



**DATA SPACES
SUPPORT CENTRE**

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Starter Kit for Data Space Designers

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1 Data Spaces 101

Data spaces create the conditions for a market among diverse participants interested in collaborating, by sharing and exchanging data. The European strategy for data¹ aims to speed up the development of the European data ecosystem and economy to harness the societal value of data, ensuring Europe's global competitiveness and data sovereignty. Through the Digital Europe Programme, the European Commission is investing in nine common European data spaces **in strategic economic sectors and domains**. This starter kit targets emerging data spaces who may benefit from a growing community of experts, developing data sharing technologies, standards, regulative and governance frameworks, and innovative business models.

A data space is an **infrastructure** that enables **data transactions** between different **data ecosystem parties** based on the **governance framework** of that data space. A data space should be generic enough to support the implementation of multiple **use cases**. For example, industrial data spaces can support different levels of trusted and secure sharing and trading of commercial data assets with automated and robust controls on legal compliance and remuneration. In data spaces, compliance with regulations for personal data is ensured; data subjects and holders can control their data and its subsequent use.

Many fundamental technical, organisational, legal, and commercial challenges exist in developing, deploying, and sustaining data spaces to support data ecosystems. **This starter kit, developed by the Data Spaces Support Centre (DSSC), provides an entry point to individuals or organizations who want to establish or take part in a data space.** This includes data space designers, data producers, data consumers, providers of data space intermediary services, and providers of data-driven services and business applications. It provides an overview of the different dimensions that enable interoperability, trust, and value creation within a data space, helps you understand the role of the DSSC as scaffolding for the European strategy for data, and points to a set of resources that can provide further guidance and support. For a comprehensive list of data space terminology and definitions please refer to the DSSC glossary².

In the future, this starter kit will be updated with references to assets and deliverables of the DSSC, as soon as these become available.

¹ <https://digital-strategy.ec.europa.eu/en/policies/strategy-data>

² <https://dssc.eu/glossary>

2 Data Spaces Start-up Checklist

We put forward the following set of questions, to contemplate and answer when setting up a data space (Figure 1). The questions are categorised across five dimensions: business, legal, operational, functional, and technical (previously referred to as the BLOFT framework³):



The graphic is a blue-to-green gradient rectangle. On the left, the title 'Data Spaces Start-up Checklist' is underlined. To the right is the Data Spaces Support Centre logo. Below the title is a bulleted list of questions categorized by dimension.

Data Spaces Start-up Checklist

- Business
 - How does the data space create value?
 - Who are the active stakeholders or participants of the data space?
 - What is the business and governance model of the data space?
 - What are the individual and collaborative business models (Incentives) for actors in the data space?
- Legal
 - What legal aspects are relevant to navigate when setting up a data space?
 - What are the legal requirements and challenges?
 - What are the legal dimensions of data governance?
 - How can data spaces ensure the full uptake of EU values?
- Operational
 - What is the operational governance framework for the data space?
 - What day-to-day activities and processes are essential for sustaining a data space?
- Functional
 - What core functionality should a data space offer?
 - What are the essential building blocks that make up each functionality?
- Technical
 - What are the formal and de-facto standards that should be followed when deploying a data space?
 - What software requirement specifications to use as references when implementing a data space?
 - Which open source software implementations are compliant with the recommended standards and specifications?

Figure 1: Data spaces start-up checklist according to the BLOFT framework.

To help data space designers find answers to relevant questions in coherence, we will first describe the five dimensions and then propose a design approach to guide the process of realising a Data Space.

³ <https://datasharingcoalition.eu/data-sharing-canvas-2/>

3 Business: Value and Models

Data spaces are a strong and collaborative alternative to platforms, creating “multi-sided business models” that rely on network effects, serving both “supply” and “demand” of data and data-related services. Offering a useful collection of data resources and services attracts users of data, and a large user base attracts additional data resources and services⁴. The challenge in making this work, however, is organisational rather than technical. Creating substantial value requires consensus through collaborative efforts from multiple users and organizations.

Data spaces go through different life cycle stages⁵, i.e., preparatory stage, implementation stage, operational stage (including maintenance and improvement), and scaling stage. The value of data spaces, as with any multi-sided business model, is most prominent in the scaling stage. This is because the data space and its technologies and services become available to more users and organizations compared to the previous stages.

Beyond the key objective of secure and sovereign data sharing for value creation, data spaces can be established for different purposes. In fact, patterns of collaborative business cases can be identified. For example, a data space can reduce the overall cost of linking systems or collectively ensuring compliance with data regulations, typically in established industries (e.g., SCSN in manufacturing). It can produce joint value by creating a set of data and logic that cannot be achieved individually, as in end-to-end multi-modal mobility services (e.g., Catena-X and the Mobility Data Space). It can operate as a marketplace where the data space can be seen as a sales channel between data service providers and data service consumers (e.g., MDM platform for open mobility data in Germany). Table 1 contains a first set of business-case patterns (which are not necessarily mutually exclusive), including an indicative assignment of Gaia-X⁶ lighthouse projects.

⁴ Stolwijk, C. C. M., and F. T. H. M. Berkers. Scalability and agility of the Smart Connected Supplier Network approach. No. TNO 2020 R11179. TNO, 2020.

⁵ Hedeler, Cornelia, et al. "Dataspace." *Search computing*. Vol. 5950. Springer Berlin Heidelberg, 2010. 114-134.

⁶ <https://gaia-x.eu/>

	Business-case pattern	Description	Examples
	Cost Sharing	<ul style="list-style-type: none"> Data space participants share their data to meet shared requirements (e.g., compliance, process efficiency, transparency). Every member saves money and time by sharing the burden. 	<ul style="list-style-type: none"> Catena-X⁷ SCSN⁸
	Joint Innovation	<ul style="list-style-type: none"> Customer innovation can only be realized by ecosystem members working together. No single ecosystem member has all the necessary data. 	<ul style="list-style-type: none"> Eona-X⁹ Mobility Data Space¹⁰
	Combined Forces	<ul style="list-style-type: none"> Ecosystem members team up to prevent a limited number of dominant market players from emerging. No single ecosystem member has the necessary resources and commitment to do this alone. 	<ul style="list-style-type: none"> EUProGigant¹¹
	Shared Marketplace	<ul style="list-style-type: none"> Ecosystem members team up to provide quality-assured, easy access to data of a domain of common interest (open data, business partner data, etc.). Transaction costs go down for all ecosystem members. 	<ul style="list-style-type: none"> Catena-X Mobility Data Space
	Greater Common Good	<ul style="list-style-type: none"> Public and private sector share data for a greater common, societal goal (e.g., climate protection). 	<ul style="list-style-type: none"> Mobility Data Space

Table 1: Business-case patterns of data spaces

Principles and rules need to be set according to the business-case pattern to help govern and coordinate the contributing organizations that help a data space meet its objectives and progress through the different life-cycle stages. Following the logic of multi-sided business models, the data space can only be sustained if it creates value for the involved organisations that use data-driven applications (that also need business models).

⁷ <https://catena-x.net>

⁸ <https://smart-connected.nl/en>

⁹ <https://eona-x.eu/>

¹⁰ <https://mobility-dataspaces.eu/>

¹¹ <https://euprogigant.com/>

Business-model radars for data-driven applications and data space participants (Figure 2):

The Base/X¹² business engineering approach exemplifies how to design collaborative business models. The core of this tool is the value created by the interactions of multiple organisations, including the end-user, which a single organisation cannot create alone. Catena-X, for example, represents a data space in the automotive industry and identifies the following roles¹³:

- Data receiver (called data consumer by Catena-X)
- Data provider
- Provider of business applications
- Provider of enabling services (e.g., EDC connector)
- Provider of core services (identity management, data catalogue etc.)
- Provider of on-boarding services

For every individual role and the whole data space, it is crucial to observe the value creation and capture, by individual participants, and the overall value created. For example, within the Smart Connected Supplier case: manufacturing companies and suppliers can exchange data with partners in their supply chain easier, faster, and more reliably. The overall value created is a governed secure data exchange for a more resilient supply chain. Such a data-driven application is one of the many similar applications in the manufacturing domain that could use an underlying data space. Data spaces must also be managed and maintained, and consequently, a collaborative business model addressing the different organizations and roles necessary to keep the data space up and running is needed (e.g., by querying stocks and acquiring shortest time to delivery to comply rush orders of OEMs). Collaboratively, the organizations will have the above-mentioned growth and network effects and reflect the different objectives, or patterns, like cost sharing, joint value creation or marketplaces.

¹² Grefen, P. W. P. J. "Service-dominant business engineering with Base/X: business modeling handbook." BASE/X Handbooks 1 (2015).

¹³ Catena-X Operating Model Whitepaper

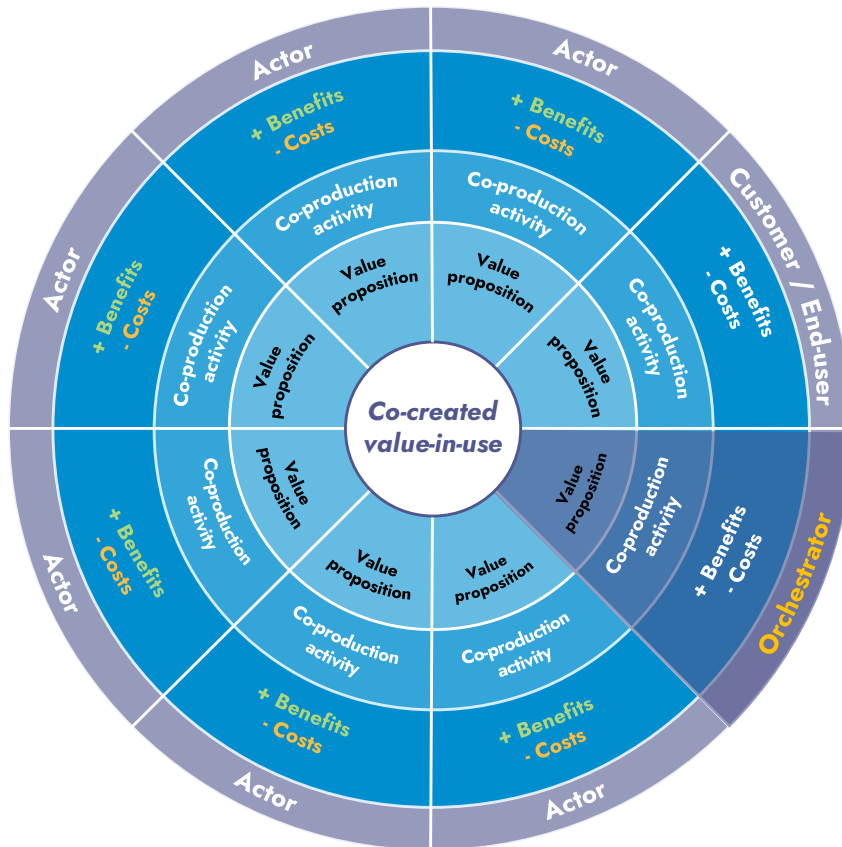


Figure 2: Business model radar

4 Legal Aspects of Data Governance

Understanding the legal aspects of data governance pertinent to data spaces can be a difficult task. To function, data spaces need to navigate the patchwork of domestic and EU legal entitlements to data, the intense European legislative agenda, and the intricate interplay between different relevant regulatory instruments. One of the objectives of the DSSC is to support data space initiatives in navigating these legal challenges. We will collect and select relevant legal issues and requirements pertinent to data spaces and collaborate with the Community of Practice (CoP) to prioritise the challenges.

Building on previous work, such as OpenDEI design principles¹⁴, the BLOFT Framework³, the Support Centre for Data Sharing (SCDS)¹⁵ and the European Hubs for Data (EUH4D)¹⁶, we will present a legal framework of data governance to enable discussions regarding legal issues. Specifically, our approach to legal aspects of data governance is inspired by the work done by EUH4D. We propose to update and expand the pillars identified by EUH4D, so they are relevant to different data spaces described in the European Strategy for Data.

As a result, the DSSC will develop legal and governance building blocks as part of its Blueprint, as well as instruments, based on the needs of data space initiatives in co-creation with the CoP.

The DSSC proposes a reflection on relevant legal issues across the below areas and describes the relevant instruments to be developed:

Cross-cutting legal frameworks: this area deals with cross-cutting legal frameworks applicable to data spaces, such as contract law, data protection, intellectual property, competition law and cybersecurity. It also includes regulatory and enforcement aspects recently introduced to regulate data and data spaces. The legal compass will be the instrument developed by the DSSC to help data space designers navigate the scattered landscape of legal frameworks and assess applicable legislative requirements. It clarifies the relationships between legal frameworks and the allocation of legal responsibilities and liabilities in data value chains. The ambition is to adopt a user-centric approach and to co-create an instrument with demand-based entry points to increase its practical use.

The organisational aspects: this area focuses on mapping systems of data governance, including exploring decision rights and accountabilities for information-related processes. As an instrument related to this area, the data governance matrix will compare archetypical data governance models using entry points. It helps data spaces to identify, based on a series of criteria, the recommended data governance models and mechanisms for their specific case. It considers the different roles in data spaces, as well as business strategies (as outlined in the previous section) and the legal environment. The data governance matrix is an instrument for data space initiatives to build their data governance model based on use cases. The wider organisational/operational governance of the data space is considered in section 8.

The contractual (or transactional) dimension: this area focuses on models, templates and architectures relating to data exchanges. The DSSC will create a catalogue of contractual modules offering guidelines, modular model agreement templates and a range of checks on how to set out general terms and conditions for data-sharing agreements within data spaces. The purpose of the catalogue is to support different data usage and transaction types, providing data space initiatives with an easily accessible and user-friendly starting point for defining the legal agreement terms.

¹⁴ <https://design-principles-for-data-spaces.org/>

¹⁵ <https://eudatasharing.eu/legal-aspects>

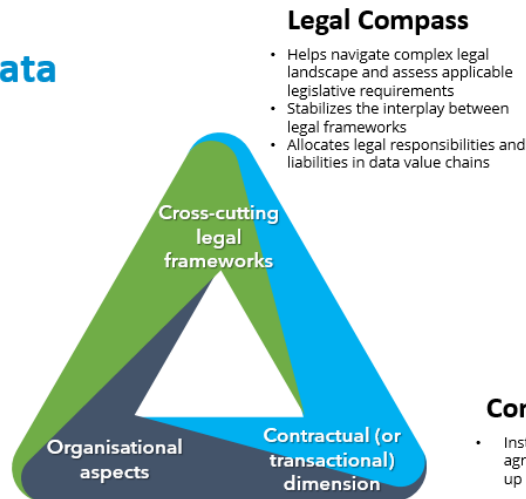
¹⁶ <https://euhubs4data.eu/>

The catalogue will be based on pre-existing principles, templates and rulebooks and developed through the co-creation process.

Legal aspects of data governance

Data Governance Matrix

- Compares archetypical data governance models
- Recommends data governance models and mechanisms
- Considers roles, business strategies and the legal environment



Legal Compass

- Helps navigate complex legal landscape and assess applicable legislative requirements
- Stabilizes the interplay between legal frameworks
- Allocates legal responsibilities and liabilities in data value chains



Catalogue of Contractual Modules

- Instructions, modular model agreements and checks on setting up general terms and conditions

Figure 3: Legal framework of data governance and the user-centric instruments to be developed by the DSSC.

The DSSC will further invest efforts to promote the full uptake of EU fundamental rights and values in data spaces. The different resources and building blocks will work towards data spaces that promote values that are core to the European way such as privacy, plurality, data self-determination, fairness, etc. These values should be enshrined in concrete settings and brought to the level of technical implementation to ensure individual and collective control of data and safeguard a human-centric and fair approach¹.

5 Operational Activities

The operational aspects of Data Spaces encompass the day-to-day activities that are required for the successful functioning of a Data Space. These activities are typically addressed in the scope of data and organizational governance design (See section 8). The design of operational activities includes operational governance agreements, such as compliance with GDPR, onboarding of organizations, decision making, and dispute resolution. In addition, business operations such as process streamlining and automation, marketing, and awareness activities are also important components of operational activities.

Monitoring and logging of day-to-day data exchange between data producers and consumers is another essential aspect of operational activities. This ensures that the flow of data is monitored, tracked, and logged, which helps in detecting issues and resolving them quickly. Furthermore, monitoring of software infrastructure, resource consumption, and availability is critical to ensure that the Data Space is running efficiently and effectively. In cases of core components going down unexpectedly, alerting mechanisms should be in place to ensure that issues are addressed promptly.

Documentation in the form of user, developer, and administrator guides is also essential to support the day-to-day operations of the Data Space. This documentation helps users to understand how to use the system and provides guidance for developers and administrators on how to manage and maintain the system. Additionally, a support infrastructure is necessary to enable users to report technical and operational issues and seek support when required. Overall, effective operational activities are crucial for the smooth and successful functioning of Data Spaces.

6 Functionality

In each data space present today, and the ones to be developed in the future, several **building blocks** need to be considered when setting up: they delineate areas where choices are required to enable effective and trusted sharing of data among participants.

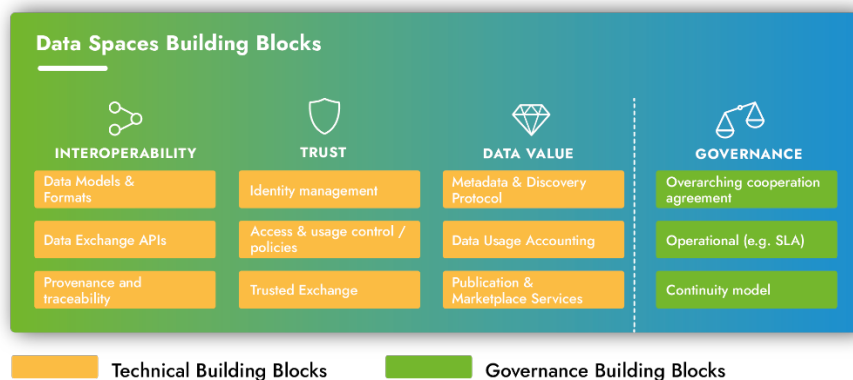


Figure 4: Building blocks pertaining to interoperability, trust, data value and governance¹⁴.

The assembly of building blocks for data spaces relies on reference architectures that specify a role model and the distribution of building blocks among roles. As stated in the Glossary, a data space is an infrastructure that enables data transactions between different data ecosystem parties based on the governance framework of that data space. Thus, the data service providers and data service consumers connect with each other and use optional third-party services. Figure 4 shows an overview of the taxonomy of these building blocks. These building blocks with the set of guidelines and architectures will conform the DSSC blueprint which is described in section 13.

In sections 3, 4, and 5, we already mention the business, legal and operational agreements participants agree to adopt. As discussed in section 4, the DSSC will further elaborate and extend **governance building blocks**. Besides governance, data spaces also require a technology foundation covering three major pillars:

Interoperability: Data spaces should provide a solid framework for efficient data exchange among participants, supporting the complete decoupling of data providers and consumers, making data services FAIR (Findable, Accessible, Interoperable and Reusable¹⁷). Interoperability between domain-specific data spaces is crucial for two reasons. First, an individual or organisation is never just part of one single space but operates in different data spaces simultaneously. If different technologies are adopted for interoperability, data spaces will turn into silos. Therefore, interoperability helps provide users with more value by reducing integration and adaptation costs.

¹⁷ FAIR Principles. <https://www.go-fair.org/fair-principles/>

It is also crucial to achieve the vision of the European strategy for data, to create one common data space, comprising many sector-specific data spaces. Second, use cases are not limited to a single data silo. Fragmentation of the data economy must be prevented to reap the maximum value for organisations and individuals. This requires the adoption of a “common lingua” every participant uses, which materialised in adopting interoperable APIs for data exchange and the definition of compatible data models. Interoperable mechanisms for the traceability of data exchange transactions and data provenance are also needed.

Trust: Data spaces should bring technical means for guaranteeing that participants in a data space can trust each other and exercise sovereignty over the data they share based on user-controlled consent. This requires the adoption of interoperable standards for managing the identity of participants, verifying their trustworthiness, and enforcing policies agreed upon for data access and usage control.

Data value: Data spaces should provide possibilities for participants to generate value from sharing data (i.e., going beyond FAIRness towards data quality and further on to creating data value chains). Therefore, data spaces often can contain multi-sided markets if participants intend to trade, buy, and sell data services as part of their business model. This requires the adoption of interoperable mechanisms enabling the description of terms and conditions (including pricing) linked to data service offerings, the publication and discovery of such offerings and the management of all the necessary steps supporting the lifecycle of contracts that are established when a given participant acquires the rights to access and use data.

For each building block, a data space can make specific choices. For example: how certain bodies provide ‘trust’ in the ecosystem, based on what criteria, what are the necessary steps and the extent to which marketplace functionalities will be arranged will vary from one domain to the other. However, the underlying fundamental specifications and standards to define those can be the same. There can also be best practices and technology options. This is where the DSSC seeks to achieve synergies: allowing participants of one data space to connect to others: by using similar, compatible specifications, standards, and technologies for each of the building blocks. Ultimately this should allow for seamless ‘roaming’ of participants from one data space to the other.

7 Technology

Data spaces functionality is implementation-agnostic. However, for data space designers, it is important to not only know what functionality needs to be provided, but also which standards and software implementations are available to support their implementation. Having common standards and software components is important to improve efficiency, transparency and achieve growth.

The DSSC will not develop components itself, but will provide the landscape of the following types of contributions to make recommendations of compatible technology stacks, including:

- Baseline formal and de-facto standards to be followed.
- Specifications covering lack of standards, solving optional parts or gaps in identified standards, or describing how standards can be integrated, as references for implementations.
- (Open source) software implementations (products, projects, and repositories) by different implementers.

The three types of elements will be classified under pillars and mapped to the building blocks of the functional framework referred to in Figure 4. For each element we will identify:

- the publisher/provider/implementer,
- other elements it may comply or be compatible with,
- maturity level,
- source/link (where to find more info about the element),
- and the level of endorsement (e.g., which ongoing European data spaces endorse the element).

Candidate standards, specifications and implementations are being collected and will be further assessed according to criteria to be defined. Based on this list, in September 2023, the collection of candidates building blocks will be published, and from then, the recommended building blocks will be selected based on compatibility, adoption and usability criteria. We will show how different standards or technologies can work together where needed. The intent is to avoid vendor lock-ins and proprietary standards and software.

The DSSC will then provide versions of building blocks and at proposing “releases” of compatible technology stacks to acknowledge the fact the business requirements as well as technology change over time. The new releases of existing technical building blocks and new possible technical building blocks will be validated according to a validation schema to assess the DSSC criteria for data spaces components.

8 A design approach for data and organizational governance for Data Spaces

As indicated above, the BLOFT dimensions provide a broad view on the different aspects of a Data Space. In this section, we provide a design approach based on which the aspects of the BLOFT framework can be applied by organizations that have an intention to set up and operate a Data Space. We explain how this design approach works based on the data and organizational governance of a Data Space.

In the context of data spaces, data governance cannot be separated from the governance of organisations and individuals involved. The literature¹⁸ provides a synthesis of existing works and gives insight into the many factors to consider and the choices to make in setting up governance. But these will have to be established by the organizations setting up and maintaining the data space. We put forward two approaches that have proven helpful in the design of data space governance: (1) The data-sharing “use case blueprint” (Data Sharing Coalition)¹⁹, and (2) The templates for data space governance agreements from the Rulebook for a fair data economy (Sitra)²⁰ and the IDSA rulebook²¹. The governance design will have to address, among many other aspects, the above-mentioned objectives of the data space and the evolution of the data space through the different life cycle stages. As new works on governance appear, regular alignment with the legal governance to come to one multidisciplinary governance structure is important.

In a Data Space, multiple organisations together, and in different roles, need to collaborate to design, realize and maintain the data space. This requires organizations to build together a view on the why, what, and how of such collaboration. We contend that governance and business models are closely related: the governance must ensure that the data space virtually operates as a single organization. Furthermore, as the literature¹⁸ showed, governance is a broad topic that can include many different aspects of a Data Space (e.g., legal, operational, or technical).

Governance models in the context of data-driven applications and data sharing involve multiple choices that must be made in coherence by multiple organisations. Such as data sources, access conditions, algorithms, interfaces, onboarding rules, and service levels. It is too complex for a single person to make the correct choices for all available options and expect this to yield the desired outcomes and impacts, supported by all organisations involved.

To deal with this, governance modelling is approached as a design process to develop a preparatory framework of business and governance models. First, templates are developed and used as models for making choices. Next, based on the understanding and interpretation of the

¹⁸ Abraham, Rene, Johannes Schneider, and Jan Vom Brocke. “Data governance: A conceptual framework, structured review, and research agenda.” *International Journal of Information Management* 49 (2019): 424-438.

¹⁹ <https://datasharingcoalition.eu/app/uploads/2022/03/data-sharing-coalition-use-case-blueprint.pdf>

²⁰ <https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/#preface-and-templates>

²¹ https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-White-Paper-IDSA-Rule-Book.pdf

relevant contexts and objectives, such templates are filled collaboratively by multiple stakeholders. This results in a complete draft design that is evaluated against chosen criteria. The evaluation process should aid in identifying improvement suggestions or critical assumptions, which should then be tested through explorative or validation experiments. Finally, the experiment results are incorporated into the overarching design until the evaluation yields satisfactory results to commit to implementation. The design process is composed of the following steps:

- **Onboarding:** building trust among the participants in the design process.
- **Exploration:** what is already known about the governance topics and what is in and out of scope.
- **Design:** find answers to the many topics included in governance.
- **Evaluation/Experimentation:** find additional answers to open parts.
- **Finalisation:** All stakeholders agree.
- **Formalization:** The governance can be formalized in agreements. The Rulebook suggests the agreements listed in Figure 5.

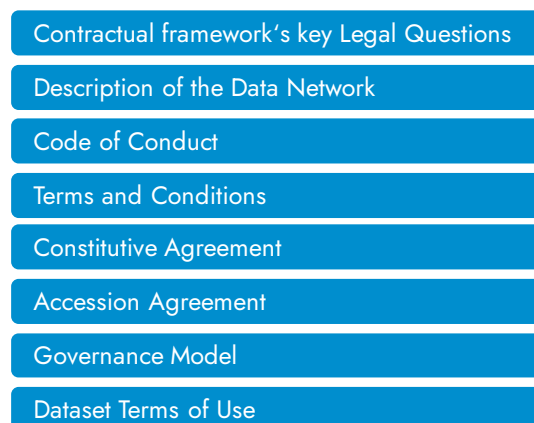


Figure 5: Governance agreements

Based on the Use Case Blueprint and the Rulebook, and additional governance related aspects, we propose to organize the process along the following lines:

1. Strategic orientation:
 - a. Purpose and principles,
 - b. Applications and functionality,
 - c. Dynamics and change,
 - d. Legal and financial matters
2. Processes and procedures (operation)
3. Technology and technical data management

These lines interact, and only after completion, they can be formalized into the suggested agreements.

9 DSSC Blueprint

The DSSC will identify building blocks across all five dimensions described above and provide further guidance for each building block through our common **blueprint**. This data interoperability buildings blocks, technical data sovereignty, security and trust building blocks, data value creation building blocks, and data governance and legal building blocks.

To start with, the blueprint will bundle existing best practices and ensure alignment towards interoperability and replicability. For new data spaces, this provides – once relevant domain-specific business objectives have been identified – an ability to start at a higher flight-level for implementing the various building blocks according to their needs. In addition, it will help to achieve interoperability between data spaces and provide significant economies of scale.

When defining the blueprint, the DSSC does not start from scratch. Various European and global initiatives are already developing data sharing technologies, specifications, standards, legal frameworks, and innovative business models. Through our Community of Practice (CoP), we will work with these initiatives to shape the blueprint. We will start by carefully listening to the needs of data spaces in key selected areas where investments will take place through the Digital Europe Programme. We also welcome input and feedback from others. An open governance process will be put in place to facilitate the decision-making process for the blueprint. Where possible, we will use a consensus-based decision-making process.

10 Appendix 1: DSSC – Supports

The DSSC will support the data space community following a heartbeat and release cycle, creating many assets in collaboration with the Community of Practice (CoP). The Support Centre drives adoption through support activities, a platform dssc.eu for knowledge and asset sharing, a help desk, toolboxes, and active engagement with the CoP. The support options are packaged to serve the needs of the data space initiatives at different maturity levels. The work of the DSSC will continuously evolve with a user-centric approach as the result of co-creation with the stakeholders and the sharing of lessons and experiences between data spaces.

Support Platform: The Support Platform is accessible through the Portal at dssc.eu. It presents a minimal set of features at the moment. It will be enriched following the project's timeline and its assets' release. The Support Platform serves the following objectives:

The Go-to-place to get information and learn about data spaces.

Access point to join the co-creation process of the data spaces blueprint and other assets supporting the realisation of data spaces.

An entry point to organise the support by data spaces experts (in priority for data spaces funded under the Digital Europe Programme).

For support requests please reach out via e-mail to contact@dssc.eu. More fine-grained interactions will be added in the future (ticketing system, knowledge base, etc.)

11 Appendix 2: Resource Inventories

The resource inventories provide an overview of both the state-of-the-art and the state-of-the-practice in data spaces. Within this initial set of resources, we have taken an inclusive approach to showcase the breadth of ongoing work. The inclusion of a resource does not infer an official endorsement from the DSSC. Resources will be added and removed over time.

Name	Description	Org
Data Spaces 101		
Designing Data Spaces	It provides a comprehensive view of data ecosystems and platform economics, from methodical and technological foundations to reports from practical implementations and applications in various industries. https://link.springer.com/book/10.1007/978-3-030-93975-5	Fraunhofer
Data Spaces: Design, Deployment, and Future Directions	Data sharing and exchange techniques using data spaces. Theory, technologies, methodologies, and best practices. https://link.springer.com/chapter/10.1007/978-3-030-98636-0_1	BDVA
Data sharing Canvas	The Data Sharing Canvas is the foundation for generic and harmonised agreements which, once implemented, enable data sharing at scale within and across domains and sectors. This has been created together with the 40+ Data Sharing Coalition participants from different domains that represent over 100.000 organisations. https://datasharingcoalition.eu/app/uploads/2021/04/data-sharing-canvas-30-04-2021.pdf	Data Sharing Coalition (DSC)
FIWARE for Data Spaces	This white paper brings a perspective on how data spaces enabling the trusted and effective exchange of digital twin data between smart applications can be achieved. Furthermore, it brings the first perspective on how FIWARE and IDS Reference Models can be reconciled and contribute to accelerate the materialisation of Gaia-X. https://www.fiware.org/marketing-material/fiware-for-data-spaces/	FIWARE
Gaia-X Cleaning Houses	Gaia-X Cleaning Houses (GXDCHs) are nodes of verification of the Gaia-X rules. It is the place to go to obtain Gaia-X compliance and become part of the Gaia-X ecosystem. https://gaia-x.eu	Gaia-X

How to build Data Space	The knowledge base (a.k.a. "How to build Data Spaces?") is the store of information that relies on IDS expertise that is meant to support building IDS components and contribute to the existing open source components based on a five-step approach. (https://docs.internationaldataspaces.org/knowledge-base/)	IDSA
Principals for Data Spaces	It defines the design principles for data spaces, agreements on the building blocks for a soft infrastructure and governance for data spaces. (https://design-principles-for-data-spaces.org/)	OPEN DEI
Real-time Linked Dataspaces	The Real-time Linked Dataspace (RLD) is an enabling platform for data management for intelligent systems within smart environments that combines the pay-as-you-go paradigm of dataspace, linked data, and knowledge graphs with entity-centric real-time query capabilities. (http://dataspaces.info/)	Insight
European-Governed data sharing space	It enables data exchange and unlocking AI potential to create the conditions for developing a trusted European data-sharing framework. https://www.bdva.eu/sites/default/files/BDVADataSharingSpacesPositionPaperV2_2020_Final.pdf	BDVA
The European Common Data Space	Data.europa.eu and the European Common Data Spaces (ECDS). https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/EN_data_europa_eu_and_the_European_common_data_spaces_0.pdf	EC
Data spaces landscape	Data spaces landscape is an overview and relations of data spaces in initiatives, standards, and tools. (public available end of February)	IDSA
Business: Value and Models		
Data Spaces Brochure 2021	Use cases are cross-company business processes enabled by the IDSs standard. They help identify, analyse, and evaluate user requirements for IDS. https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/220812_Use-Case-Bro_2022_35-MB.pdf	IDSA
Fair Data Economy Rulebook	Designed to guide forming of trust-based data-sharing networks with a common mission, vision, and values. https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/	SITRA

<p>New Business Models for Data Spaces Grounded in Data Sovereignty</p>	<p>This paper applies frameworks and methods, including the business model and business ecosystem canvases, to the IDS perspective. These support a structured approach and a checklist for business planning purposes. https://internationaldataspaces.org/wp-content/uploads/IDSA-Position-Paper-New-Business-Models-sneak-preview-version.pdf</p>	<p>IDSA</p>
<p>Legal Landscape and Governance Models</p>		
<p>Analytical report on EU law applicable to sharing of non-personal data</p>	<p>A report focusing on a thorough analysis of EU legislation applicable to sharing non-personal data, aiming to provide a structured overview of all the relevant European instruments within this field. https://eudatasharing.eu/legal-aspects/report-eu-law-applicable-sharing-non-personal-data</p>	<p>SCDS</p>
<p>Digitranscope: the governance of digitally transformed society</p>	<p>Full report of the Digitranscope research project, exploring the increasing awareness of the strategic importance of data and emerging governance models to distribute the value generated more equitably in society. https://publications.jrc.ec.europa.eu/repository/handle/JRC123362</p>	<p>EC JRC</p>
<p>EU regulation builds a fairer data economy</p>	<p>Working paper that summarises the European Data Strategy and the new legislative proposals for the data economy (Data Governance Act, Digital Markets Act, Digital Services Act, Artificial Intelligence Act and Data Act). It complements this overview with an exploration of the proposals' opportunities from the perspective of the public sector, SMEs, and individuals. https://www.sitra.fi/app/uploads/2022/06/sitra-eu-regulation-builds-a-fairer-data-economy.pdf</p>	<p>SITRA</p>
<p>IDSA Rule Book</p>	<p>This book provides a common governance framework that specifies the functional, technical, operational and legal agreements that structure roles and interactions within and across the various parts of the IDS ecosystem. https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-White-Paper-IDSA-Rule-Book.pdf</p>	<p>IDSA</p>

Principles for a Data Economy: Data Transactions and Data Rights	Set of transnational Principles that can facilitate the drafting of model agreements or provisions to be used voluntarily by parties in the data economy. https://www.europeanlawinstitute.eu/fileadmin/user_upload/p_eli/Projects/Data_Economy/Principles_for_a_Data_Economy_Final_Council_Draft.pdf	ALI-ELI
Rulebook for a fair data economy	Guide for creators of fair data economy networks, providing agreement templates and other tools to facilitate building and joining data networks. https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/	SITRA
White Paper on the Data Act	The data act white paper attempts to provide a first detailed analysis of the various provisions of the data act in light of the broader EU data economy policy and regulatory landscape. https://www.law.kuleuven.be/citip/en/news/item/white-paper-data-act	KU Leuven
White Paper on the Data Governance Act	The white paper offers an academic perspective to the discussion on the Data Governance Act proposal (“DGA proposal”), as adopted by the European Commission in November 2020. It contains a legal analysis of the DGA proposal and includes recommendations to amend its shortcomings. The White Paper aims to cover the full spectrum of the DGA proposal and therefore offers an in-depth analysis of its main provisions. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3872703	KU Leuven
Gaia-X Compliance	Set of rules to have legally relevant, measurable and comparable proofs of adherence to transparent and verifiable information in order to create trust at scale https://docs.gaia-x.eu/	Gaia-X
Functionality and Technology: Blueprints and Building Blocks		
Data Sharing Coalition	The Data Sharing Coalition builds on existing data-sharing initiatives to enable data sharing across domains. By enabling multilateral interoperability between existing and future data-sharing initiatives with data sovereignty as a core principle, parties from different sectors and domains can easily share data, unlocking significant economic and societal value. https://datasharingcoalition.eu/	DSC

Data Connectors	<p>This report captures 16 Data Connector variants and provides insights into their current development and usage status. Beyond the Data Connectors, this report provides insights into emerging technologies and concepts in data spaces and fundamental technologies that form a basis for data spaces.</p> <p>(https://internationaldataspaces.org/download/35299/)</p>	IDSA
Data Usage Control in the IDS	<p>This paper focuses on data usage control and data provenance, which are conceptual and technological solutions to cope with data sovereignty challenges. It presents three approaches researched and developed within Fraunhofer: The MYDATA control technologies, the logic-based usage control and degree.</p> <p> (https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Position-Paper-Usage-Control-in-the-IDS-V3..pdf)</p>	IDSA
FIWARE for Digital Twins	<p>It describes how smart applications from multiple domains can be developed based on the Digital Twin paradigm using FIWARE software building blocks. Central in the vision, the NGSI-LD API is proposed as an open standard API for getting access to digital twin data and the use of standard data models is promoted to ensure the portability and replicability of solutions.</p> <p>(https://www.fiware.org/marketing-material/fiware-for-digital-twins/)</p>	FIWARE
iSHARE	<p>iSHARE is a coherent model ("Trust Scheme") of functional, technical, and legal agreements and standards used in the Dutch transport and logistics sector to exchange data.</p> <p>(https://ishare.eu/)</p>	iSHARE
IDS Reference Architecture Model 4.0	<p>The IDS RAM contains the conceptual level, including technology-agnostic specifications. The general outline of the IDS RAM is based on the five layers and the three perspectives. Each layer should reflect the main components and aspects of the IDS.</p> <p> (https://github.com/International-Data-Spaces-Association/IDS-RAM_4_0)</p>	IDSA

Minimum Viable Data Space (MVD)	A minimum viable data space (MVDS) is a combination of components to initiate a data space with just enough features to be usable for secure and sovereign data exchange, as specified by IDSA. https://docs.internationaldataspaces.org/knowledge-base/mvds	IDSA
OPEN DEI building blocks catalogue	Repository on GitHub to provide a state of the art of the various building blocks from projects and data-sharing initiatives participating in the OPEN DEI survey. https://github.com/International-Data-Spaces-Association/Building-Blocks-Catalog	OPEN DEI
Smart Data Models	Smart Data Models is a collaborative program to provide data models for digital twins and data spaces. The SDMs are free and open-licensed, multisector, based on real use cases and adopted open standards, collaborative, at market speed, customisable to local needs and compatible with linked data. https://smartdatamodels.org/	FIWARE
Technical Convergence Discussion Document	The discussion document is an agile paper that defines a common reference technology framework for creating data spaces. This framework is based on the technical convergence of existing architectures and models for data spaces defined by members of the Data Spaces Business Alliance. https://data-spaces-business-alliance.eu/dsba-releases-technical-convergence-discussion-document/	DSBA
Gaia-X Architecture	Set of description models and operating rules for decentralized cross-dataspace interoperability. https://docs.gaia-x.eu/ .	Gaia-X
DCAT-AP	The DCAT Application profile for data portals in Europe (DCAT-AP) is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing public sector datasets in Europe. Its basic use case is to enable a cross-data portal search for data sets and make public sector data better searchable across borders and sectors. This can be achieved by the exchange of descriptions of data sets among data portals. https://github.com/SEMICeu/DCAT-AP	EC

Use Cases		
Catena-X	Catena-X sees itself as a rapidly scalable ecosystem in which all participants in the automotive value chain participate equally. The goal: to provide an environment for the creation, operation and collaborative use of end-to-end data chains along the entire automotive value chain. (https://catena-x.net/en/)	Catena-X
Data Spaces Radar	The site gives an outlook on many data space initiatives and use cases, with an indication of maturity. (https://internationaldataspaces.org/adopt/data-space-radar)	IDSA
Data Space Energy Transition	Supply chain management in the energy sector - Energy communities - optimisation of supply and demand/power grid stabilisation - data services and products for renewable energies. (https://gaia-x.eu/wp-content/uploads/files/2021-06/Gaia-X_Data-Space-Energy_Position-Paper.pdf)	Green Data Hub
European Health Data Space	The goal is to ensure that natural persons in the EU have increased control in practice over their electronic health data. It also aims to ensure a legal framework consisting of trusted EU and Member State governance mechanisms and a secure processing environment. (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0197)	EC
Health Data Hub (HDH), France	The Health Data Hub (HDH) is a unique gateway to health data in France. The goal is to improve the quality of care and patient support. The HDH is a platform where pseudonymised health data from different sources is duplicated and made available. (https://www.health-data-hub.fr/)	Health Data Hub
I4Trust Data Space Experiments	i4Trust brings a framework that enables the creation of data spaces to exchange digital twin data. Latest version of this framework released January 2023 aligns with recommendations from the DSBA Technology Convergence discussion document. Thirty pioneer use cases will be experimented with in domains such as cities, mobility, energy, agrifood, logistics, ports or manufacturing. (https://i4Trust.org)	FIWARE, iSHARE

Mobility Data Space	The Mobility Data Space is the data-sharing community for anyone who wants to make mobility more eco-, user-friendly, safer, and fair. (https://mobility-dataspace.eu/)	DRM
Resilience and Sustainability Data Space	The Resilience and Sustainability Data Space will allow for transparency of the supply chain by early identification of crisis and their effects on supply and production conditions for each individual participant. (https://www.resilience-sustainability-dataspace.eu/about/)	Advaneo RSDS
Smart Connected Supplier Network (SCSN)	Smart Connected Supplier Network (SCSN) is a data standard that makes exchanging information in the supply chain more efficient, allowing companies to share data more easily, quickly, and reliably. https://smart-connected.nl/en	TNO
TEHDAS - European Health Data Space	The goal is for future European citizens, communities and companies to benefit from secure and seamless access to health data regardless of where it is stored. (https://www.sitra.fi/en/projects/joint-action-towards-the-european-health-data-space-tehdas/)	Sitra
Building Blocks	The Building Blocks are standards-based open and reusable digital solutions that enable basic capabilities, such as trusted authentication and secure data exchange. They offer basic capabilities that can be used in any European project to facilitate the delivery of digital public services across borders. https://ec.europa.eu/digital-building-blocks/wikis/display/DIGITAL/Digital+Homepage	EC
AgriDataspace	Agdatahub brings together public and private players in the agricultural sector to provide agriculture with a shared and sovereign technological infrastructure to guarantee the development of digital agriculture in France and Europe. https://agdatahub.eu/en/entreprise/	AgDatahub
Organisations and Associations		
BDVA	With more than 230 members all over Europe, Big Data Value Association - BDVA focuses on enabling the digital transformation of the economy and society through Data and Artificial Intelligence by advancing in areas such as big data and AI technologies and services, data platforms and data spaces, Industrial AI, data-driven value creation, standardisation, and skills. https://www.bdva.eu/	BDVA

Data Space Business Alliance	<p>Bringing together data providers, users and intermediaries, data spaces are key to driving businesses to extract value from data competitively. With its combined cross-industry expertise, resources and know-how, the Alliance drives awareness, evangelises technology, shapes standards and enables integration across industries.</p> <p>(https://data-spaces-business-alliance.eu/)</p>	DSBA
DSC	<p>The Data Sharing Coalition - DSC aims to drive (cross-sectoral) data sharing, under control of the entitled party, by realizing data sharing use cases, enabling interoperability between data spaces, and strengthening individual initiatives. It explores and defines agreements on topics such as technical standards, data semantics, legal agreements, and trustworthy and reusable digital identities.</p> <p>(https://datasharingcoalition.eu/)</p>	DSC
FIWARE	<p>Together with its members and partners, FIWARE Foundation drives the definition – and the Open Source implementation – of key open standards that enable the development of portable and interoperable smart solutions and the trusted and effective exchange of data among solutions.</p> <p>(https://www.fiware.org/)</p>	FIWARE
Gaia-X	<p>With Gaia-X, representatives from business, science and politics on an international level create a proposal for the next generation of data infrastructure: an open, transparent, and secure digital ecosystem, where data and services can be made available, collated, and shared in an environment of trust.</p> <p>(https://gaia-x.eu/)</p>	Gaia-X
IDSA	<p>With 130 member companies, the International Data Spaces Association - IDSA aims to develop a reference architecture for international data spaces IDS, including a governance model and adoption strategy. Continue to evolve IDS-based on use cases. Establish IDS as the international standard for data exchange in the economy of the future. And support certifiable software solutions and business models.</p> <p>(https://internationaldataspaces.org/)</p>	IDSA
MyData Global	<p>The purpose of MyData Global is to empower individuals by improving their right to self-determination regarding their personal data.</p> <p>(https://mydata.org/)</p>	MyData

Sitra	<p>Sitra is a Finnish Fund that is influential nationally and internationally and acts as a think tank, promoter of experiments and operating models and a catalyst for co-operation. They collaborate with partners from different sectors to research, trial and implement bold new ideas that shape the future.</p> <p>https://www.sitra.fi/</p>	Sitra
Team Data Space	<p>Team Data Spaces brings together the leading European players in data spaces from European associations, industry, and research organisations with a common vision to deliver European data spaces.</p> <p>(https://dataspaces4.eu/)</p>	Team Data Space