member, or a DSI coming from a region with low DSI activity, there is a higher amount of financial support. The buddy programme can also be on a voluntary basis or be included as task in new research and innovation projects.
- We assume organising regular trainings by the CEADS itself will be complicated, but we propose to have a **matchmaking page for trainings** on the platform. On that page, all members, but equally other organisations providing trainings can publish their offer online. The other organisations should first pass a quality check before they can upload a training offer. These trainings can come from organisations working in data spaces, on technical components, EDIHs, DIHs, knowledge and research institutions, etc. There can be also links to existing webinars and online trainings, such as the EU data academy[9].
- An **annual event** will be organised. This emerges as a strategic initiative to gather stakeholders, including existing CEADS members, those interested in joining, and those seeking to learn more. This communal event not only supports the introduction of new

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- [9] https://data.europa.eu/en/academy

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use cases but also facilitates upscaling efforts, encouraging the organic growth of CEADS membership.

In conclusion, the successful practical implementation of CEADS necessitates a multifaceted approach, including linguistic inclusivity, resource allocation, collaborative events, dedicated teams for data integration, clear guidelines, and the sharing of best practices through comprehensive documentation. These elements collectively contribute to the establishment and growth of a vibrant and collaborative European agricultural data space.

3.2.6. Scaling up with additional use cases

3.2.6.1. Call and support for extra use cases

In deliverable D1.1 a comprehensive overview of the agricultural data sharing landscape in Europe, consisting of an up-to-date inventory of 454 data sharing initiatives, an analysis of their key building blocks and a description of the needs of data sharing initiatives towards the CEADS can be found. Many of these data sharing initiatives are already working on use cases that can be categorised in three bigger groups, being data sharing initiatives that are working on a specific topic in agrifood, data sharing initiatives that are working on a specific agrifood service and data sharing initiatives that are working on a data related service. Many of an inclusive approach must be devised to encompass a wide range of data sharing initiatives in the development of CEADS.

At least once a year, there will be a call for participants, with financial support. This call will be open for new participants, as well as for participants that want to develop towards a higher maturity level. During this process, the support given by the CEADS remains crucial, to accompany new participants and guide existing to more mature levels.

When new use cases start using the CEADS, the parties directly using the CEADS services need to become CEADS participants. These can be data providers, data users, data rights holders, or data intermediaries. In the agricultural sector, the biggest group of data rights holders are farmers, who normally won't themselves become data space participants, but will instead be connected through data providers, users and/or intermediaries. It is probable that in the beginning of operating the CEADS, mainly data intermediaries will be interested to become a participant.

To join the CEADS, organisations must first obtain a participant certificate, which they can apply for once the CEADS is operational. Participants criteria, established during the implementation stage, will be accessible on the CEADS online platform.

To facilitate onboarding, we will provide comprehensive documentation guiding DSIs towards achieving the required level of technical interoperability, including identity, consent management, and contractual compliance. In the documentation, there will also be examples of building blocks used by the initial lighthouse DSIs, as well as good practices. An onboarding support team will assist DSIs throughout the process — from the initial functional and technical assessment to the development and eventual launch of their use case within CEADS.

A question the GA will need to investigate, is how participants of other European data spaces can access data and/or services of the CEADS. Technically, interoperability needs to be foreseen. But also organisational, legal and business conditions need to be determined, keeping in mind the general objective to create a single European data market throughout all sectors.

Participants in the CEADS can begin their involvement by understanding the platform's offerings and requirements, and by leveraging the support mechanisms in place to enable efficient use of CEADS resources. This includes taking into use the key technical components envisioned by the CEADS, i.e., common identities, data catalogues, and consenting mechanisms.

3.2.6.2. Selection criteria

At the start of the operational stage, it's crucial to introduce new use cases to the CEADS, additional to the ones that tested out the framework in the implementation phase (Lighthouse DSIs). These use cases can easily be found in the already existing agricultural data sharing landscape, as shown in deliverable D1.1. The inventory reveals a diverse range of data sharing initiatives, emphasising the need to account for this diversity in preparing the CEADS for maximum participation. Specific use cases can drive this inclusivity, utilising existing initiatives, examples, and learned experiences to adopt a bottom-up approach for the CEADS. Local ecosystems are pivotal in this regard, and strong incentives from the European data strategy, offering funding and a legal framework, are imperative.

Uses cases will be first scored by their capability to implement and demonstrate different data-sharing scenarios, as described in chapter 2.1.3. While demonstrating the benefits of these variation in data-sharing, the CEADS can evaluate their support towards use case orchestrators in turning the scenarios into practice. Additional to their ability to implement the variation of the data-sharing scenarios, use cases will be selected based on the following criteria's:

1. **Use Cases built around key data products**

   There are certain data products to be defined in the agricultural sector, that will attract many data space participants, and be useful for a broad range of use cases.

2. **Use Cases pushed by different stakeholder groups**

   The initial use cases need to reflect a diversity in organisations active in them, as DSI, data provider and/or data user. Based on the stakeholder feedback and the validation process the ADS project did on the results of the WPs 2 and 3, it is clear that the needs, expectations and requirements of different groups are often quite far apart. Some use cases can combine several stakeholder groups, other can be focussed on one specific group. In this way, there will be a broad range of data space participants from the beginning.

3. **Use cases that represent different geographical regions**

   In deliverable D1.1, the inventory of data sharing initiatives shows that there are big differences between regions and member states in number of active data sharing initiatives. The description of the data sharing landscape shows that also on awareness, ecosystem building and skills there is more work to be done in certain regions. That is why it's important

4. **Use Cases in which different types of data flow**

The business model of the CEADS is based on a data market and an open data policy. This means the CEADS needs to attract different types of data from the beginning: open as well as proprietary data, public as well as private data.

5. **Use Cases with different objectives**

The objectives of the use case will also be different: some strive for the common good, others will be driven by the agricultural industry, and others seek to help farmers with efficient and sustainable farming.

6. **Use Cases with different technical building blocks**

The technical basis of CEADS will rely on common data space architecture as defined by the DSSC Blueprint and its related activities (e.g. Gaia-X, IDSA). However, there will be a multitude of software implementations of these building blocks for smart middleware components and connectors (SIMPL, EDC, FIWARE) and the use cases should cover this landscape to test and verify interoperability. There should be use cases from the different clusters, referred to in the third scenario.

This diversity reflects the reality in the agricultural sector, which is needed to provide examples to a broad range of potential interested participants.

Attracting new use cases can be stimulated by setting up a call for proposals, including financial support to integrate and implement the building blocks at the start. But DSIs can also join the CEADS on their own initiative, supported by a member state, as part of a research project, etc.

In the upscaling stage, new participants don't necessarily need to bring a new use case to join. They can join an existing DSI, join and find participants to collaborate with within the CEADS, or bring new data sets that can be of interest for others.

3.2.7. Iterations for the technical implementation

3.2.7.1. Reference architecture

Technical considerations need to ensure that a business-driven data exchange can be supported by the CEADS. During the deployment stage, the different scenarios for the reference architecture will be tested and discussed. Based on that, the further roll out will be planned and implemented.

During the deployment stage, the focus lays on the control plane building blocks, especially the interoperability of data products descriptions and identity. This is also linked with the technical scenarios that are described below. The basic interoperability will need to function, once the operational stage starts. Additionally, compatibility with SIMPL needs to be ensured.

3.2.7.2. Control plane

At the end of the implementation project, the elements of the control plane will be established, and it will become clear which scenario will be followed at the start of operationalisation. Depending on the scenario, certain technological building blocks on the control plane will be required as compliance criteria to become a participant. Probably, there will be certain elements that are obligatory, e.g., the use of the metadata catalogue or the use of a certain type of clearing house. For other elements, there can be a range of options to choose from, e.g., for identity and consent management.

During operationalisation, the technological evolutions around data sharing need to be followed up, linking with the DSSC, SIMPL, the Partnership of Agriculture of Data, etc. Improvements and adaptations of the existing building blocks will be necessary to comply, stay interoperable and competitive.

In agriculture there is always specific attention needed to manage consent from the data right holders, i.e., the farmers in case data is collected by them or on their farm. This principle is supported by the EUCC and confirmed by the recent DA. For agricultural data, the farmers themselves are identified as data right holder, meaning that although farm data is hosted by agribusiness or companies further in the food chain, farmers do have the right to decide if their data can be shared or not with other agribusiness as data users. This implicates that if companies as data providers want to share this data with a third party as data user, explicit consent of the farmers needs to be obtained. Consequently, to exchange data, a "three-sided" data sharing platform that involves the data providers, the farmers and the data users is needed. Possibly, there will be consent 'by code' implementation in the reference architecture.

3.2.7.3. Data plane

In the operational stage, data needs to start flowing between participants, hence the data planes building blocks also need to be implemented. To enable data interoperability and data processing, there is a need for clear and sector-specific ontologies, data models and standards. As described in deliverable D3.1, there is a multitude of existing standards in the agricultural domain, making semantic interoperability a main challenge. The CEADS should facilitate semantic and technical support and will provide a selection of mapping tools, best practices and representative mapping exercises based on recommended ontologies and vocabularies. Moreover, the CEADS will be also providing the mechanisms for the emergence and maintenance of an ecosystem of relevant semantic mappings among existing data sources and reference ontologies and vocabularies.

In deliverable D3.1, a list of future needs for the CEADS is made, linked to the current practices for specific building blocks, mainly focusing on the data plane. These will need to be picked up during the operational stage.

Table 5: Current Practices and Future Needs for CEADS

Building Block	Current Practice	Future Needs

Data Exchange APIs	Mostly Electronic Data Interchange (EDI) based, sub-sectoral semantics, often service provider specific.	Accessibility of a broader range of data through standardised APIs; APIs following standardised data models and common semantics; Functional/dedicated APIs with minimised data exchange; Replacing data exchange APIs with federated approaches.
Provenance and traceability	Provenance is not implemented, traceability is limited.	Standards/guidelines to describe provenance. Provenance required to ensure reusability. Standards/guidelines for traceability required to ensure auditability, reproducibility and allow certification.
Identity management	Mainly siloed, sometimes centralised, so many IDs/credentials per user.	Broader adoption of centralised and/or SSI mechanisms. Centralised identity should be performed by trusted authority (trust anchors).
Access and usage control / policies	Access control partly covered through private or sectoral consent mechanisms. Control over data usage and redistribution arranged through legal agreements.	Demand for more control, especially over usage, redistribution. Monitoring usage and redistribution and policy enforcement through infrastructure. Stack of broadly usable/configurable standard policies to reduce burden.
Trusted Exchange	Currently mainly implemented through provider specific authentication, encryption mechanisms, etc.	Common harmonised mechanisms to protect exchanged data. Replace trusted data exchange with federated data and trusted algorithms and models.
Metadata and discovery protocol	In general, considered less relevant, so mostly not implemented.	A catalogue of available data, services and associated policies.
Data Usage Accounting	No direct accounting mechanisms, indirect through value added services, subsidies/rewards etc.	Accounting mechanisms in place for data cooperations. Mechanisms linked to data traceability.

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| **Publication and marketplace services** | Non existing. | A catalogue of available data, services and associated policies, possibly complemented with a marketplace function. |
| **Overarching cooperation agreement** | EUCC for agricultural data sharing | EUCC extended and adapted to evolving EU regulations on data use, data privacy etc. |

Source: Deliverable D3.1.

3.2.8. Iterations for the governance framework

3.2.8.1. Organisational governance framework

CEADS is designed to be a trusted facilitator of cooperation, unifying diverse DSIs providing or needing agricultural data within a secure, interoperable platform governed by a multi-stakeholder governance framework. This setup enables DSIs to connect and exchange data effectively.

The governance structure of CEADS will evolve iteratively, in sync with the expansion of its business model and user community, to meet the evolving demands of its key stakeholders, keeping attention to the role of the farmer, the agri-industry and policy needs.

The organisational governance guides setting up the data space governance authority by identifying key decision points and options for establishing inclusive governance and transparent rules and roles. There are three key elements of organisational governance defined.

Figure 22: Elements of organisational governance (DSSC Blueprint).

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The central operating body of CEADS must maintain a position of credible neutrality within the market, ensuring that voices from all critical sectors, from dairy and livestock to agricultural machinery and governmental bodies, are included in the decision-making process. Moreover, the business practices of CEADS must exemplify transparency to all members, fostering an environment of trust and collaboration.

From the organisational governance viewpoint, the MVP of the CEADS should provide to ensure the basic interoperability of DSIs, by having a common governance model of the data space in place. During the operational stage, this should grow and evolve.
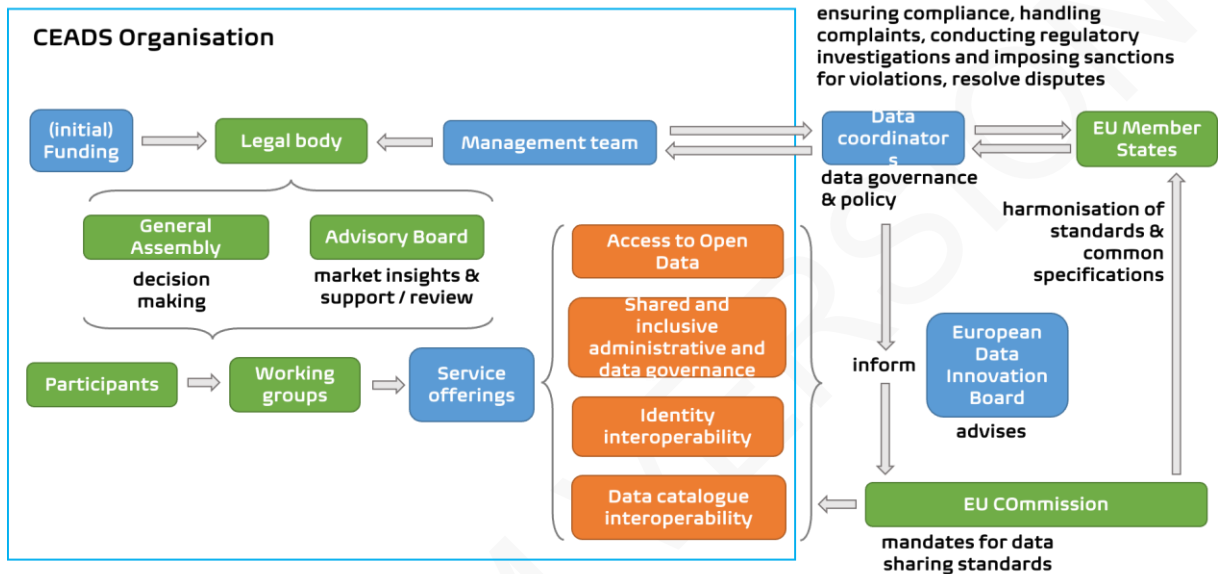
Figure 23: Overview on the organisational structure of the CEADS.

3.2.8.2. Roles and responsibilities

3.2.8.2.1 General Assembly (GA)

The GA, consisting of all members and the management of the CEADS, is the body which can make decisions on the CEADS. They make decisions on the following topics:

- Operations – technical, governance, business and legal developments;
- Education and awareness support;
- Policy development;
- Membership evaluation;
- Conflict resolution.

The management team of NAO proposes the agenda, based on evolutions, questions and discussions encountered, and on input received by the CEADS members. In the articles of association, proposed during the deployment stage, there needs to be guidelines on the procedure to apply as a new member, and on the rights and obligations of CEADS GA members, and on the frequency of meetings.

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The initial lighthouse DSIs will become the first members of the GA of the NAO. Since those will be chose based on selection criteria (more described in chapter 3.2.4), representing a diversity in participating DSIs, this will ensure a well-balanced group. The GA is established in the articles of association of the NAO. At least once a year, there will be an agenda point for the GA to approve new members.

The GA is envisioned to comprise members behind DSIs participating in the CEADS. A notable consideration is whether the GA should encompass all participating entities as operations expand or if a process for balancing diverse interests among members is warranted. Should the latter be desired, the following options serve as potential selection criteria for DSIs becoming members of the GA:

- Mixing Public and Private Organisations:
    - Deliberately incorporating a mix of both public and private organisations, ensuring a balanced representation that reflects the diverse nature of stakeholders involved in CEADS.
- Geographical Coverage of EU MSs:
    - Ensuring representation from a broad spectrum of member states, promoting geographical diversity and inclusivity in the decision-making processes of the GA.
- Involvement of Sub-Sectors within the Agricultural Sector:
    - Incorporating diverse sub-sectors within the agricultural industry as members, recognising the varied interests and expertise present.
- Involvement in Data Exchange Activities and Data Space Intermediaries:
    - Prioritising DSIs actively engaged in data exchange activities and those functioning as data intermediaries, recognising the pivotal role they play in shaping and enhancing the CEADS ecosystem.

These criteria provide a structured approach for selecting GA members, allowing for a well-balanced and representative assembly that aligns with the multifaceted nature of the CEADS.

3.2.8.2.2 Advisory board (AB)

The role of the AB was discussed in chapter 2 as part of the deployment roadmap. The composition of the AB needs to be reviewed at least one a year, allowing new candidates to join, keeping enough balance according to the considerations described in chapter 2.

The AB is chaired by (a) representative(s) of the NAO and consists of organisations that are not members or participants of the CEADS. The board members are representatives of public bodies, stakeholder groups (farmers, industry, technology providers, etc). The agenda is prepared by the daily management of the NAO, after consultation with the AB members and the GA.

In the articles of association of the CEADS, proposed during deployment stage, the role and framework of the AB will be determined and implemented during the operational stage. Some elements to be addressed are:

- How often will the AB meet?
- Which procedure to follow for a new candidate?

- Which rights and obligations do the members of the AB have?

3.2.8.2.3 Working groups

In the working groups, the service offerings of the CEADS are further developed once the CEADS is operational. At the start of the operational stage, there will be a basic organisation and service offering, but these will need to be improved, shaped and refined for the agricultural sector specifically. This is the task of the working groups. Topics of the working groups can be suggested by the AB and by members of the GA. A new working group will only start after having determined a specific topic, objective and timeframe, described in a concept note and submitted to the GA. During a GA meeting, a voting will be done to accept the new working group. It is possible that a working group needs a budget to do the work and can be allocated funds of the CEADS or specific funds can be collected for this objective.

A working group can be joined by members of the GA and AB, as well as by CEADS participants. If needed, topic experts can also be invited to join a working group.

As a recommendation, there is the proposal to the DSSC to organise some joint working groups for several CEDS, organised jointly.

3.2.8.2.4 Governance support for DSIs

The CEADS will offer support for (potential) participants and members of the GA, AB and working groups, to ensure a smooth course of activities.

- Articles of association of the NAO
- Collaboration agreements between CEADS/NAO and DSIs and other organisations or representatives in various roles
- Topics and structure of the working groups
- Concrete ways and actions to connect the CEADS with the value chain actors, e.g. active involvement
- Integration of DSI services in the CEADS
- Involvement of public bodies with the CEADS and the DSIs

3.2.8.3. Governance of data sharing

To allow a good data sharing governance, the CEADS requires appropriate structures and processes to support data-sharing across DSIs and the implementation of across DSI use-cases. All kinds of DSIs are welcome to join the CEADS, when they follow certain rules and standards. Eligibility criteria have been described in Chapter 2 and will be more detailed during the deployment stage.

The mapping of the European agricultural data sharing landscape (deliverable D1.1) shows that the governance of data sharing relies heavily on standardized agreements (e.g., terms and conditions) and standard API specifications. While data rights, handling, and access are crucial aspects, not all data sharing initiatives effectively manage or coordinate these elements. The percentage of data sharing initiatives implementing processes and formal rules for specific activities, like data management and transfer, remains relatively low. Three types of data —

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personal, machine, and agronomic — were identified, with GDPR regulations governing personal data management. Notably, farmers set access rights on all three levels. Slightly over half of the data sharing initiatives reported using a domain standard. There is still a lot of diversity in systems, preventing smooth collaboration.

That is why all data related CEADS services will focus on collaboration support:

- Shared, inclusive administrative and data governance
- Facilitating access to Open Data

If DSIs will act as data intermediaries in Europe, they must implement the following functions and principles that result from the DGA**:**

- Neutrality with respect to pricing and service purposes
- Restriction of data usage to data intermediary services
- Non-discriminatory, fair and transparent access to data intermediary services
- Security against fraud and unauthorised access
- Data availability to authorised parties
- DSGVO compliant handling of personal data
- Documentation of intermediary activities

The DA will require companies that collect data via IoT devices to:

- make the data accessible by design and to provide access for the users of those IoT devices on request,
- ensure portability of data so the stored data can be transferred to a third party on request by the users.

These requirements will therefore be part of the collaboration agreements of the CEADS with the specific DSIs, seeking to offer services through the CEADS to the agricultural ecosystem, including IoT technology providers.

Many DSIs have no experience yet in inter-DSI collaboration (bi- or trilateral), let alone in DSI networks, due to differences in the technical, legal and economical implementation of the DSIs, as concluded in deliverable D2.1.

In order to support this technical, legal and economical interoperability of DSIs, the CEADS should develop interoperation services and provide them to its members, including:

- templates for contractual agreements (to deal with certain discrepancies),
- best practices
- a framework for interoperation that categorises common and valid DSI design options and assesses their interoperability (compatibility grid)
- technical interoperability tools, such as interfaces, connectors, data models, etc.

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3.2.8.4. Participants

As a participant of the CEADS, one gets access to all services of the CEADS, as described in the deployment roadmap.

CEADS will offer interoperability support for DSIs to comply with the rules and standards for data sharing governance. The biggest challenges for inter-DSI collaboration lie in the interoperability of their respective data exchange services. CEADS should facilitate onboarding of DSIs in the early stages from an economic perspective by sharing best practices from mature DSIs through training and tutoring. Compliance will be assessed by the NAO daily management, potentially after a self-assessment of the candidate first, and approved by the GA. Some elements can be implemented as policy-by-design. It can be necessary to regularly do re-assessment of participating DSIs to ensure continuing compliance.

One of the crucial eligibility criteria is the interoperability compliance. This is on a technical level, as well as for the business model as regarding the legal framework.

3.2.8.4.1 Transparent rules for participation

It is necessary to define specific rules for each role in detail. The key stakeholders for the CEADS include both current and future DSIs who offer data-intermediary services to agricultural stakeholders across various regions of Europe.

3.2.8.4.2 Examination of potential participants

Key to this process is the identification and verification of actors upon entry. In the technological design phase, specific guidelines are essential.

Protective measures against access by fraudulent actors are imperative. The DGA requests DSIs to implement such measures, supported by CEADS and aligned with equivalent practices on the DSI-network level. CEADS must establish robust procedures to deter fraudulent or abusive practices by parties seeking access through its data intermediation services. A dedicated working group should compile information for the GA concerning fraudulent behaviour or conflicts and their resolutions.

Furthermore, CEADS should establish a working group dedicated to aligning fraud prevention activities on the DSI level. This includes actions such as de-publishing data across DSIs and blacklisting end users. The same working group should handle mediation in cases of suspected misconduct by member DSIs. If specific cases cannot be resolved internally, the management team is responsible for communicating fraudulent behaviour or conflicts to data coordinators for appropriate resolution.

3.2.8.4.3 Onboarding

The importance of attracting new players to enhance the emerging data ecosystem is acknowledged, as it brings fresh perspectives and expands domains. However, this can also raise concerns about legitimacy and trust among existing members. Therefore, careful attention

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must be given to establishing rules for the CEADS. Key design elements of a Collaboration Framework include:

- **Memoranda of Understanding (MOUs):** Establish MOUs or collaboration agreements with key partners to formalise relationships and responsibilities.
- **Develop Policies:** Establish clear data governance policies that address ownership, privacy, security, and ethical considerations.
- **Data Quality Standards:** Define standards for data quality and integrity to ensure reliability.
- **Open Membership:** Design an open membership framework as far as possible to encourage participation from various stakeholders.
- **Membership Criteria:** Establish criteria for membership, considering factors such as expertise, contribution potential, and commitment to data sharing principles.
- **Communication and Outreach:** Develop a communication plan to raise awareness about the organisation's mission and activities and Conduct outreach programs, workshops, and awareness campaigns to engage with potential members and stakeholders.
- **Technical Support and Training:** Provide technical support to help members integrate with the organisation's data sharing framework and offer training programs to ensure that members understand and adhere to data sharing protocols.

3.2.8.5. Management team

As highlighted in section 2.1.1.2, the NAO has been chosen as the governance model for CEADS. As a legal entity, the NAO demands continuous daily management, emphasising the need for a dedicated allocation of person-months to fulfil this requirement. This planning measure ensures that sufficient resources are committed within each organisation, facilitating the successful integration and participation in CEADS initiatives.

A dedicated team is essential for the addition of diverse data sources. Establishing and maintaining contact with data providers, negotiating contracts, and implementing technical provisions are critical aspects. Equally important is the cultivation of trust and the facilitation of cooperation among stakeholders to ensure a collaborative and transparent data sharing

3.2.9. Iterations on the legal aspects

Looking at the recommendations of deliverable D1.2 and those of deliverable D2.2, some insights should be implemented irrespective of the legal scenario(s) followed.

1. There should be clear, practical examples/use cases for applying the (principles of) the EUCC and the DA in practice.
2. Documentation on how to consistently apply the DGA and DA, would be a valuable resource for various DSIs. This is especially relevant concerning the roles of different legal entities involved in facilitating data exchange.
3. There should be more clarity on the GDPR-centric concepts like anonymisation and pseudonymisation in the agricultural data sharing setting.

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4. The continuum between personal and non-personal data for farmers needs to be delineated.
5. There should be model contracts, adapted for the sector.
6. If local codes of conducts will be developed continuedly, support for this can be offered by the CEADS, to ensure integrating the right principles.

To achieve this, it is important to provide documentation and training to improve the skills of (potential) CEADS participants. Next to that, supporting member states in addressing legal solutions should take into account the progress made by various EU-member states in implementing the European Data Strategy, particularly in terms of enforcing national competent authorities. Guidelines and regulations are needed, specifically regarding categories of data, trade secrets, and the necessary safeguards to ensure data sovereignty.

During the operationalisation of the CEADS, it would be good to look into the introduction of digital data commons (see deliverable D2.2). This can be done by starting a working group on the topic. During the implementation of the scenarios, aspects touched upon during the stakeholder discussions held within the project should be taken into account. While the DA will serve as a crucial legal foundation for the data space, additional legislation may be required to safeguard data sovereignty within data spaces, as suggested in the EU-workshop, as written in deliverable D1.2. Policymakers should explore options such as self-regulation and certification to protect data sovereignty, along with providing legal support for certain rights such as data portability and the right to be forgotten, as discussed in a Dutch workshop and written in deliverable D1.2. Considerations such as profit sharing, intellectual property rights (IPR), trade secrets, and sensitive data are essential when developing data spaces, as highlighted in the EU-workshop.

Regarding conflict resolution, two recommendations require closer examination: first, the possibility of collective action by representative farmers' unions or consumer associations before a court of law, and second, the determination of measures and penalties by competent authorities based on the relevant national legal system.

Regarding public emergencies, it is necessary to assess whether the CEADS needs to take action. Public sector bodies or the European Commission should provide justification information to data holders explaining why data is needed, with specific protections for personal information. The Data Act currently lacks specifications on how users will be informed about mandatory requests made to data holders. To ensure trust and transparency in the CEADS, users, especially in the agricultural sector, should have access to the same level of information as data holders through justification information. Considerations also need to be made regarding how the connection with the user is established and how users are informed when their data is collected during a public emergency.

In terms of open data, the European Commission is mandated by the Open Data Directive to establish a list of high-value data sets that must be made available for free, in machine-readable formats, accessible through APIs, and available for bulk download if necessary. These data sets encompass various categories including meteorological data, earth and environmental observation data, statistical data, data concerning companies and their shareholders, and mobility data.

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3.2.10. Sustainability of the CEADS: business model and funding

The CEADS business model should evolve iteratively, in tandem with its governance structures and expanding user base, to remain responsive to changing needs and requirements. Transparency in business practices is a foundational principle.

Functions of the Business model development building block are:

1. Develop the business model of the data space
2. Adjust the business model and explore novel business models for the data space

Important to take into consideration is that through the data sharing landscape mapping (deliverable D1.1), it became evident that many data sharing initiatives rely on public funding. This is a trend that is unlikely to change immediately. Therefore, it must be taken into account at the outset of CEADS. It cannot be expected that DSIs will pay substantial fees if their own business models are not yet established.

CEADS will initially be fully funded but will transition towards financial sustainability during operational and scaling stages. General services will be financed through the business model, while support for new and improving DSIs and internal innovation within CEADS may necessitate external funding. The CEADS business model is shifting from relying solely on external grants to incorporating participant fees and paid services. Implementing membership fees can establish a reliable source of income. Members financially support the organisation's mission and receive various benefits, including access to data-sharing platforms and exclusive events.

Figure 24 outlines the structure of the proposed services of the CEADS. Central is the concept of shared governance and the creation of an environment where DSIs can freely exchange data while maintaining their operational and technological autonomy. It prioritises various tiers of data sharing, with clear focus on **open data, paid services**, and **licensed data**, with the overarching goal of fostering an ecosystem where diverse service levels can thrive and mutually enhance one another. The emphasis on interoperability between identity and data catalogues underscores a dedication to forging a seamless, inclusive data marketplace that respects regional nuances and fosters innovation, expansion, and competitiveness within the agricultural domain.
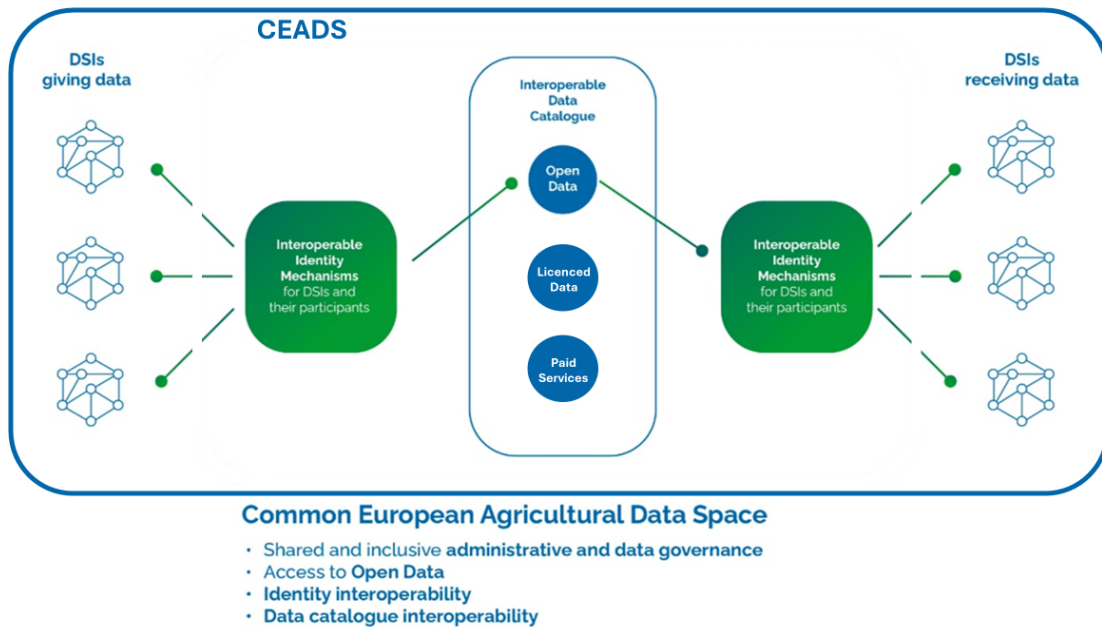
Figure 24: Proposed CEADS services from business model perspective

The primary guiding principle is that the charging model should not aim for profit but instead strive to cover costs. This approach aligns with the ethos of participating DSIs, where excessive profits or margins are discouraged as they may impede participation.

Different elements of the data space business model:

- Participants
- Value proposition for both supply and demand data
- Data space revenue model
- Data space cost model
- The organisation of the data space operations

As concluded in deliverable D2.1 from this project, the CEADS will implement a hybrid business model merging aspects of a Data Marketplace with an Open Data Policy. Acting as a trusted facilitator, with a public-private governance scheme, it will bring together different DSIs on a secure platform under a Multi-Stakeholder Governance scheme, promoting data sharing through interoperability mechanisms. The organisation will support an Open Data Policy, using a freemium revenue model to provide free access to select data sets while creating revenue opportunities through enhanced data sharing among DSIs. This balanced approach aims to foster innovation while promoting open data sharing, benefiting the larger ecosystem.

The value proposition for engaging with CEADS services includes:

- For participants: Depends on the maturity level, participation in calls, use of the platform, training opportunities, and events.
- For members: Those who invest additionally will gain a seat in the GA.

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- For Members of other CEDS: They will have access to the available data under similar conditions as CEADS members.

3.3. Micro level and Stakeholder perspectives

3.3.1. Introduction

For modern businesses and society to thrive, it's imperative to grasp the mechanisms of value creation within broader ecosystems. Merely focusing on internal operations or boundaries is insufficient. This is precisely where the concept of data ecosystems or data spaces becomes crucial. A high level of participation and collaboration and intensive knowledge exchange by people with different perspectives and expertise is needed for the long-term growth of a data space. At the same time, the European data space needs to facilitate the green and digital transition of food systems while safeguarding social capital (trust, belonging, identity, feeling safe) and well-being. Data spaces require reflection on the characteristics of the communities that form part of the digital platforms, both off and online, and how these are intrinsically motivated and attribute meaning to data and information, e.g. acquire knowledge.

In this chapter, several big questions are discussed from four different stakeholder perspectives. It compiles key stakeholders' views on the essential changes and actions required for the transformation towards the data space for agriculture. Input was gathered through the mapping of the data sharing landscape, while interviews with data sharing initiatives provided insights into governance and business aspects. Member state representatives participated in four webinars to share experiences and views on CEADS development and governance. Additionally, stakeholder and AB meetups were organised to gather feedback. In each part an illustrative example is given, selected from the agridata use cases within deliverable D3.2 and D3.3. We build a bridge between these use cases in the agricultural sector and the proposed reference architecture for the CEADS, and demonstrate and the advantages it could bring and hurdles to take.

The engagement of established DSIs as primary members and decision-makers is crucial to ensure a pragmatic establishment process for CEADS, prioritising the specific requirements of diverse stakeholders within the agricultural landscape while ensuring a foundational trust in the neutrality of the CEADS. Conversely, the inclusion of pertinent industry players via supportive structures like an AB guarantees equitable representation of all voices – including farmers, farmer organisations, governmental bodies, machinery manufacturers, and data service providers – preventing any single stakeholder group gaining too much influence. It is advisable to progressively expand the involvement of DSIs and other stakeholders over time. However, for the implementation phase of CEADS, commencing with a smaller cohort of committed DSIs, coupled with transparent communication among existing DSIs in European agricultural sectors and a fixed deadline for participation confirmation, may facilitate a smoother start.

An important building block, as written in deliverable D3.3, addressed by DSIs is trust, meaning that you can verify that a participant of a data space adheres to certain rules. Lack of trust is a very complex issue that must be considered from several aspects, all of which deserve attention, e.g., confidence in new technologies' performance, reliability of the new digital tools, interoperability between different data providers, Clear technical and legal requirements on

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secure/automated/seamless data sharing and on roles/rights/obligations of the different stakeholders will be the main trust-building elements and thus the incentive for all involved parties to share their data.

As mentioned before, it is imperative to consider farmers in the design of the CEADS, recognising their central role in the agricultural data ecosystem. The importance of use cases is already emphasised, underscoring the necessity for DSIs from diverse stakeholder groups to involve farmers when introducing new use cases to the CEADS. This collaborative approach ensures that the development and integration of use cases align with the practical needs and perspectives of the farming community.

Guidelines and practical handles on actions to take as DSI to become part of the CEADS are also included in this chapter, as far as they have been collected already during the preparatory stage of the CEADS. These guidelines will be developed during the implementation project and improved and adapted continuously while operating the CEADS.

3.3.2. Farmer's perspective

As previously mentioned, the establishment of trust among all stakeholders is identified as a crucial aspect of the data space framework. Farmers are an important group of stakeholders of the CEADS and need to be strongly represented.

Addressing the identified needs and challenges, trust again emerges as a primary concern. This extends to overcoming farmer distrust towards the government, but also towards processors, retail, ea. Especially when it comes to sharing data for monitoring and control purposes. An essential consideration is enabling farmers to autonomously decide with whom and for what purposes they share their data. Exploring solutions such as digital identity and consent management is crucial in this context. Additionally, collaboration with the DSSC on trust-related issues, not exclusive to agriculture, should be part of the strategy.

The fair distribution of benefits, correcting misconceptions about farmers' role as both data consumers and providers and ensuring that farmers retain control over their data are of paramount importance. The voluntary nature of farmers' long-term participation in the CEADS raises questions, calling for mechanisms to ensure that individual farms and farmers are adequately protected.

With regard to data portability, the proposed approach should indicate how it improves the portability of agricultural data for farmers. Moreover, it becomes crucial to distinguish between personal and non-personal data for farmers. Establishing criteria for this distinction is essential and the importance of making this distinction should be carefully examined.

Careful consideration should be given to recognising the diversity in digital skills among farmers, particularly the challenge faced by the older generation in transitioning from physical work to digital tools. Strategies to account for this diversity and facilitate a smooth transition to digital platforms should be integrated into the broader CEADS framework.

It is important to consider the value proposition of data sharing within the CEADS framework. Highlighting the benefits of data sharing is paramount, with an emphasis on the idea that these

benefits should be shared fairly among all participants. Beyond purely monetary or economic value, the concept of 'added value' should encompass broader dimensions, including e.g. sustainability gains, less administration and better insights for decision making.

In terms of ideas and recommendations, a crucial aspect is the translation of the Data Act into the language of the agricultural sector. This requires making terminology context-specific and directly relevant to agricultural practices. Effective dissemination of information is vital and highlights the importance of using the right channels to reach farmers. Matching provisions to sectoral needs are essential for the successful integration of the CEADS framework into the agricultural landscape. Simplification emerges as a key issue and highlights the need for a user-friendly approach that ensures farmers can easily and intuitively participate in the CEADS' initiative.

It is advisable to actively engage and consult with farmers' organisations and associations to gain valuable insights into the practical needs and concerns of farmers. Incentivising farmers is crucial, with a specific focus on emphasising benefits aligned with sustainability goals and other significant objectives. Establishing a transparent and explicit connection between government requirements and the utilisation of the data space is essential to ensure that farmers understand the purpose and relevance of their involvement. Exploring the possibility of providing monetary motivation for farmers could be a strategic approach, linking financial incentives to data-sharing activities to enhance their participation in the CEADS framework.

3.3.2.1. Illustrative example: eDWIN

eDwin, a Polish national platform tailored for farmers, is currently operational, offering a set of core functionalities to farmers and other stakeholders. Figure 25 shows the current state, without the existence of the CEADS.

Suppose the farmer wants to improve the irrigation system of its greenhouses. The farmer wants to use an AI model from a startup, that offers a tool with an AI solution for precision irrigation recommendations. Data on crop growth, sensors data and data from robots are not immediately integrated into the AI tool. The farmer must manually input this data separately, or in some cases, download it in Excel or CSV format and upload it to the AI tool. However, many farmers lack the digital skills or time to invest in this process. Moreover, they struggle to navigate the multitude of apps being developed.

At the same time, the farmer is already using a certain FMIS, where a lot of data connections are already automated, because it is linked with a regional DISP, with a good working data marketplace. But part of the information is not yet available through the DISP, and still requires a lot of work by 1-to-1 integration of data sources by the FMIS but also by manually inputting data by the farmers themselves. All this information would be very useful to the AI model, to make the results more company specific.

The AI model also takes into account the weather conditions, for which information of local weathers station is needed. There is an application that bases its weather forecasts on local weather stations, that also provides an API.

The farmer has numerous other separate apps, e.g. a risk tool, that is being used by the government, to support farmers by giving timely advice or managing damage. The local TEF solution also wants the farm data, to improve its tested solutions, instead of only basing itself on their own test field data.

For every application, the farmer needs to deal each time with privacy policies, looking into the contract, and provide consents for sharing data. Each system has its own way of logging in and retrieving the results.
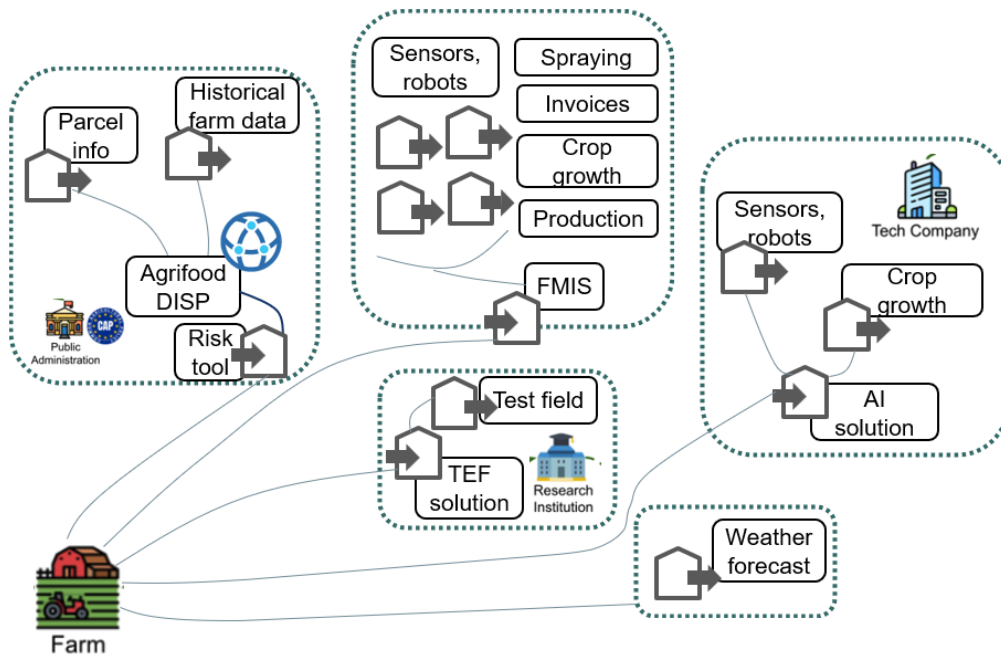

Figure 25: Farmer using different DSIs, i.e. eDWIN platform, without CEADS.

Figure 26 shows what becomes possible when the different DSIs become CEADS participants and are interoperable. The farmers don't need to join the CEADS themselves but can use DSIs services in an easier way that makes the farming practices more efficient and sustainable.

The farmer only needs to use one interface to have access to all DSI services. The results of the AI model are improved significantly and are shown in the FMIS interface. The FMIS itself demands a lot fewer manual data input from the farmer and can pull in and provide data via connectors. Also, weather information can be shown in the FMIS and is linked with the crop planning. Consent for data sharing can be given in a farmer dashboard, that covers the whole cluster of DSIs. The risk tool also gains access to crop information from the FMIS, allowing for better risk assessment and support for farmers. And the TEF solutions can be optimised with access to much more data.
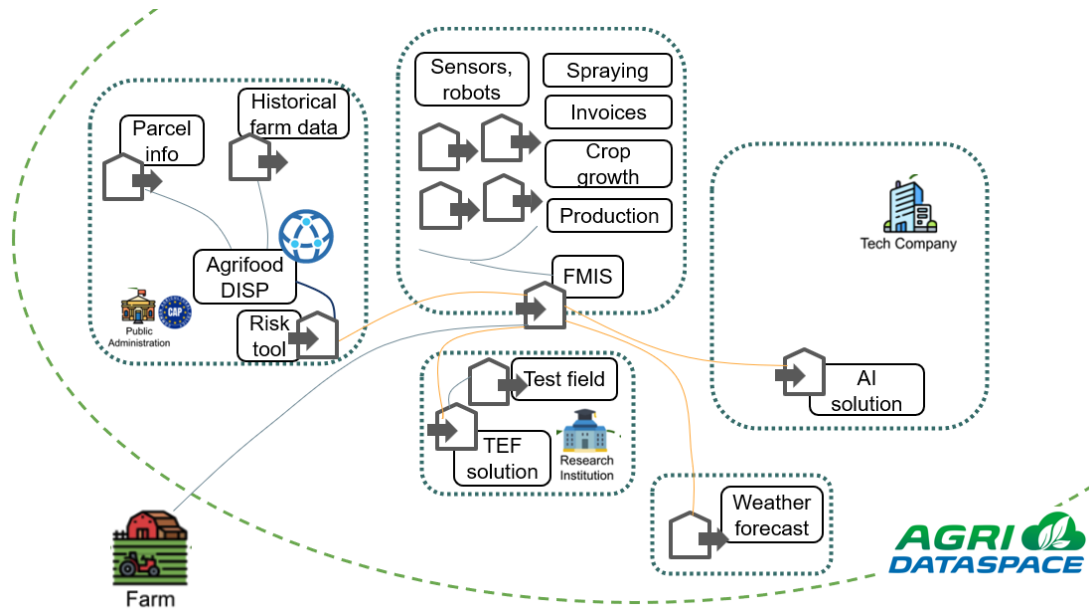
Figure 26: Farmer using services of connected DSIs within CEADS.

Farmers may not be directly aware that the platform is part of the CEADS framework. However, they indirectly benefit from advantages such as

- Interoperability of DSIs
- Enhanced cross-border consent
- Improved system functionality due to standardised ID systems and formats
- Access to a standardised vocabulary, including e.g. a service for mapping crops to AGROVOC terms.

3.3.3. Industry perspective

Benefits of being part of the CEADS from industry perspective include the ability for "big players" to gain access to regional ecosystems through connections with local DSI. This can grant access to local authorities, API plots, local legislation, and trusted data intermediaries that increase the likelihood of obtaining consent from regional farmers.

The CEADS has the capacity to unite industry participants in shaping a data-driven future, enabling organisations and individuals to maximise the potential of their data. Acknowledging the pivotal role of CEADS in fostering sovereign, interoperable, and trustworthy data-sharing across both businesses and societies.

Centralised, clean, and curated data sets empower third-party developers to create innovative services utilising AI and machine learning models. These services automate daily operations, mitigate risk, and enhance production and efficiency across various domains.

The industry's position on the CEADS framework also raises some needs and challenges that need careful consideration.

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A key challenge is to keep a low barrier for entering the CEADS while establishing specific criteria to inspire confidence and trust in the system. Finding this delicate balance is essential for the credibility and effectiveness of the framework. It is necessary to ensure wide dissemination of a clear CEADS framework, covering its themes, goals and objectives. This clarity serves as a basis for making informed decisions regarding target groups, barriers and conditions.

Engaging key industry players, such as manufacturers, in data space activities within CEADS is an ambitious goal. The levers to achieve this goal need to be explored, as well as the elements that make the proposed approach attractive to these "big players".

The call for a level playing field within CEADS raises a critical question: how can participation be equitable for members of all sides and positions? Addressing this issue is paramount to promoting inclusiveness and collaboration within the industry.

For companies, it's also crucial to consider methods for incentivising farmer participation in member organisations and utilising their services. Simplifying the process for farmers to access CEADS benefits, regardless of their role, is essential. Additionally, creating added value is key to establishing a mutually beneficial model for all partners, ensuring a win-win-win scenario. Determining what information is both useful to share and non-harmful requires careful consideration to strike a balance that accommodates farmers' needs and concerns.

Another facet is the international component, which calls for seamless alignment with global standards and cross-border cooperation to effectively integrate the international dimension of CEADS.

3.3.3.1. Illustrative example: Digital Twins as logical centralised storage

Although digital twins have yet to play a significant role in digital agriculture, they hold immense potential as a logical framework for consolidating data and functionalities within a distributed data space. Through various interfaces, digital twins can facilitate interoperability, serving as a cornerstone for the envisioned CEADS. This system will encompass a wide range of data and services beneficial not only to farmers but also to companies within the agricultural ecosystem.

Digital twins serve two primary functions: first, the storage and management of data, and second, the provision of extended or cognitive functions that leverage this data. As part of the CEADS, digital twins necessitate a hosting system to make their capabilities accessible within the agricultural data space. Existing options, such as cloud platforms offered by machinery manufacturers or cloud-hosted FMIS, are already established. Additionally, future prospects include independent digital data hubs.

Digital twins are a well-established concept, modelling not only specific assets but also production and business processes. These concepts, transferable to the agricultural domain, can support not only crop and animal production but also emerging use cases across the entire food production value network.

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It's worth noting that digital twins thrive on a wealth of data sourced from various systems, often spanning administrative boundaries. This underscores the importance of prior agreements and relationships among parties holding rights to specific data sets within the agricultural landscape.
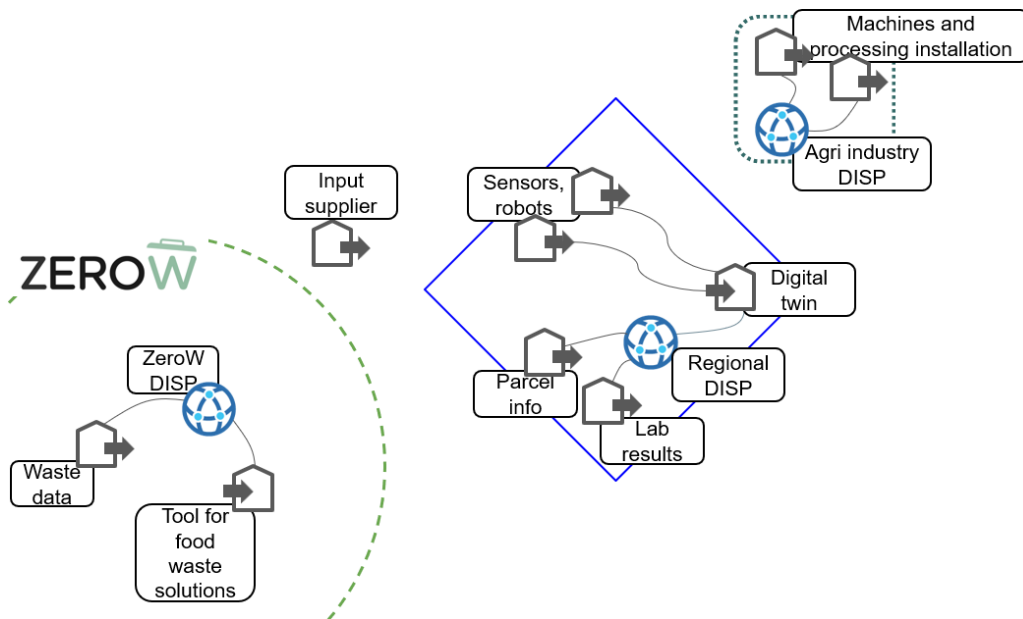

Figure 27: Digital twin without CEADS.

Figure 27 shows an example of a digital twin for horticulture (e.g., for greenhouses). The use of sensors, data from robots, and sales figures enables better alignment of production practices, promoting sustainability, efficiency, and responsiveness to fluctuations in sales. Additionally, there exists a ZeroW data space, but it is not connected to other data spaces.

Thanks to CEADS, it becomes possible for the digital twin to get more data, but also supply data to other data space initiatives (Figure 28):

- The existing data exchange through a DISP, such as AgIn or Agrirouter, is expanded towards the DSI of the digital twin. Connectors, provided by the DISP, are integrated into the digital twin, making secure data sharing possible.
- Additionally, data from input suppliers (e.g. data on seeds, fertilisers, pesticides), who are also CEADS participants, is effortlessly pulled in via the same connectors.
- Another benefit comes from the interoperability with the ZeroW data space, which was before the existence of the CEADS not possible. As a consequence, a portion of the waste can be recycled in a circular manner to create e.g. vegetable spreads/dips. Data regarding surplus or reusable waste can now also be smoothly transmitted to the ZeroW data space, enabling synergised solutions based on shared data, knowledge, and collective intelligence.
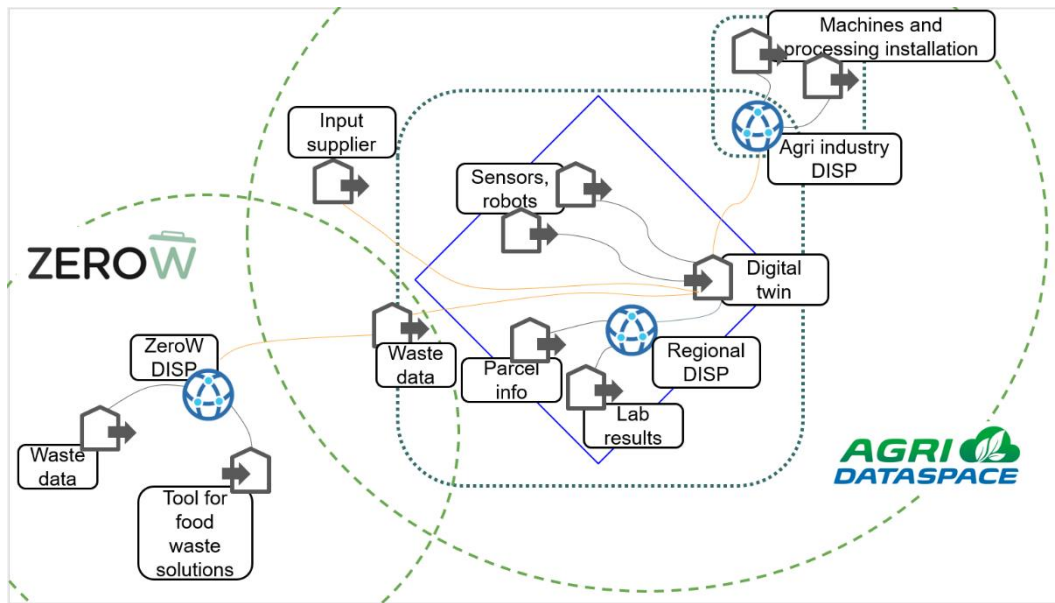
Figure 28: Digital twin within CEADS.

3.3.4. Governmental perspective

In the governmental perspective within the CEADS framework, a critical consideration involves defining the specific roles that public bodies should undertake within the data space. Clarifying whether the government should serve as a contact point, coordinator, funder, data user or all of the above is essential for establishing a clear and effective role within the CEADS. The articulation of these roles is crucial to guide the government's active and purposeful participation in the data space. The availability of more data for policy monitoring also underlines the importance of CEADS in providing relevant data to facilitate informed decision-making.

The implementation of the DGA creates responsibilities for EU Member States that affect the governance and operational aspects of the CEADS. These duties encompass setting up competent authorities, ensuring compliance monitoring, developing operational standards, handling complaints, and instituting sanction protocols for any violations.

In accordance with the DGA, Member States retain the authority to regulate data intermediation services. This holds significance within the framework of the CEADS. By appointing competent authorities to supervise notification procedures, Member States ensure the compliance of data intermediaries with legal standards, potentially fostering secure and transparent data sharing among data subjects.

Clarity is needed regarding decision-making on access to publicly held data, specifically whether these decisions are made at the state or EU level, underscoring the governance structure for data access within the CEADS framework. As written in the DGA, the government needs to develop a plan for how these procedures will be implemented; there must be a contact point for companies to turn to, along with a procedure for providing timing and responses. The CEADS could potentially play a role at the EU level.

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The involvement of governmental organisations in CEADS can vary, as they can also offer data-based solutions. They may serve as participants, qualify as members (provided they meet predefined minimal requirements), contribute to ABs, or participate as members of working groups. Another aspect to think about is why a government department would use the data space alongside their existing (open) data initiatives. Understanding the motivations behind such decisions is crucial for improving the use of data resources. It is essential to ensure that all member states have comparable data intermediaries, such as IDDEN, DjustConnect, Agrirouter and AgDatahub. However, data intermediaries are not yet present in all member states. Therefore, strategies should be developed to enable the participation of other member states in CEADS. Regardless, recognising the role of the member states and these data intermediaries in fostering the local ecosystem, which includes capacity building and awareness raising, is crucial for fostering a resilient and participatory data environment. Public bodies should also have a role in encouraging farmers to join DSIs and the CEADS. This can be achieved by supporting DSIs in reducing administrative burdens for individual farmers.

From a governmental perspective, it is suggested to initially focus on creating added value through DSIs, which may not always be clear at the outset. National governments can initiate public investment to kickstart initiatives. As the added value and associated business models become more evident, there can be a gradual reduction in public investment, coupled with an increase in commercial revenues.

In the implementation project, a proposed funding model suggests a balanced contribution of 50% from the European Commission and 50% from Member States, aiming to establish a financially equitable framework.

Governmental entities should demonstrate their commitment to complying with Data Governance Agreements (DGA), Data Act (DA), and interoperability standards.

CEADS can be a way to implement the Open Data Directive: the re-use of public sector information provides common rules for a European market for government-held data.

3.3.4.1. Illustrative example: Monitoring agro-environmental performance use case

EU and national policies have shifted towards more climate-smart farming and agricultural considerations. Consequently, various countries are developing tools to monitor this transition (see Figure 29), amidst the currently fragmented and siloed data ecosystem, making it complicated to access required data. In this scenario, each country operates with its own tool, lacking connections to European data sources or automatic connections for European monitoring. In this case, agro-environmental monitoring data is transmitted to the tool via DISP, and the results of the tools can be made available again through DISP. Potentially, this enables national governments to access results for rewards, subsidies, etc.
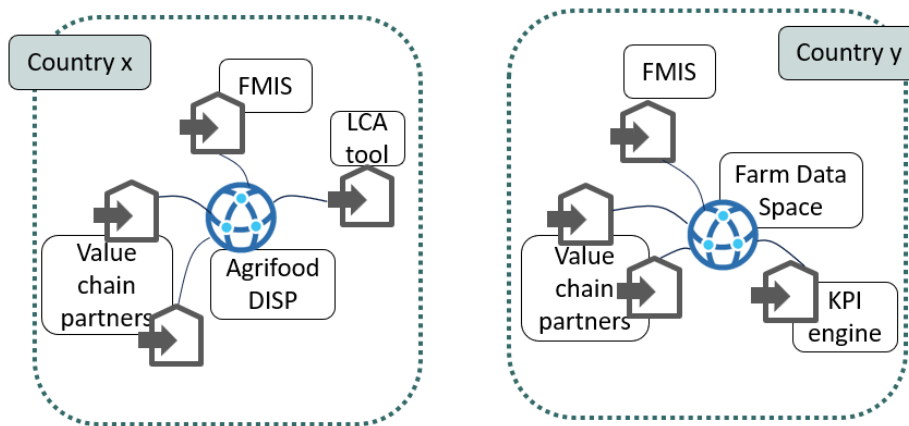
Figure 29: Monitoring agro-environmental performance without CEADS.

In Figure 30, the yellow lines indicate the additional connections. The European data source (AICS) can be easily incorporated, either by becoming a data source at DISP or by establishing its own European DISP. Alternatively, it can connect directly to the system through the use of a connector. This allows the tools to have smoother and broader access to data. Exchange between two countries becomes possible, with more data sources becoming available, such as data providers located in other countries or international players. DISPs are direct CEADS participants from the outset, having agreements on ID and consent management systems they utilise, and already possess legal contracts for data exchange based on the standard modules provided by CEADS.

Consequently, national governments from different countries gain access to more accurate agro-environmental performance data from their farmers, requiring less effort and time from farmers and advisors due to increased automation.

The (aggregated) results can also be easily transmitted to the EU-level Monitoring and Evaluation (M&E) system, as everyone within this cluster utilises the same technical building blocks for the control plane (ID, consent, etc.). Thus, the European Commission can monitor developments more efficiently.
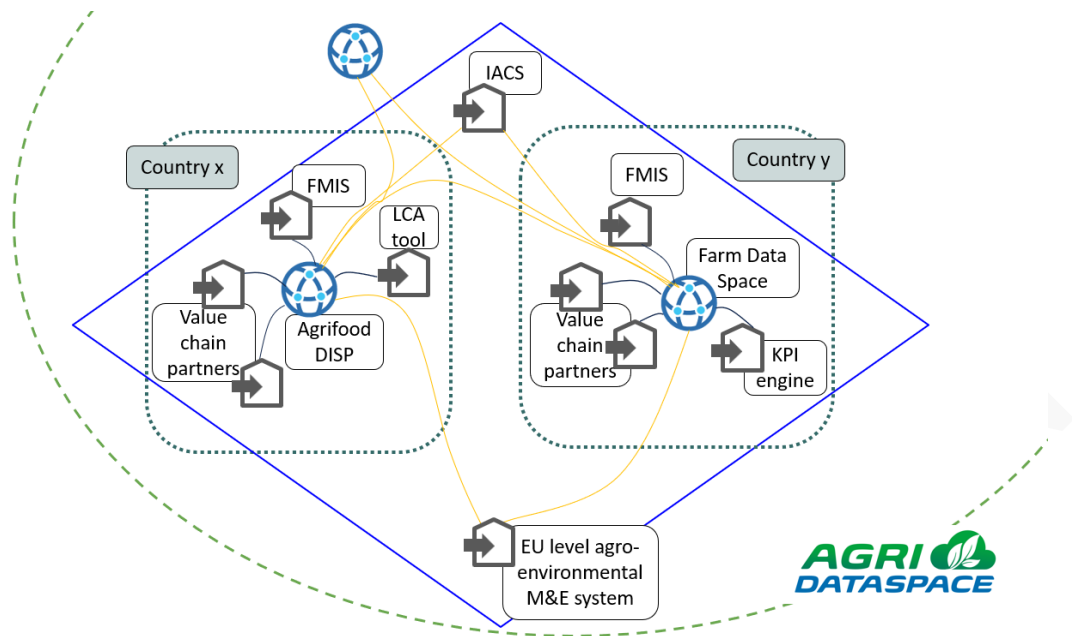
Figure 30: Monitoring agro-environmental performance within CEADS.

3.3.5. Data Intermediary perspective

As previously mentioned, CEADS is not intended to function as a central data intermediary. However, the services offered by member DSIs within CEADS must comply with the regulations outlined in the Data Governance Act (DGA), which serves as Europe's primary legal framework for data space intermediaries. Given that many participants are obligated to adhere to these regulations for data intermediary services, compliance is paramount. In the agricultural sector, several DSIs already operate as data intermediaries.

Data space intermediaries offer enabling services to other data space participants or the data space governance authority, the NAO. These services encompass tasks such as identity management, observability, cataloguing, and connector services. Instead of handling all enabling services internally, the data space may opt to utilise external intermediaries, which specialise in providing these services to multiple data spaces.

DSIs can offer as result of participation in CEADS immediate and efficient access to tailored data sets with defined specifications, formats, and interoperable structures, facilitating effective communication. Furthermore, they serve as incubators for enhancing standardisation and uniformity within the agricultural data space. DSIs serve as neutral intermediaries, ensuring access to agricultural data while safeguarding the privacy and security of all parties involved, thereby promoting peace of mind and operational success. They play a crucial role in ensuring the safety and security of shared data, protecting against events such as hardware failures or malicious attacks. Additionally, many DSIs enhance transparency by making data transactions fully traceable.

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For the DSIs the user base will be increased for existing services (economies of scale): A data sharing initiative with services designed for a small (regional) user group will be able to offer the same service to a much bigger group. A fundamental advantage in digital business is the exploitation of network effects. This means that the value of a network increases proportionally to the square of the number of its nodes, i.e. the number of participating entities and their users. The CEADS will create a much larger network that can be leveraged much better through these network effects.

As concluded in D2.1, the decision was made to embrace the Service Dominant Business Model Radar as a pivotal and indispensable tool for organisations aspiring to forge new frontiers in business model design and orchestration.
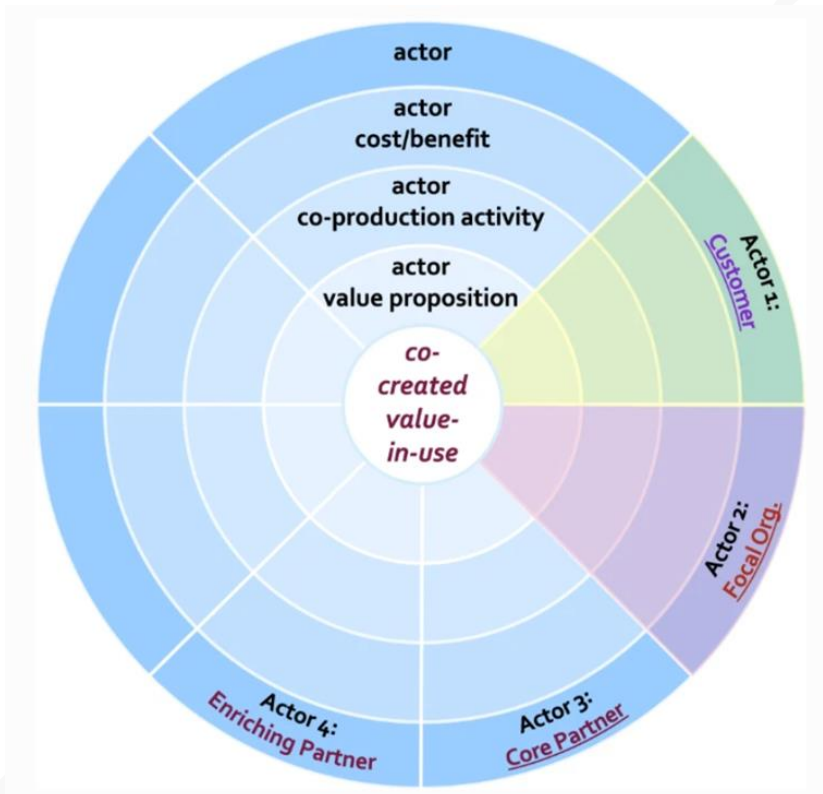
Figure 31: Business model radar.

The actors in the value creation network and the value streams are interconnected and mutually dependent within the value chain network. The suppliers provide the data, which is accessed and utilised by partners and operators, who in turn offer services or products to customers. The value streams (data, money, services) flow between these actors, creating a collaborative ecosystem for value creation in the context of DSIs.

Data space intermediaries play a crucial role in streamlining the adoption of data spaces by reducing entry barriers for both organisations and individuals seeking to participate in the data space. By relying on intermediaries, organisations are relieved of the necessity to adopt new technologies or independently manage all governance aspects associated with a specific data

space. Additionally, data space intermediaries facilitate the onboarding process for individuals looking to join the data space.

3.3.5.1. Illustrative example: The Tri-National EU Data Space

This use case illustrates the emergence of regional data spaces, even before the CEADS. These grassroots initiatives are laying the foundation for a robust and scalable data space by implementing existing reference architectures. Each regional data space incorporates essential governance, legal, organisational, and technical elements necessary for operating a unified European agricultural data space. This grassroots-level activity complements the top-down approach of defining a reference architecture for CEADS, highlighting a dynamic interplay between local initiatives cooperating and an overarching European Architecture guiding them.

In Figure 32, there are four separate DISPs, each with its own ecosystem consisting of data providers, data users, and farmers. Each DISP has multiple operational use cases, one of which is not specific to agriculture but applicable across all industries. Each DISP has its own identification and consent management system and utilises different building blocks for the data plane.
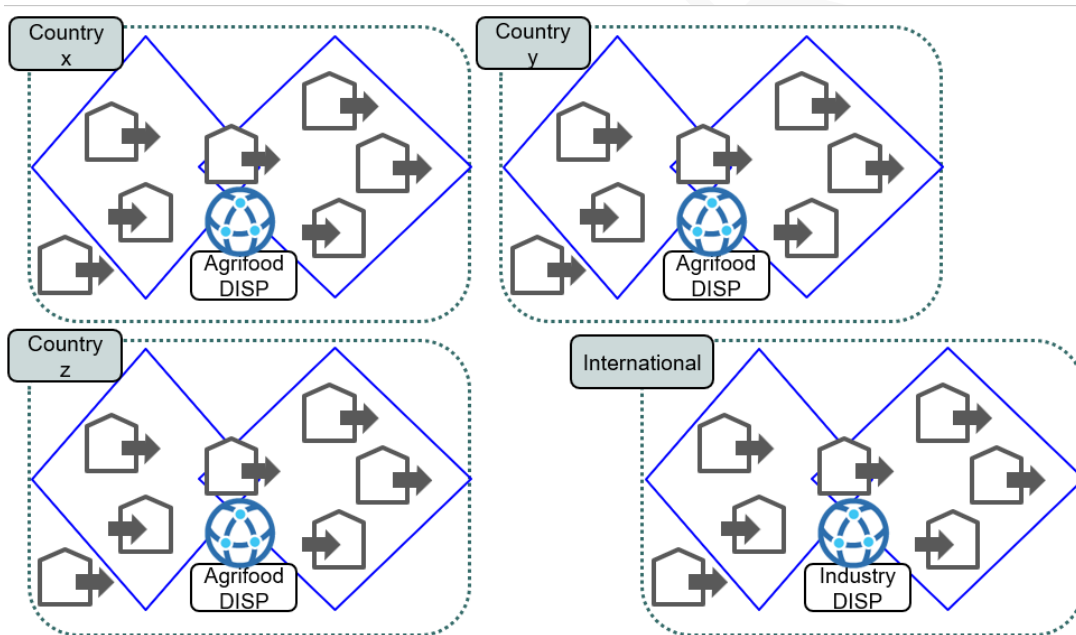
Figure 32: Four separate DISPs.

In Figure 33, with the initiation of CEADS, all DISPs begin to adopt Gaia-X technology gradually. By employing verifiable credentials, they can exchange identification and consent information based on trust. In the CEADS metadata catalogue, data users can view the available data in other DSIs. Through technical interconnections, data is shared among DISPs, making it more accessible to all data users. DISPs develop their business models to facilitate data sharing between them, without imposing additional hurdles for their clients. It is important to ensure that interfaces are well described using appropriate semantics so that the systems are machine-readable.

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DISPs attract more clients due to the increased availability of data. Additionally, international clients can access the data they require. Data providers who collect data from farmers across multiple countries can connect with a single DISP, ensuring that all data users connected to CEADS can access their data easily, securely, and fairly.

Figure 33: Four DISPs within the CEADS.

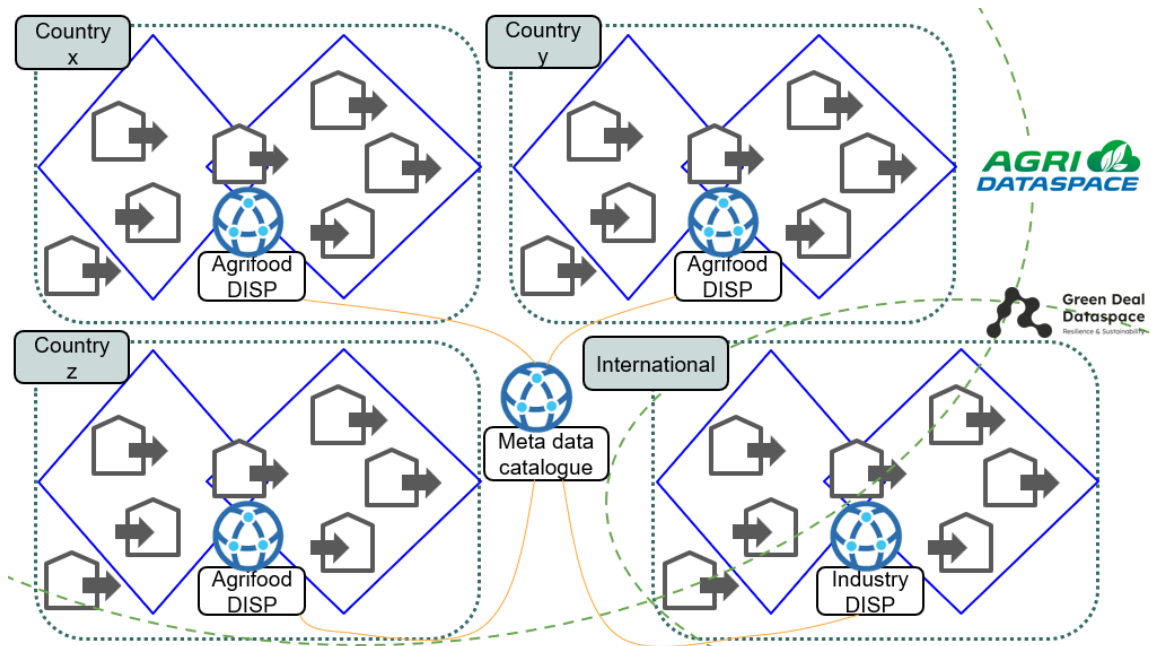Document no validated by European Commission

4. Supporting materials

4.1. Methodology

In our approach, we rely on the experience of our partner 1001 Lakes from the development of the "Finnish roadmap to a circular economy 2016-2025 – Leading the cycle"[10] conducted by SITRA[11] and PESTLE (political, economic, socio-cultural, technological, legal and environmental dimensions)[12] that already builds the baseline for the design of the ADS project and the idea of CEDS.

The SITRA methodology encompasses a set of basic steps that are required for developing a strategic roadmap for an initiative that has an economic as well as a socio-cultural impact. The resulting pathway to a circular economy in a particular European country (i.e. Finland) touches all the outlined PESTLE dimensions. A CADS is going to incorporate and connect a variety of already operating initiatives across Europe and is expected to have an impact on the European level.

The basic steps of the SITRA methodology and their implementation in the ADS project include the following:

- **GROUNDWORK AND PRECONDITIONS**: Define the preconditions, create a project plan for the process, define team roles and make sure there are sufficient resources available.

The ADS is a CSA that received funding from the European Commission. The consortium involves several Data Sharing Initiatives that already operate on the market, a Data Space tech provider, industry associations representing the agricultural industry and experts from the scientific community. Thanks to the funding of the European Commission, the project partners received sufficient resources to provide their views and expertise to lay the groundwork for the preparation of the CEADS.

- **STAKEHOLDERS AND PARTICIPATION**: Identify key stakeholders and make sure they are committed to the process. Form a steering group and identify needs for other working groups.

The major stakeholders of the data-driven value chain in the agricultural sector: suppliers, machinery vendors, farmer associations, data sharing initiatives and platform providers, participated in the surveys and workshops conducted in WP1 and in validation webinars and

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[10] https://sustainabilityguide.eu/?guide=roadmap-to-a-circular-economy
[11] The Finnish Innovation Fund
[12] PESTLE (political, economic, socio-cultural, technological, legal and enviromental)(3): introduces legal, technical, service and market offerings, social economic, legal and socio-cultural dimensions describes a framework of macro-environmental factors that is commonly used to develop strategic roadmaps for industry associations, big and small companies and also politics.

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stakeholder meetings. The food and retail sector stakeholders were out of scope of the ADS project.

Stakeholders will need to actively contribute to the design of the CEADS. This was already done through various means:

1. Inputs through the **Series of Webinars**: Stakeholders actively participated by providing valuable inputs and feedback during a series of webinars dedicated to the design process.
2. **Review of the Projects Proposals**: Stakeholders played a crucial role in shaping the CEADS by reviewing and providing insights into the project proposals submitted for consideration.
3. Participation in **Stakeholder Meetups** (December 2023 – January 2024): Engagement extends to stakeholder meetups, where participants actively contributed to discussions and decision-making.
4. A series of **AB Meetings** (December 2023 – March 2024): Selected experts gave their insightful feedback during the meetings.

During the webinars and meetups, a significant question arose concerning the possibility of national organisations securing funding within the data strategy to enhance the sharing of public data through national data spaces. While instruments such as Horizon Europe were introduced, it became apparent that they might not cover the costs associated with the development of data spaces. Current EU-level initiatives primarily focus on supporting pilots at the national level. To address funding challenges, stakeholders are encouraged to explore alternative sources such as Technical Assistance or the RRF for national-level deployment.

The involvement of stakeholders will be, however, essential in the later implementation stages of the CEADS.

- **THE SITUATIONAL PICTURE**: Deepen the understanding about the current state of the Data Sharing Initiatives in Europe. The situational picture will serve as a solid basis for the next steps.

The project started with mapping of the current landscape, stocktaking of ongoing data sharing initiatives and design approaches in agriculture, including experience with the EUCC (WP1). The total number of initiatives mapped covered 454, of which 140 Data Sharing Initiatives answered a survey. It included questions regarding experience with data sharing and organisations involved in data sharing, e.g., data providers, consumers and right owners. Based on the collected survey data, we conducted stakeholder segmentation, which laid the background for the development of Multi-Stakeholder Governance Scheme and Business Models of the CEADS in WP2 (see deliverable D2.1).

- **VISION AND GOALS:** Create an inspiring vision for the roadmap as well as set specific and measurable goals.

Together with consortium partners, we developed a common vision for the CEADS. The vision provided a starting point for the Multi-Stakeholder Governance Scheme and Business Models, legislative framework (WP2) and a conceptual technical reference architecture (WP3) that serve

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as a target for the deployment and operation of the CEADS. The setting of the vision workshop and the results are described in Section 2.1. According to the vision and its core value proposition, the CEADS is a facilitator of cooperation for national, European and internationally operational Data Space Initiatives (DSIs). Business, governance, technical and legal interoperability are crucial factors for the cooperation of DSIs.

- **FOCUS AREAS**: Define the focus areas based on the vision and strategic goals. Define the procedures needed to establish the European Agriculture Data Space.

Correspondingly, the four dimensions: business, governance, legal and technical frame the goals, milestones and actions that have to be performed to develop, deploy and operate the CEADS.

- **PLANNING THE ACTIONS**: Plan the actions that lead to the roadmap goals.

The results of the WP2 and WP3 provided a basis for the development of scenarios that involve cooperation of different DSIs at the national, European and international levels. The scenarios include influencing factors that may cause different options in the deployment and operation of the Common European Agricultural Data Space.

- **COMPILE AND PUBLISH**: Start compiling the roadmap. Ask for stakeholder comments. Communicate to inspire others to start their own actions to promote the Common European Agricultural Data Space.

The current document includes the roadmap consisting of scenarios for cooperation of DSIs at various levels, milestones, synergies with other initiatives, and actions that are required for the deployment and operation of the CEADS.

- **EVALUATION AND REVISION**: Evaluate ongoing projects, explore supplementary actions and decide on updates. Do not forget to secure the maximum impact.

The roadmap including scenarios, milestones and actions needed to deploy and operate the CEADS will be validated in stakeholder meetings and consultations with Member States.

4.2. Vision workshop

A common vision of the CEADS served as the basis for the development of a roadmap. This sets the direction of further developments and unites the ideas of the project partners into a common, shared vision of the CEADS.

In order to discuss and formulate the common vision, a Visions Workshop was held in July 2023. Due to the relevant experience in the process of Vision creation, the workshop was organised by VDI-VDE-IT. The workshop was held online, with the aim of achieving the highest possible participation of the consortium partners in order to ensure a high level of commitment to the workshop result.

The method used was Simon Sinek's Golden Circle. The aim of the Golden Circle is to articulate the meaning and purpose of a project, and thus its core, in a structured and inspiring way. The

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method is a simple model consisting of three overlaying circles, which are addressed from the inside out. As shown in the diagram below, the core of the model is the question of "Why", i.e. the meaning and motivation behind the project. The second dimension is the question of "How". The focus here is on the methods, strategies and processes used to achieve the previously defined purpose. The last dimension is the actual desired outcome. This raises the question of the "What" and describes specific actions, products and services that contribute to the overarching purpose. Communication thus follows from the inner circle, via the middle, to the outer circle.
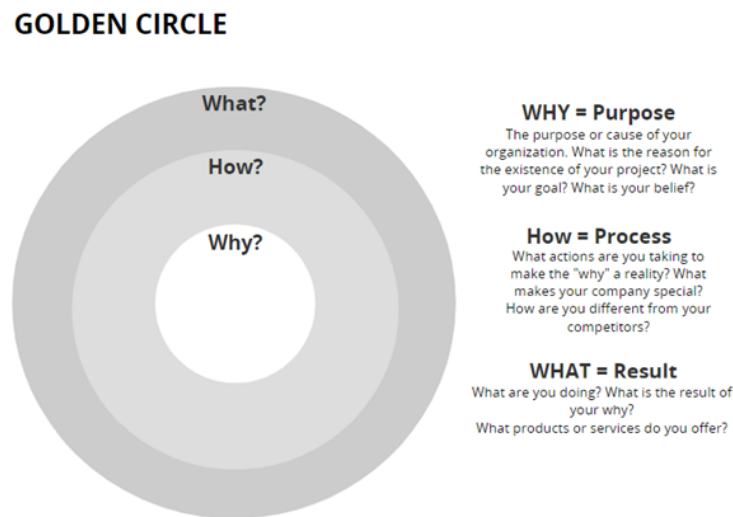
Figure 34: Golden circle

The workshop built on the following collected insights from the work packages that reflect the perspectives and dimension of the agricultural data space:

- WP1: Understanding and mapping of the data sharing landscape
- WP2: Building blocks for profitable and responsible data space in agriculture
- WP3: Data space technological landscape

The following list provides an overview of the participating project partners:

Table 6: Participants

	Organisation	Number of participants (total 24)
1	Agdatahub	3
2	DFKI	1
3	1001 Lakes	2
4	FoodScaleHub	2
5	EV ILVO	3
6	WUR	2
7	VDI/VDE IT	4
8	UdL	1

9	FBK	1
10	PSNC	1
11	CEMA	1
12	ANAMOB	1

Following an introduction to the method by the moderator, the participants were divided into three working groups, each of which developed a vision for the Common European Agricultural Data Space. The three formulated Golden Circles were then presented to all participants and consolidated into a common vision in a further interactive session (see chapter 1.3 for results).

The consolidated vision provided a baseline for the further development of the business models, a governance scheme, legal framework, conceptual technical reference architecture and the roadmap for CEADS. Following the workshop, the jointly formulated vision was shared with the rest of the consortium and feedback was actively sought. This ensured that the different dimensions and perspectives of the partners were taken into account in the common vision.

The vision embedded in the Golden Circle can be used for both internal and external communication in the form of a pitch. This pitch formulates the vision for the Common European Data Space. It can serve as a shared narrative and mission statement for internal communication and as a compelling, inspiring and brief presentation of the project to communicate with external stakeholders from industry, research and politics. The pitch illustrates how the governance, legal, business and technical building blocks should be aligned to each other. At the same time, the pitch also highlights what value proposition that is going to be provided by the ADS for the target groups (farmers, public authorities and ICT service providers).

4.3. Stakeholder consultations

4.3.1. Stakeholder feedback on governance and business dimensions

Feedback from the Stakeholder Meetups and Advisory Board Meetings, as well as comments on draft deliverables from the European Commission and the Advisory board, have been included in the final version of deliverable D2.1. Particularly the below questions were addressed.

Governance

1. What are the tasks and the role of the MSs in CEDS according to the DA and DGA?
2. Do DA and DGA mention model contracts with data sharing parties? Are MSs involved in consultations regarding these model contracts, or in providing support in synergies between different public authorities such as the EDIB and others?
3. Can a public authority join CEADS as a DSI and provide public data?

Business Models

1. What are the main incentives for the key stakeholders to join the CEADS?

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2. Which business scenarios are possible for the key stakeholders when operating the CEADS?
3. Will farmers or land machinery providers be able to set up, invest, and operate a CEADS?
4. Will public authorities be able to operate a CEADS and which services would they offer? E.g., monitoring of food production and reporting from farmers? Are these services sufficient for the CEADS?
5. In addition to the already provided business models for DSIs, are there more options that could be discussed?
6. Which business models can scale?
7. Who will be ready to invest in CEADS?
8. What are the main benefits and value proposition of the CEADS for DSIs?

4.3.2. Feedback from MS representatives

The ADS project solicited and received feedback on draft deliverables also from MS representatives. In this section there are included both the specific questions received and their answers clustered under three identified themes: opportunities and challenges for agricultural data, other EU-lever initiatives, and implications of the EU regulatory regime.

4.3.2.1. Opportunities and challenges of the use of agricultural data

What are the main opportunities to increase the reuse of agricultural data, considering both – public and private data?

- Less bureaucracy,
- Easy access to data,
- Research,
- Improved quality through standards,
- New business models,
- Simplification,
- Reduced administrative burden.

What are the main challenges to fully exploit the potential of agricultural data in the fields of B2B, B2G and G2B data sharing?

- Coming too much from a top-down perspective of monitoring and controlling rather than from real farmer needs.
- Lack of incentives for SMEs and other companies to share data.
- Generational challenges related to switching from analogue methods to digital ones.
- Lack of understanding of how companies can give the farmers flexibility and a sense of the information that would be useful to share but would not be harmful for them.
- Lack of clarity around data protection requirements and personal data use, and in particular purpose-limitation and implementing the once-only principle.
- Lack of understanding and clarity on the gains of data sharing.
- Practical complexity for farmers.
- Need for public sector encouragement towards data sharing.

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What are the main obstacles for the participation of farmers to the CEADS?

- Practical matters such as lack of connectivity, etc.
- Lack of trust and the need for public bodies to be very transparent, since control and undue monitoring are considered threats.
- Lack of added value as incentives to share data are limited in force.
- Lack of communication toward farmers, which means many are not aware of potential benefits.
- Need for capacity building among farmers as well as for finding the right use cases to communicate about.
- The concept of a data space is not yet clear, and the field is still maturing. Patience is also needed.

4.3.2.2. Initiatives at EU level related to the development of the agricultural data space

How can DIHs help with advancing the data strategy?

By upscaling and testing of relevant R&I results, capacity building among relevant stakeholders, including start-ups and end users.

How can the EDIC for agriculture help?

- By providing a legal entity for the CEADS (once the EDIC is established as one).
- By investing into the CEADS and/or other agri-food related digital infrastructure.

Can national public organisations get funding within the scope of the data strategy in order to increase the sharing of public sector data through national data spaces?

- The funding instruments introduced (Horizon Europe, etc.) seem unlikely or unable to support national data spaces.
- For now, EU-level initiatives focus on the EU level and support pilots only at a MS level.
- Other funding sources, such as Technical assistance or the RRF, could be explored for data space deployments on a MS level.

4.3.2.3. Implications of the EU regulatory regime and the EUCC

The DA only relates to raw data. What is the link between raw data and trade secret?

Raw data is data not yet processed by software. Having full access to raw data from a connected device makes it possible to reverse engineer potentially proprietary aspects of the device producing the data. This in turn enables the unfair creation of competing or copycat products. This is one reason that raw data is covered by trade secret.

What further extension of the provisions of the DA might be needed for the agricultural sector in particular?

The DA adopts a horizontal approach, but it offers opportunities for supplementary sectoral provisions. Further, the governance of and within a data space (not EU regulation itself but framed by such legislation) can be tailored to sectoral needs and interests.

Could the DA's interoperability requirements and access rights play a role in the preliminary stage to access data that could then be shared?

The preliminary steps are first gaining access to data and then its diffusion via the data space. An objective of the CEADS is to bring the "big players" (e.g., internationally operating equipment manufacturers, etc.) to use the CEADS, which would then become the entry point for sharing data. The CEADS can be seen as a federation of DSIs, which will provide services to complement existing solutions for instance by ensuring the interoperability of identities, etc.

From the perspective of agricultural administration on a MS level, what are the experiences with application of the EUCC?

Some highlights:

- The Netherlands is creating its own code of conduct with a blacklist and a whitelist.
- Lots of expectations at the beginning of the dissemination effort, but limited impact.
- The EUCC is felt to be too generic, and a list of good practices would be considered as being useful for farmers.
- The current asymmetries of powers on the market are a cause to question the merits of the voluntary approach of the EUCC.
- The EUCC seems to be promoted by certain organisations but has only had limited impact on farmers, as it seems more of a political concern.

To what extent is the blurred line between personal and non-personal data solvable in the context of agricultural data sharing?

The importance of distinguishing between personal and non-personal data is related to the need to comply GDPR (or not) and interpretations in this matter differ between MSs. For MSs, it is also important to identify other types of confidential information in agriculture and how it can and should be protected. There are also challenges around communication about what personal data is, what business data is, and how each is protected and can be used.

4.4. Glossary

Where possible, we use the terminology defined in EU law or described in the DSSC glossary version 2.0 (dated Sep 27, 2023). Included below are the most commonly used terms in this roadmap and their descriptions or definitions as well as their sources.

Table 7: Glossary.

Term	Description / Definition	Source
Single European Data Space	A genuine single market for data – open to data from across the world – where personal and non-personal data, including sensitive business data, are secure and businesses also have	Data strategy

	easy access to high-quality industrial data, boosting growth and creating value.	
Common European data spaces	A sectoral/domain-specific data spaces established in the European single market with a clear EU-wide scope that adheres to European rules and values.	Data strategy
Common European Agricultural Data Space (CEADS)	A sector-specific data space for agriculture established in the European single market with a clear EU-wide scope that adheres to European rules and values. See also: Common European data spaces.	ADS
Guidelines for common European data spaces	DGA (Article 30, paragraph h) defines that the European Data Innovation Board will propose guidelines for common European data spaces. The guidelines shall address, among other things: (i) cross-sectoral standards for data sharing, (ii) counter barriers to market entry and avoiding lock-in effects and ensuring fair competition and interoperability, (iii) protection for lawful data transfers to third countries, (iv) non-discriminatory representation of relevant stakeholders in the governance of common European data spaces and (v) adherence to cybersecurity requirements.	DGA
Data	'Data' means any digital representation of acts, facts or information and any compilation of such acts, facts or information, including in the form of sound, visual or audiovisual recording;	DGA
Data sharing	'Data sharing' means the provision of data by a data subject or a data holder to a data user for the purpose of the joint or individual use of such data, based on voluntary agreements or Union or national law, directly or through an intermediary, for example under open or commercial licences subject to a fee or free of charge;	DGA
Data holder	'Data holder' means a legal person, including public sector bodies and international organisations, or a natural person who is not a data subject with respect to the specific data in question, which, in accordance with applicable Union or national law, has the right to grant access to or to share certain personal data or non-personal data. OR 'Data holder' means a legal or natural person who has the right or obligation, in accordance with this Regulation, applicable Union law or national legislation implementing Union law, or in the case of non-personal data and through control of the	DGA or DA

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	technical design of the product and related services, the ability, to make available certain data.	
Data recipient	'data recipient' means a legal or natural person, acting for purposes which are related to that person's trade, business, craft or profession, other than the user of a product or related service, to whom the data holder makes data available, including a third party following a request by the user to the data holder or in accordance with a legal obligation under Union law or national legislation implementing Union law;	DA
Data user	'Data user' means a natural or legal person who has lawful access to certain personal or non-personal data and has the right, including under Regulation (EU) 2016/679 in the case of personal data, to use that data for commercial or noncommercial purposes;	DGA
Data intermediation service	'Data intermediation service' means a service which aims to establish commercial relationships for the purposes of data sharing between an undetermined number of data subjects and data holders on the one hand and data users on the other, through technical, legal or other means, including for the purpose of exercising the rights of data subjects in relation to personal data, excluding at least the following: • services that obtain data from data holders and aggregate, enrich or transform the data for the purpose of adding substantial value to it and license the use of the resulting data to data users, without establishing a commercial relationship between data holders and data users; • services that focus on the intermediation of copyright-protected content; • services that are exclusively used by one data holder in order to enable the use of the data held by that data holder, or that are used by multiple legal persons in a closed group, including supplier or customer relationships or collaborations established by contract, in particular those that have as a main objective to ensure the functionalities of objects and devices connected to the Internet of Things; • data sharing services offered by public sector bodies that do not aim to establish commercial relationships;	DGA
Personal data	'Personal data' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or	GDPR

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	indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person;	
Non-personal data	'Non-personal data' means data other than personal data.	DGA
Permission	'Permission' means giving data users the right to the processing of non-personal data.	DGA
Data subject	An identified or identifiable natural person	GDPR
Consent	'Consent' of the data subject means any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her;	GDPR
Data space	A distributed system defined by a governance framework that enables secure and trustworthy data transactions between participants while supporting trust and data sovereignty. A data space is implemented by one or more infrastructures and enables one or more use cases.	DSSC
Data space participant	A party that has committed to the governance framework of a particular data space and may have one or more roles in it.	DSSC
Data space role	A distinct and logically consistent set of responsibilities within a data space, that encompass associated rights and duties required to perform specific tasks, and that are designed to be fulfilled by one or more participants.	DSSC
Data space governance	The processes to develop, maintain and enforce the governance framework of a particular data space.	DSSC
Data space governance framework	The set of principles, standards, policies (rules/regulations), agreements and practices that apply to the governance, management, and operations (including business and technology aspects) of a data space as well as to the enforcement thereof, and the resolution of any conflicts.	DSSC
Data space rulebook	The documentation of the data space governance framework for operational use. The rulebook can be expressed in human-readable and machine-readable formats.	DSSC

Data space infrastructure	A technical, legal, procedural and organisational set of components and services that together enable actual data transactions to be performed in the context of one or more data spaces.	DSSC
Data transaction	The result of an interaction between two participants with the purpose of sharing, accessing, exchanging or processing data.	DSSC
Transaction participant	A data space participant that directly participates in a data transaction in a data space by providing data, providing permissions/consent related to the data or by receiving data and/or permissions/consent to use the data.	DSSC
Data space governance authority	The data space participant that is accountable for creating, developing, operating, maintaining and enforcing the governance framework for a particular data space, without replacing the role of public enforcement authorities.	DSSC
Data rights holder	A party that has (legal) rights and/or obligations to use, grant access to or share certain personal or non-personal data. Data rights holders may transfer such rights to others.	DSSC
Data provider	A transaction participant that, in the context of a specific data transaction, technically provides data to the data recipients that have a right or duty to access and/or receive that data.	DSSC
Data recipient	A transaction participant to whom data is, or is to be technically supplied by a data provider in the context of a specific data transaction.	DSSC
Data space initiative	A collaborative project of a consortium or network of committed partners to initiate, develop and maintain a data space.	DSSC
Data space use case	A specific setting in which two or more participants use a data space to create value (business, societal or environmental) from data sharing.	DSSC
Data space enabling service	A compulsory or optional core function of a data space that enables data transactions for the transaction participants and/or data space operations for the governance authority. Examples of enabling services include identity, observability, catalogue, membership management, and connector services.	DSSC
Data space intermediary	A data space participant that provides one or more enabling services while not directly participating in the data transactions itself.	DSSC

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Clearing house	A data space intermediary that provides clearing and settlement services for all financial and data transactions. *Note: This deliverable uses the term "Data clearing house" or DCH.*	DSSC
Marketplace	A data space intermediary that enables functions such as catalogues and online transaction capabilities (e.g. ordering, billing, payment) for trading data products.	DSSC
Data space connector	A technical component that is run by (or on behalf of) a participant and that provides connectivity with similar components run by (or on behalf of) other participants.	DSSC

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