State of Data Spaces

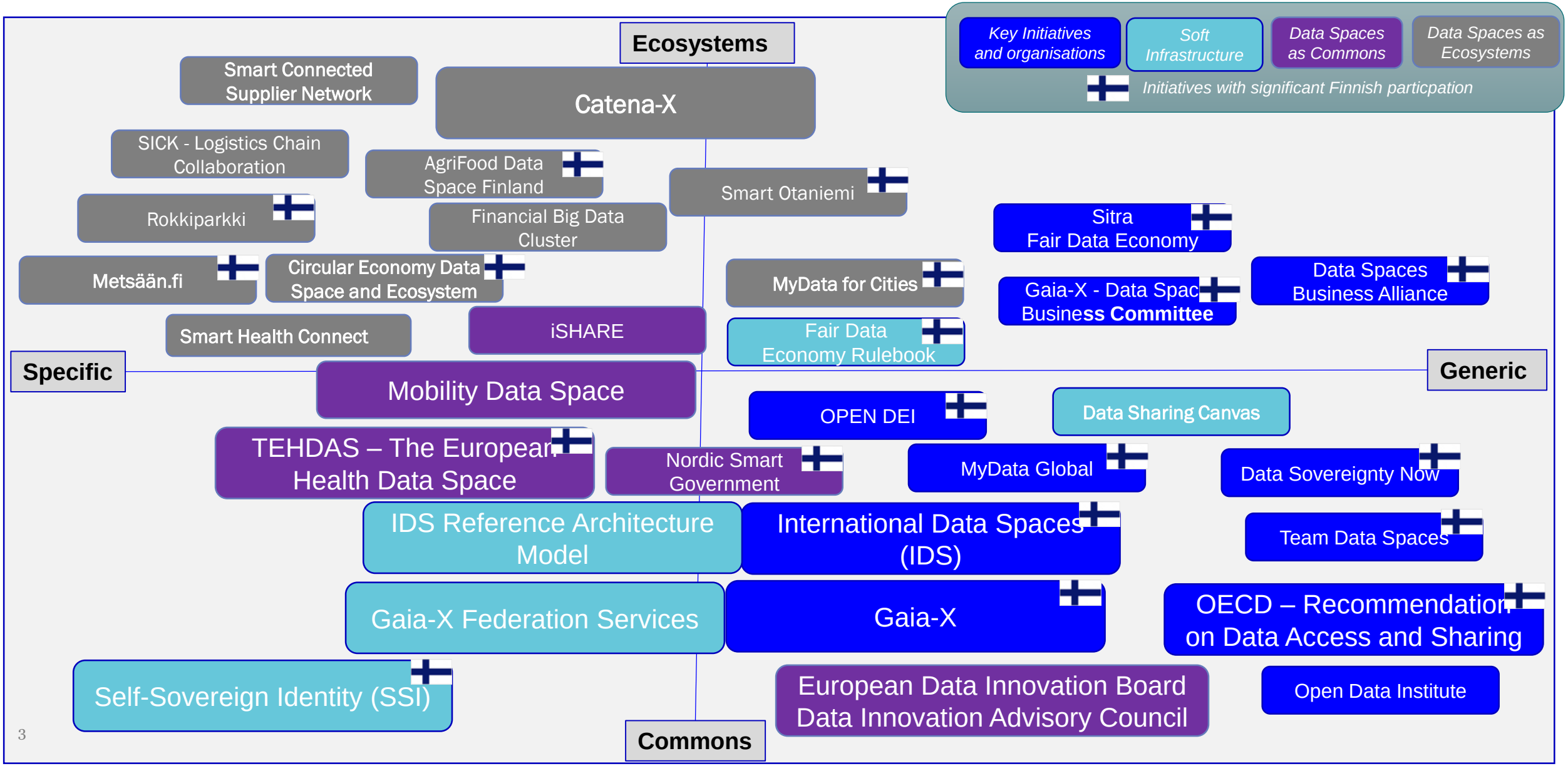
October 2021

MINISTRY OF TRANSPORT AND COMMUNICATIONS

Executive Summary

Data spaces are here	Essential concepts and principles	Key messages
There are plenty of initiatives, activities and buzz around data spaces, e.g.: • OECD's Recommendation on Data Access and Sharing, • International Data Spaces, • Gaia-X, • Data Spaces Business Alliance, • Sitra's Fair Data Economy, • Team Data Spaces, • MyData Global. Central objectives are related to • building frameworks and standardization, • developing generic building blocks, • preparing regulation for data spaces.	**Data space:** a framework and a medium that creates a secure space for data exchange, **Data sharing:** conditioned exchange of data aiming to create added value, **Data ecosystem:** integration of and interaction between stakeholders to access and share data, **Data sovereignty**: self-determination in a digital world, **Data intermediaries**: a wide set of data intermediation actors and services, **Soft infrastructure**: neutral building blocks and core services to create an interoperable digital market.	• Data spaces implement our common distributed soft infrastructure. • Data spaces evolution is in early stages moving from definition of generic principles, architecting the frameworks and identifying the potential value in pilots towards wide scale industrial adoption. • There is a broad international consensus on the need for fair data access and sharing and this momentum should be used to accelerate the developments. • Data Space Design Guidelines: Fair, Human-Centric, Responsible, Trust, Data Value, Real-time.

Map of Data Space Initiatives



Contents

1. Introduction

Background, goals, methods

Background

This state of data spaces study has been commissioned by the Ministry of Transport and Communications of Finland and conducted by 1001 Lakes.

The key data-related duties of the Ministry are to

- Improve access to data
- Provide opportunities for data-based businesses by means of regulation
- Draft legislation concerning data resources and the use of information and matters related to privacy protection and the securiy and confidentiality of transport and communications services

MINISTRY OF TRANSPORT AND COMMUNICATIONS

1001 LAKES

Team

Ministry of Transport and Communications

Lotta Engdahl, Laura Lassila, Pauliina Penttilä, Taru Rastas, Maria Rautavirta

1001 Lakes

Sami Jokela, Olli Pitkänen, Marko Turpeinen

Goals of this study

- Provide a snapshot of the state of data spaces in 2021
- Clarify concepts and principles behind data spaces
- Analyse objectives of data space initiatives, programmes, implementers
- Summarise key messages regarding data space developments

Methods

- Literary review: EU and Finnish regulation, funding programmes, reports, specifications, articles, websites, presentations.
- Two workshops: total of 30 invited participants from public sector, industry, research institutes and NGOs representing various types of deep expertise and interests.
- Six in-depth interviews: experts from Sitra, Technology Industries of Finland, Taival Advisory, Vastuu Group, Forum Virium Helsinki, International Data Spaces Association.
- Selection of initiatives for analysis in four categories: key initiatives and organisations, soft infrastructure, data spaces as commons, data spaces as ecosystems. Analysed initiatives are a representative sample in their category selected from of a broad variety of potential activities. Geographical focus has been in the EU.

Data Spaces – Analysis Framework

Regulation

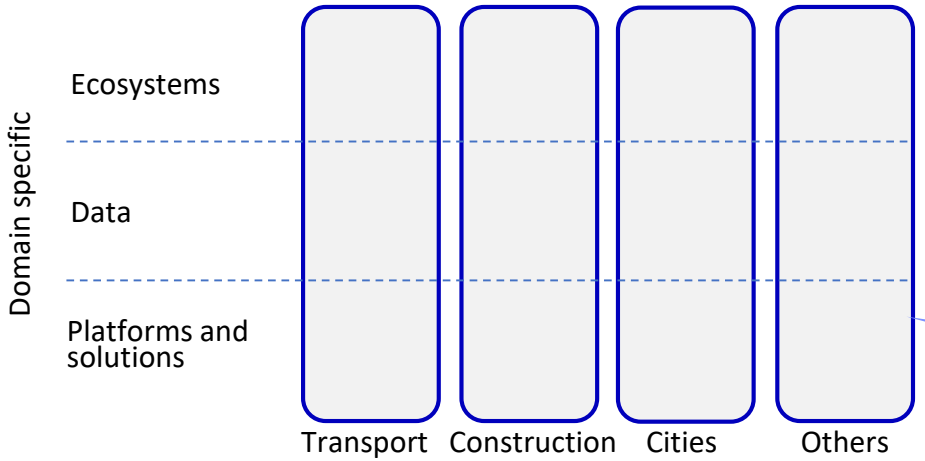
<Contibutions and aims (EU-level and national)>
<Most relevant regulatory initiatives>

Frameworks and standardization

<Common bodies>
<Major programmes>
<Standardization efforts>

Generic building blocks

<Technical building blocks>
<Governance building blocks>
<Existing and in development building blocks>



This framework was created and used to provide a more systemic view of on-going data spaces activities.

<Key facts>
<Core ideas>
<Links with Finland>

The goal was also to analyse the involvement of Finland in data space initiatives.

Data space domains were selected based on the interest areas of the Ministry of Transport and Communications.

2. Fundamentals of Data Spaces

Terminology, design principles, layered structure

Key terminology (1/2)

Term	Definition	Remarks
Data space	*Decentralized infrastructure for trustworthy data sharing and exchange in data ecosystems based on commonly agreed principles.* [2] --- *Purpose- or sector-specific or cross-sectoral interoperable frameworks of common standards and practices to share or jointly process data for, inter alia, development of new products and services, scientific research or civil society initiatives.* [3]	• "Space" has two meanings in English: "physically bounded space" (e.g. room) and "infinite space" (e.g. outer space); which meaning is more important for data spaces? • The European debate highlights the economic dimension of the concept. • Data space is a **framework and a medium that creates a secure space for data exchange**.
Data sharing	*Act of providing data access for use by others, subject to applicable technical, financial, legal, or organisational use requirements.* [1] --- *Provision by a data holder of data to a data user for the purpose of joint or individual use of the shared data, based on voluntary agreements, directly or through an intermediary.* [3]	• There is a need to emphasize that data sharing may include limitations on the users authorised to access the data, conditions for data use including the purposes for which the data can be used, and requirements on data access control mechanisms through which data access is granted. • Phrases like 'Conditioned data access and sharing arrangements' and "Data usage control" have been introduced. • Data sharing requires clarified and balanced terms of use and data interoperability frameworks and standards. • Data sharing is **conditioned exchange of data aiming to create added value**.
Data ecosystem	*Integration of and interaction between different relevant stakeholders including data holders, data producers, data intermediaries and data subjects, that are involved in, or affected by, related data access and sharing arrangements, according to their different roles, responsibilities and rights, technologies, and business models.* [1]	• Data ecosystems include public organizations, private organizations and individuals as stakeholders and actors. • Ecosystems should not be considered only from industrial viewpoint and premises; we need a **human-centric approach to building a fair data economy.**

References:
(1) OECD: Recommendation of the Council on Enhancing Access to and Sharing of Data (October 2021).
(2) OPEN DEI: Design Principles for Data Spaces (May 2021)
(3) EU Data Governance Act (draft by EU Council, October 2021)

Key terminology (2/2)

Term	Definition	Remarks
Data sovereignty	*The capability of a natural person or organisation for exclusive self-determination with regard to its economic data goods.* [2]	• Ownership of data is legally problematic, replacing the concept of ownership with the concept of sovereignty does not resolve these problems. • The concept is intended to have an empowering effect. • Data sovereignty is **self-determination in a digital world**.
Data intermediary	*Service providers that facilitate data access and sharing under commercial or non-commercial agreements between data holders, data producers, and/or users. Data holders and trusted third parties can act as data intermediaries.* [3] --- *Data spaces could require an entity to structure and organise ('orchestrate') such data spaces. Data intermediation services could include inter alia bilateral or multilateral sharing of data or the creation of platforms or databases enabling the sharing or joint use of data, as well as the establishment of a specific infrastructure for the interconnection of data holders and data users.* [3]	• The concept defines **a wide set of data intermediation actors and services**: data marketplace provider, data broker, data clearing house, vocabulary provider, data service catalogue provider, MyData operator, etc. • Data intermediation services can be very different in terms of their functions and potential business models. Can such a diverse set be regulated in a meaningful way? • How important and realistic is it for data intermediaries to be fully independent from other actors in the data ecosystem?
Soft infrastructure	*Neutral building blocks and core services. Provides a level playing field for data sharing and exchange. Made up of technology neutral and sector agnostic agreements and standards specifying how organisations and individuals can participate in the data economy and how they need to act and behave in compliance with commonly agreed rules and directives.* [2]	• Legislation is needed, which should be permissive and promote data sharing and prevent lock-in. Flexibility is also needed; agreements and bilateral practices that serve as examples for legislation. • Data is in bunkers. Building blocks and examples are needed to get data moving. • Soft infrastructure is a **milestone on the way to creating an interoperable digital market**.

References:
(1) OECD: Recommendation of the Council on Enhancing Access to and Sharing of Data (October 2021).
(2) OPEN DEI: Design Principles for Data Spaces (May 2021)
(3) EU Data Governance Act (draft by EU Council, October 2021)

Design Principles for Data Spaces

Regulation

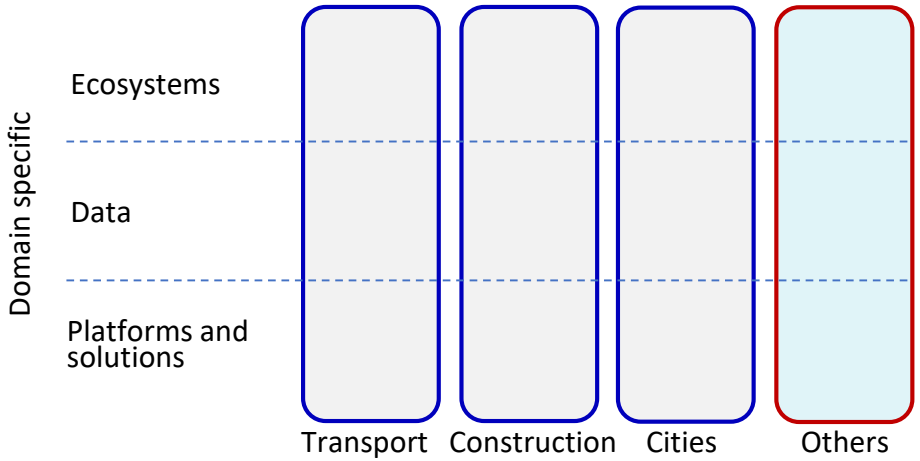
Proposes data space governance bodies and novel models, for example Data Exchange Board at the EU-level.

Frameworks and standardization

Framework for soft infrastructure and building ecosystems from generic building blocks.
Aim is to contribute as a design basis to data space programmes and standardization efforts.

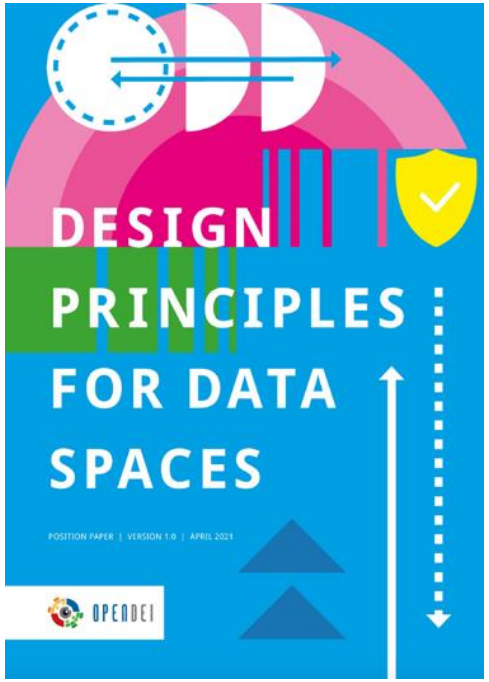
Generic building blocks

Introduces building blocks in four categories: interoperability, trust, data value, governance.



Key facts

- Collaborative effort organised by EU project OPEN DEI. This resulted in **Design Principles for Data Spaces v.1.0** white paper published in May 2021.
- Proposes four design principles for data spaces.
- Sector specific needs analysed for manufacturing, energy, health, agri-food.
- **Framework proposed is used as an underlying structure in this study.**



Data space and industrial domain experts team up to define for the first time cross-sectoral and across initiatives the fundamental design principles to build data spaces.

Authors & Contributors

Ulrich Ahle, FIWARE
Harrie Bastiaansen, TNO
Kjell Bengtsson, JOTNE
Mallku Caballero, AgriCircle
Silvia Castellvi, IDSA
Alberto Dognini, RWTH
Frans van Ette, TNO
Marianna Faraldi, TCA
Joshua Gelhaar, Fraunhofer
Alessio Graziani, ENGINEERING
Andrej Grguric, ERICSSON
Sergio Gusmeroli, POLIMI
Kristian Helmholt, TNO
Juan Jose Hierro, FIWARE
Denise Hoppenbrouwer, Innopay
Thorsten Huelsmann, IDSA
Srdjan Krco, Dunavnet
Antonio Kung, TRIALOG
Nuria De Lama, ATOS
Oscar Lazaro, INNOVALIA
Angelo Marguglio, ENGINEERING
Maria Marques, UNINOVA
Christoph Mertens, IDSA
Giorgio Micheletti, IDC
Luc Nicolas. EHTEL
Boris Otto, Fraunhofer
Eugenio Perea, TECNALIA
Carmen Polcaro, INNOVALIA
Matthijs Punter, TNO
Jorge Rodriguez, ATOS
John Soldatos, INTRASOFT INT.
Sebastian Steinbuss, IDSA
Harald Sundmaeker, ATB
Anne-Sophie Taillandier, IMT
Mariane ter Veen, Innopay
Francesco Torelli, ENGINEERING
Tuomo Tuikka, VTT
Marko Turpeinen, 1001 LAKES
Luis Usatorre, TECNALIA
Javier Valiño, ATOS

☞ **https://design-principles-for-data-spaces.org/**

Four data space design principles

#1. Data sovereignty

The capability of a natural person or organisation for exclusive self-determination with regard to its economic data goods. This is the innovative and transformative concept underlying data spaces.

#2. Data level playing field

New entrants face no insurmountable barriers to entry because of monopolistic situations. When a data level playing exists, players compete on quality of service, and not on the amount of data they control. A data level playing field is a pivotal condition to create a fair data sharing economy.

#3. Decentralised soft infrastructure

The data sharing infrastructure is not a monolithic centralised IT infrastructure. It is a collection of interoperable implementations of data spaces which comply to a unified set of agreements in all dimensions: functional, technical, operational, legal and economic. Out of the principle of data sovereignty follows functional and non-functional requirements of interoperability, portability, findability, security, privacy and trustworthiness.

#4. Public-private governance

For the design, creation and maintenance of the data level playing field a sound governance is essential. All stakeholders need to feel represented and engaged. These include users (persons, organisations) or provider of data services as well as their technology partners and professionals.

OPENDEI

Data Spaces as Ecosystems

Data sharing networks and data marketplaces

- Service and value exchange
- Use case and business driven
- Cross-sectorial ecosystems also made possible
- Rulebooks complement standards and regulation

Data Spaces as Commons

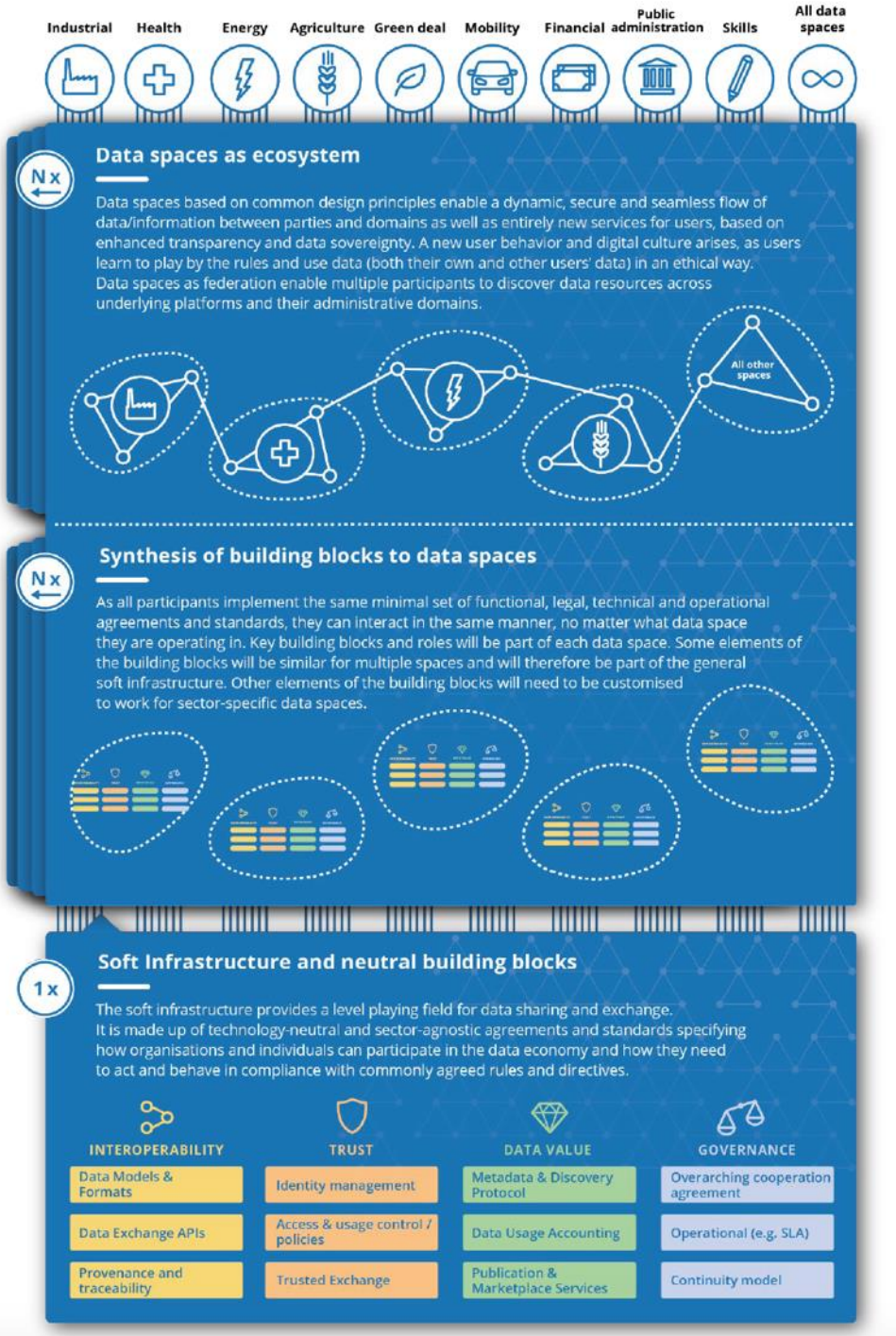
General and sector-specific principles

- Built on common soft infrastructure
- Apply sector-specific standards and regulation
- Domain-specific metadata & vocabularies
- Examples: European Health Data Space, European Mobility Data Space

Soft Infrastructure

Neutral building blocks and core services

- Interoperability
- Trust
- Data Value
- Governance



OPENDEI

3. Key Initiatives and Organisations

Data space programmes, architectures, alliances

OECD – Recommendation on Data Access and Sharing

Regulation

Recommends that Adherents adopt a **strategic whole-of-government approach** to data access and sharing

Frameworks and standardization

The recommendation aims to influence underlying principles for international data space frameworks and standards, but does not boost or promote any specific initiatives.

Generic building blocks

Domain specific

Ecosystems

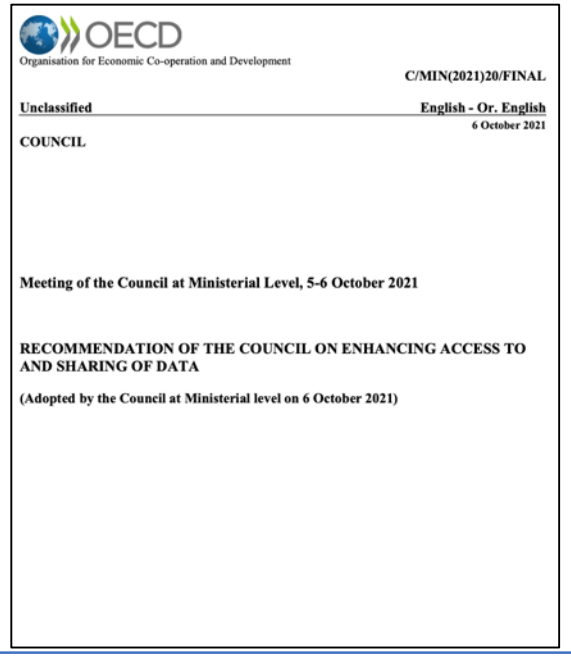
Data

Platforms and solutions

Transport Construction Cities Others

Key facts

- First internationally agreed principles and policy guidance on enhancing data access and sharing arrangements while protecting individuals' and organisations' rights and taking into account other legitimate interests and objectives
- **Reinforcing Trust Across the Data Ecosystem**
- **Stimulating Investment in Data and Incentivising Data Access and Sharing**
- **Fostering Effective and Responsible Data Access, Sharing, and Use Across Society**


OECD
Organisation for Economic Co-operation and Development
C/MIN(2021)20/FINAL
Unclassified
English - Or. English
6 October 2021
COUNCIL
Meeting of the Council at Ministerial Level, 5-6 October 2021
RECOMMENDATION OF THE COUNCIL ON ENHANCING ACCESS TO AND SHARING OF DATA
(Adopted by the Council at Ministerial level on 6 October 2021)

http://oe.cd/42Y

The aim of OECD is to "empower and pro-actively engage all relevant stakeholders alongside broader efforts to increase the trustworthiness of the data ecosystem."

International Data Spaces (IDS)

Regulation

Aims to influence EU Data Strategy, Digital Europe Programme, Data Governance Act, Data Act, Data Innovation Board, …

Frameworks and standardization

INTERNATIONAL DATA SPACES ASSOCIATION

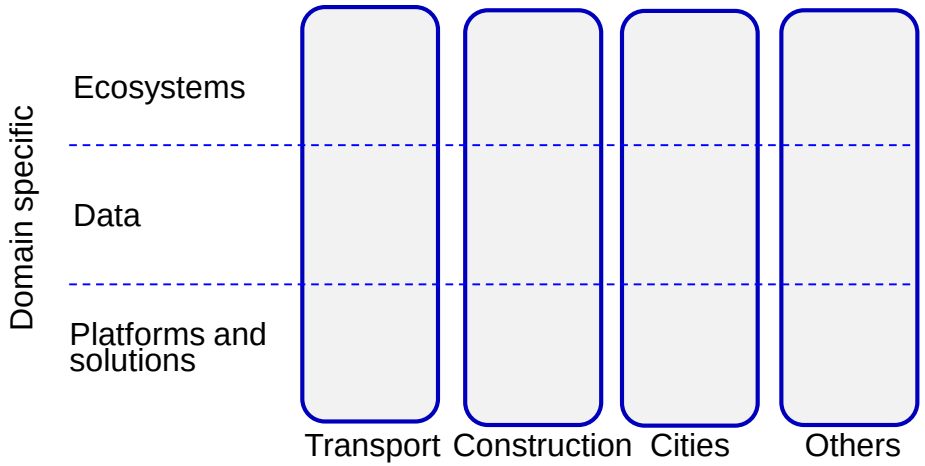
IDSA is the organizational body with approximately 200 members behind the IDS framework.

Generic building blocks

IDS Reference Architecture Model (v.3.0)

IDS_G Open Source Core Services

Open Processes (Rulebooks)

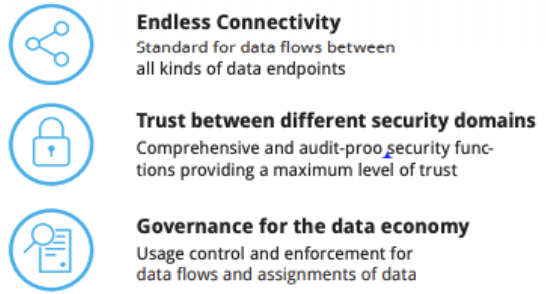


Key facts

- Goals: (1) **Driving Data Spaces in Europe** and **(2) Organizing the initiation and growth of data spaces everywhere**
- Started as a research-driven Industrie 4.0 initiative, currently in broad scale adoption phase
- Initially focused on industrial data, currently includes all data and all domains
- **Strongly linked with Gaia-X**, providing many of the data spaces building blocks

Five core pillars of IDSA offering

IDSA Guiding principles



IDSA Members from Finland:

- VTT (Finnish hub coordination)
- Aalto
- Dimecc
- Digital Living
- Vastuu Group
- 1001 Lakes

👉 https://internationaldataspaces.org/

”As an open standard, IDS guarantees data security for all parties involved in the exchange of sensitive and valuable data sets, ensures a level playing field and enforces data sovereignty with technical measures”, Lars Nagel, CEO of IDSA.

Gaia-X

Regulation

Mentioned in the **European Data Strategy**. Exchange between Gaia-X and the **European Commission** to identify synergies between Gaia-X and initiatives and programs such as the **European Cloud Federation**, **CEF 2** and **Digital Europe**.

Frameworks and standardization

gaia-x

Gaia-X AISBL

Generic building blocks

Gaia-X Architecture | Gaia-X Federation Services | Gaia-X Policy and Rules

Ecosystems

Gaia-X Data Spaces Business Committee
Gaia-X Domain Working Groups

Domain specific

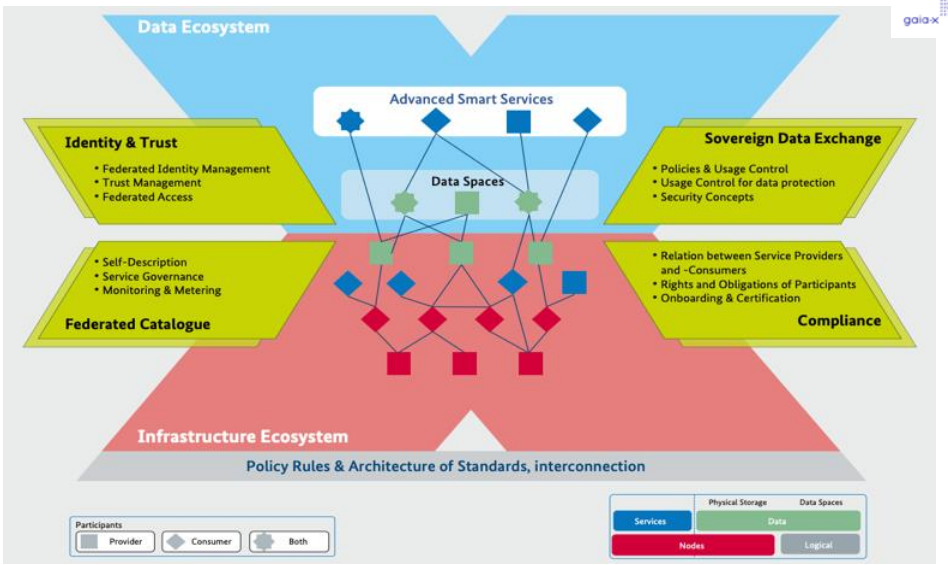
Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- Core initiative in Europe to implement European Data Strategy
- The Gaia-X project had initially a strong European cloud focus (how and where data is stored, processed and used within the data infrastructure).
- Gaia-X has evolved to include data spaces more broadly and focuses now on secure, provacy-protected and sovereign exchange and use of data.
- Leadership from France and Germany, interest growing globally.
- Main drive from EU commission and European industry (75% of members).
- 1800+ participants from ca. 500 companies and organisations.
- Relation to cloud hyperscalers (Amazon, Microsoft, Google) is evolving and becoming more inclusive instead of Gaia-X being positioned as the European alternative cloud solution.



gaia-x Hub Finland

- Finnish members: CSC, Technology Industries of Finland, Vastuu, VTT
- Business and market shaping opportunities for Finnish companies in data sharing
- Coordinated by Sitra.

☞ https://gaia-x.eu/

Our objective is to create a digital ecosystem in Europe that will foster innovation and spawn new data-driven services and applications."
Federal Minister for Economic Affairs and Energy Peter Altmaier

Data Spaces Business Alliance

Regulation

Aims to infuence data space regulation indirectly by promoting common views on key aspects to be regulated.

Frameworks and standardization

BDV BIG DATA VALUE ASSOCIATION · FIWARE FOUNDATION · gaia-x · INTERNATIONAL DATA SPACES ASSOCIATION

Generic building blocks

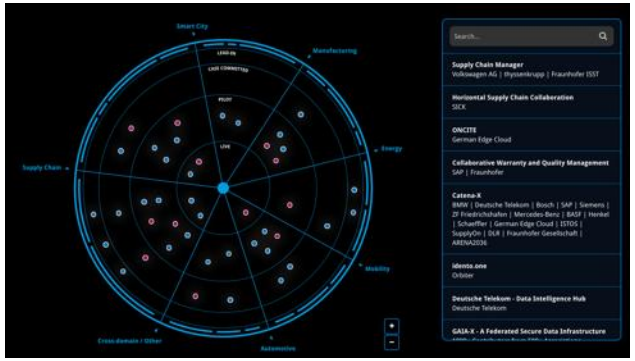
Strong contribution and commitment from all four programmes of the alliance to provide the common building blocks (combining outputs from IDSA, Gaia-X. Fiware).

Domain specific

	Transport	Construction	Cities	Others
Ecosystems				
Data				
Platforms and solutions				

Key facts

- Four key European organizations (IDSA, Gaia-X, Fiware, BDVA/DAIRO) have formed an alliance
- Creating a one voice and a common framework to make data spaces happen
- Bringing together data providers, users and intermediaries, data spaces are key to driving businesses to competitively extract value out of data
- Together, the Alliance's founding organisations represent 1,000+ leading key industry players, associations, research organisations, innovators, and policy-makers worldwide
- With its combined cross-industry expertise, resources and know-how, the Alliance drives awareness, evangelises technology, shapes standards and enables integration across industries.



Technology and architecture: Common reference model that drives interoperability by harmonising technology components and other elements.
Support: Pooling tools, resources and expertise: handbooks, roadmaps, individual evolution plans, access to Digital Innovation Hubs, acceleration programmes, go-to-market toolki.
Identification and characterisation: 'Data Spaces Radar' to actively scout potential data spaces. Overview on data spaces evolution on a global level.

https://internationaldataspaces.org/adopt/data-space-radar/

Finnish actors are involved as members in all four initiatives

"We have proven that building data spaces is possible. Now we must do it. The Data Spaces Business Alliance has all the joint capabilities to successfully build and even run data spaces. The next step is large scale adoption to fully realize the economical potential. In this Alliance, we will act now and think big for the digital future that will benefit everyone." Reinhold Achatz, Chairman of IDSA

Open Data Institute

Regulation

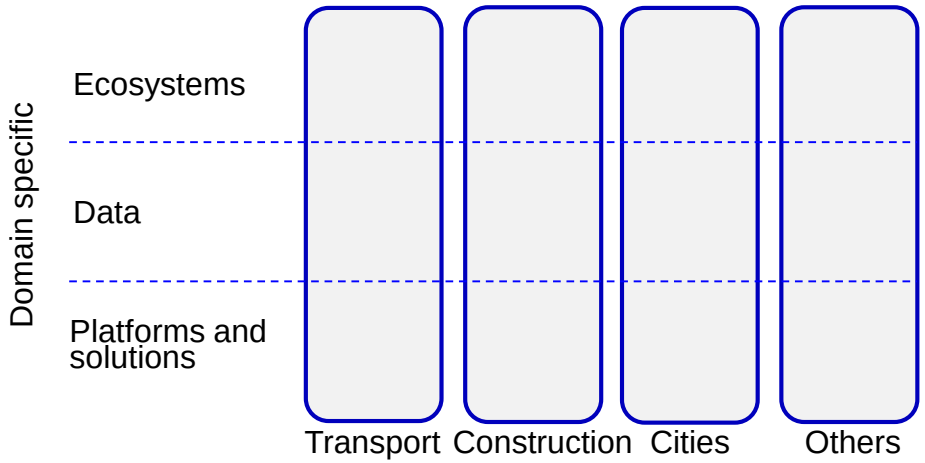
Active contributor in the evolution of data-related regulation.

Frameworks and standardization

ODI aims to enable the development of *data infrastructure* in ways that benefit people, companies, governments and civil society. We focus on increasing **data flows around the data ecosystem**, improving skills and capabilities, and encouraging innovation.

Generic building blocks

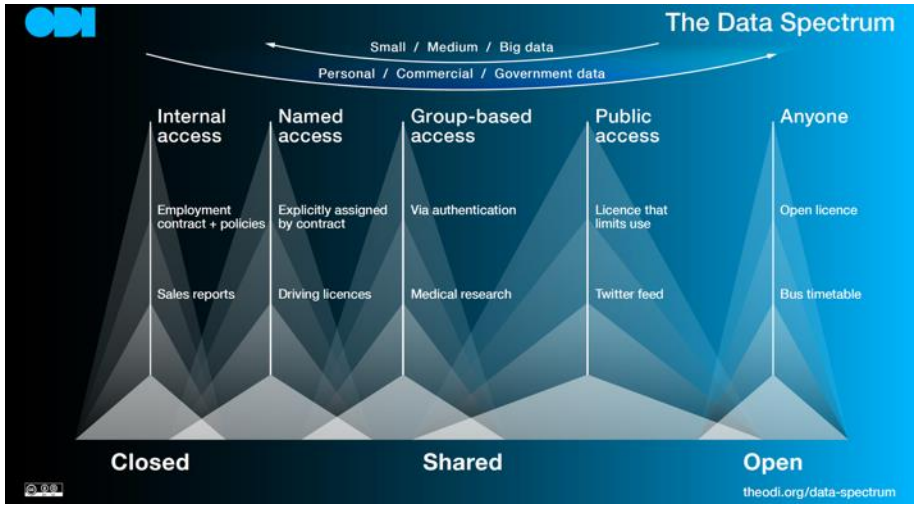
Influences indirectly the principles underlying data spaces building blocks.



Key facts

- The Open Data Institute (ODI) is a non-profit with a mission to work with companies and governments to build an open, trustworthy data ecosystem.
- ODI works with a range of organisations, governments, public bodies and civil society to create a world where data works for everyone.
- Improving the data practices of organisations so that they can build and manage adequate data infrastructure and data use.

The Data Spectrum clarifies the closed/shared/open data differences:



Example of an ODI report:

👉https://theodi.org/

OPEN DEI

Regulation

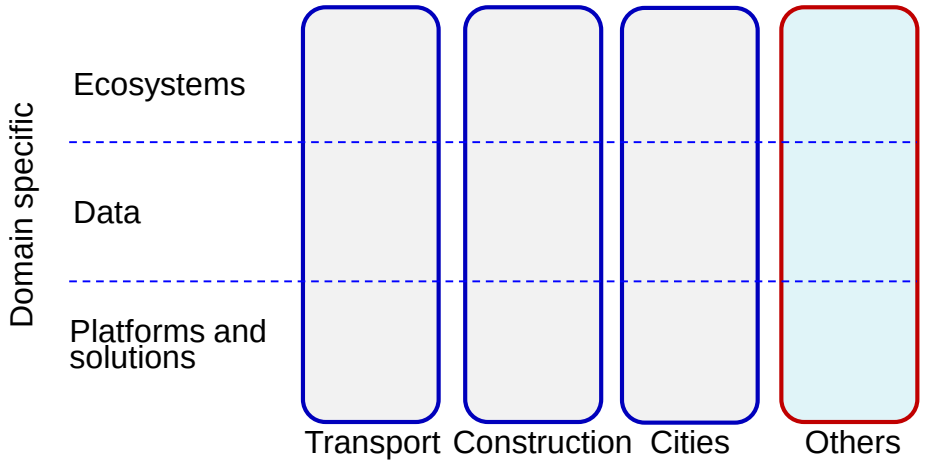
EU funded coordination action related to data spaces across various domains.
Indirectly influencing regulation and policies.

Frameworks and standardization

Aims to increase collaboration across European actors. Project has published a white paper that proposes a design framework for data spaces.

Generic building blocks

Several project partners are implementing generic building blocks that are promoted by OPEN DEI project.



Key facts

- OPEN DEI is an EU H2020 Coordination and Support Action (CSA) project (2019-22).
- Aims to detect gaps, encourage synergies, support regional and national cooperation, and enhance communication among the EU projects implementing the EU digital strategy
- Coordinates the writing of **Design Principles for Data Spaces** white paper. First version released in May 2021. Update planned to be released in Winter 2022.
- Focuses on four sectors: manufacturing, energy, health, agri-food.

Platform building
Comparing reference architectures and open source reference implementations, enabling a unified industrial data platform

Data ecosystem building
Enabling an innovation and collaboration platform, forging a European network of DIHs, contributing to industrial skills catalogue and observatory

Large scale piloting
Contributing to a digital maturity model, creating a set of assessment methods and a migration journey benchmarking tool

Standardisation
Conducting cross-domain surveys, performing promotion and implementation, building alliances with existing EU and standard developing organisations

OPENDEI

Indirect participation through white paper editing task force (VTT, 1001 Lakes) and analysed use cases (health and energy).

👉 **https://www.opendei.eu/**

Sitra – Fair Data Economy

Regulation

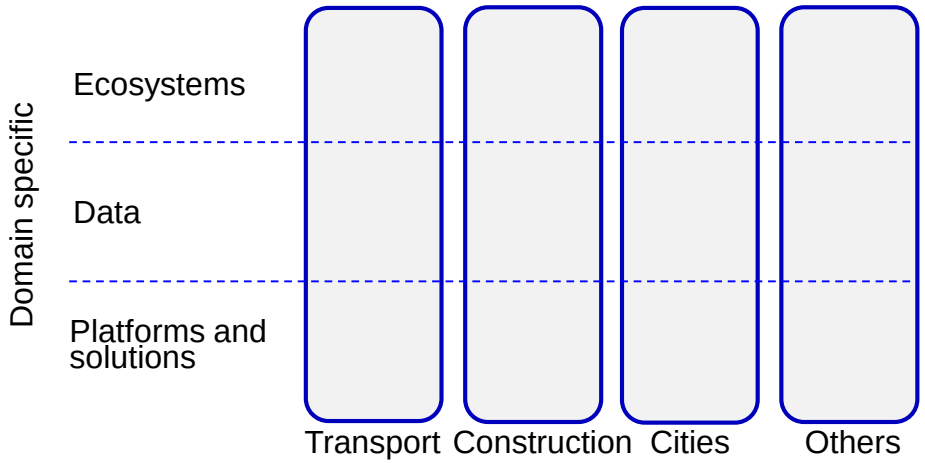
Active contributor and commentor to national and European data-related regulation.

Frameworks and standardization

The **IHAN blueprint** includes the descriptions of the principles and components of IHAN's functional architecture as well as guidelines for building fair data economy services with the aid of existing technology

Generic building blocks

The programme has built the **IHAN testbed** as an environment for testing data sharing projects.
Fair Data Economy Rulebook model helps organizations to agree on business, legal, technical and ethical rules for data sharing.



Key facts

- Sitra's IHAN® project (2018-2021), has had its focus on fair data economy, in which successful digital services are based on trust and create value for everyone.
- Sitra continues the focus on Data Economy and has promoted it to be one of Sitra's main themes alongside with circular economy and renewing democracy.
- Emphasizes that a fair digital transition is one of Europe's most important facilitator of sustainable growth and competitiveness.

Main arguments:

- The fair data economy will benefit everyone.
- Data will be shared more freely between different parties.
- Trust in service providers will encourage individuals to share their data when the sharing is based on their consent.
- People will obtain access to more targeted services that improve their well-being and daily lives.
- Companies of all sizes will achieve growth through innovation and well-being will increase.

"The data economy should be fair for all stakeholders: the society as a whole, private companies, the public sector and, last but not least, the citizens." Jyrki Katainen, the President of Sitra

Data Sovereignty Now

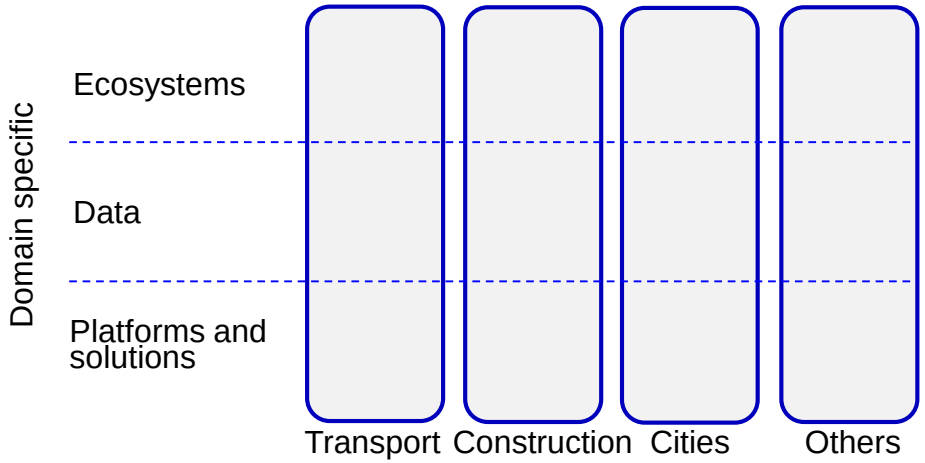
Regulation

Proposes that the European Commission should take a decisive step forwards by making Data Sovereignty a legal prerequisite for every data initiative in Europe.

Frameworks and standardization

Influences frameworks and standardization by promoting data sovereignty as one of the central design principles for data spaces.

Generic building blocks



Key facts

- Coalition of partners who believe that Data Sovereignty should become the guiding principle in the development of national and European data sharing legislation
- Initiated by Innopay (NL).
- Data Sovereignty the central design principle of the data economy as a whole and a prerequisite for every organisation's own data architecture.

The benefits of data sovereignty

- People can easily switch providers, and enable their data to be commercialised by businesses
- Businesses can trade more easily, securely and cost-effectively with other businesses
- All parties holding data can offer consistent functionalities and ways of working to their customers, suppliers and employees
- The free flow of data will increase, thereby stimulating more and faster commercial innovation to create new kinds of data-enabled business models that generate new services
- The dominance of the Big Tech giants will be reduced since customer data will no longer be 'locked in'.

Members

aNewGovernance · freedom lab · INNOPAY · International Data Spaces Association · iSHARE · Meeco · SITRA · The Chain Never Stops · TNO innovation for life

☞ https://datasovereigntynow.org/

Participation from Finland (Sitra, MyData Global)

"Data sovereignty is the right to self-determination over data."

Team Data Spaces

Regulation

Aims to become the **Data Spaces Support Center** planned to start in 2022, strong link EU-level Data Innovation Board to be expected

Frameworks and standardization

Team Data Spaces

Generic building blocks

Focuses on boosting and adoption of common building blocks

Domain specific

Ecosystems

Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- 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.

BDV · Capgemini invent · FIWARE Foundation · Fraunhofer · gaia-x · International Data Spaces Association · INNOPAY · Insight · KU LEUVEN · SITRA · TNO innovation for life · VTT

👉 https://dataspaces4.eu/

Strong participation from Finland (Sitra, VTT, MyData Global)

"Teaming Up to Support the European Data Strategy Is a Must."
Jaana Sinipuro, Sitra

MyData Global

Regulation

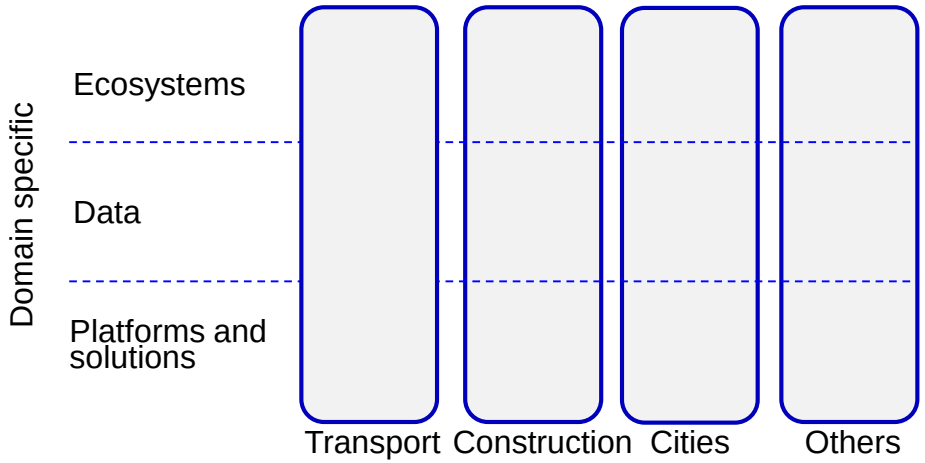
MyData aims to influence regulation, and has been active in promoting the human-centric view and the data intermediary model, for example in the context of the EU Data Governance Act.

Frameworks and standardization

MyData is both an alternative vision and guiding technical principles. It works together with other initiatives such as IDSA and Gaia-X focusing on aspects of personal data.

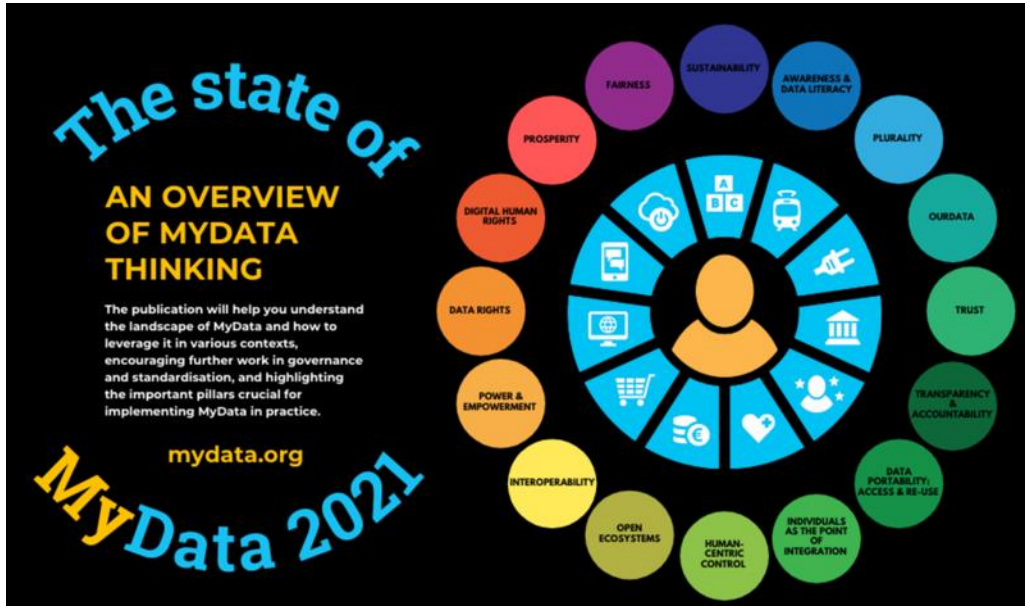
Generic building blocks

MyData Global has introduced the MyData Operator model for personal data management intermediaries, consisting of several envisioned building blocks, e.g. consent management and identity management.



Key facts

- MyData Global is an international non-profit headquartered in Helsinki.
- The purpose of MyData Global is to empower individuals by improving their right to self-determination regarding their personal data.
- MyData Global has over 100 organisation members and close to 400 individual members from over 40 countries, on six continents.
- The **human-centric paradigm** aims at a fair, sustainable, and prosperous digital society, where personal data sharing is based on trust as well as balanced and fair relationship between individuals and organisations.



👉 https://mydata.org/

”Data spaces can become a human-centric way to renew our e-identity infrastructure and to foster data sharing.” Antti ”Jogi” Poikola, Finnish Technology Industries

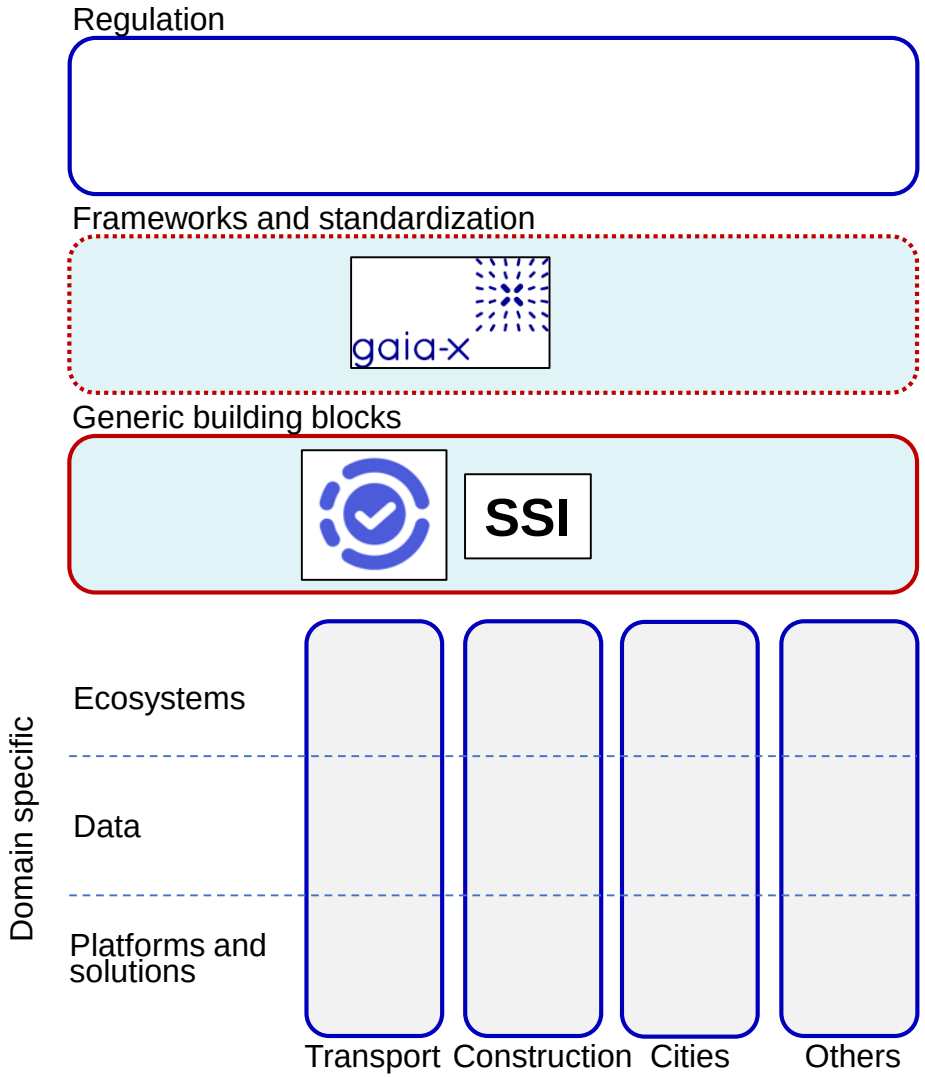
4. Soft Infrastructure

Building blocks for interoperability, trust, data value, governance

Soft Infrastructure Building Blocks

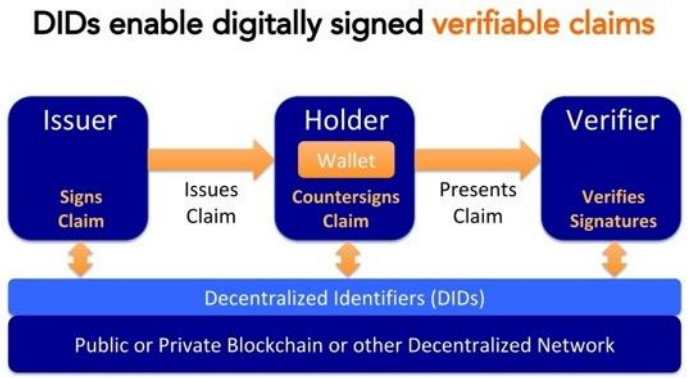
- Four categories of building blocks: **Interoperability, Trust, Data Value, Governance**
- Definition and standardization of building blocks need their **soft infrastructure governance** mechanisms.
- **Decentralised data flows and automated data transactions** building trust and efficiency in data exchange (e.g. data and API automation, smart contracts).
- For example: what does it mean for a building block to be Gaia-X or IDS compliant, and how is this certified?
- The list of individual 12 building blocks is **evolving**, and the building blocks are at **different levels of maturity**

Self-Sovereign Identity (SSI)



Key facts

- Self-sovereign identity (SSI) is a Decentralised Identity (DID) system for organizations, people, things.
- SSI allows individual or business to control their digital accounts and personal data.
- Individuals with self-sovereign identity can store their data to their devices and provide it for verification and transactions without the need to rely upon a central repository of data.
- **SSI can be seen as a fundamental building block for data spaces.**
- **Gaia-X architecture ios built on the wiode use of SSI.**



TRUST Over IP FOUNDATION
https://trustoverip.org/

iDunion
https://idunion.org/

Findy
https://findy.fi/

IDS Reference Architecture Model

Regulation

Frameworks and standardization

There are several efforts for IDS-based standardization – e.g. on European level at CEN and international level at ISO – and IDS use in public tenders. IDSA has a certification process for solutions that fulfill the IDS RAM requirements.

Generic building blocks

Data connectors, identity and access management, data usage control.

Domain specific

Ecosystems

Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- IDS Reference Architecture Model (IDS RAM 3.0) a blueprint for the European Data Spaces
- The IDS-RAM offers organizations all over the world the power to develop and utilize vendor-independent data ecosystems and marketplaces, open to all, at low cost and with low entry barriers. And all these systems can connect with one another across industries and technologies via IDS.

👉https://internationaldataspaces.org/use/reference-architecture/

Gaia-X Federation Services

Regulation

Frameworks and standardization

gaia-x

Generic building blocks

SSI based identity management, verifiable credentials, data contract services, service catalogue

Domain specific

Ecosystems

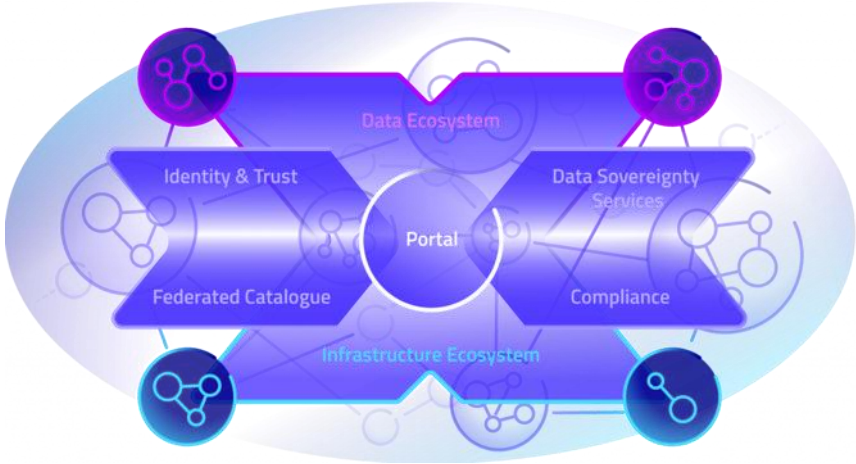
Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- The Gaia-X Federation Services represent the minimum technical requirements and services necessary to operate the federated Gaia-X ecosystem of infrastructure and data.



Identity and Trust covers authentication and authorization, credential management and decentral identity management.
Federated Catalogue constitutes the central repository for Gaia-X Self-Descriptions to enable the discovery and selection of Providers and their Service Offerings.
Data Sovereignty Services enable the trustful and sovereign data exchange of Gaia-X Participants utilizing mechanisms such as Usage Control.
Compliance ensures a Participant's adherence to Gaia-X principles in cybersecurity, data protection transparency and interoperability during onboarding and the delivery of Services.

☞ https://www.gxfs.de/

Fair Data Economy Rulebook

Regulation

Frameworks and standardization

Fair Data Economy Rulebook model has been refereed to in IDSA Rulebook as an option to define and agree on rules for the IDS-compliant data space instances.

Generic building blocks

Gereric model for governing data space instances. The template is domain independent and can be used by any data ecosystem..

Domain specific

Ecosystems

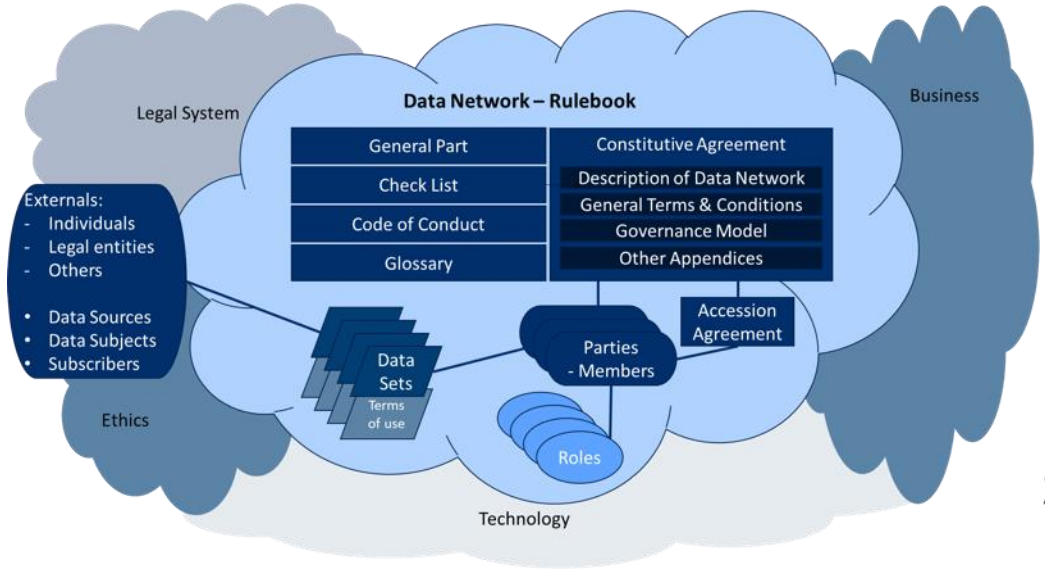
Data

Platforms and solutions

Transport Construction Cities Others

Key facts

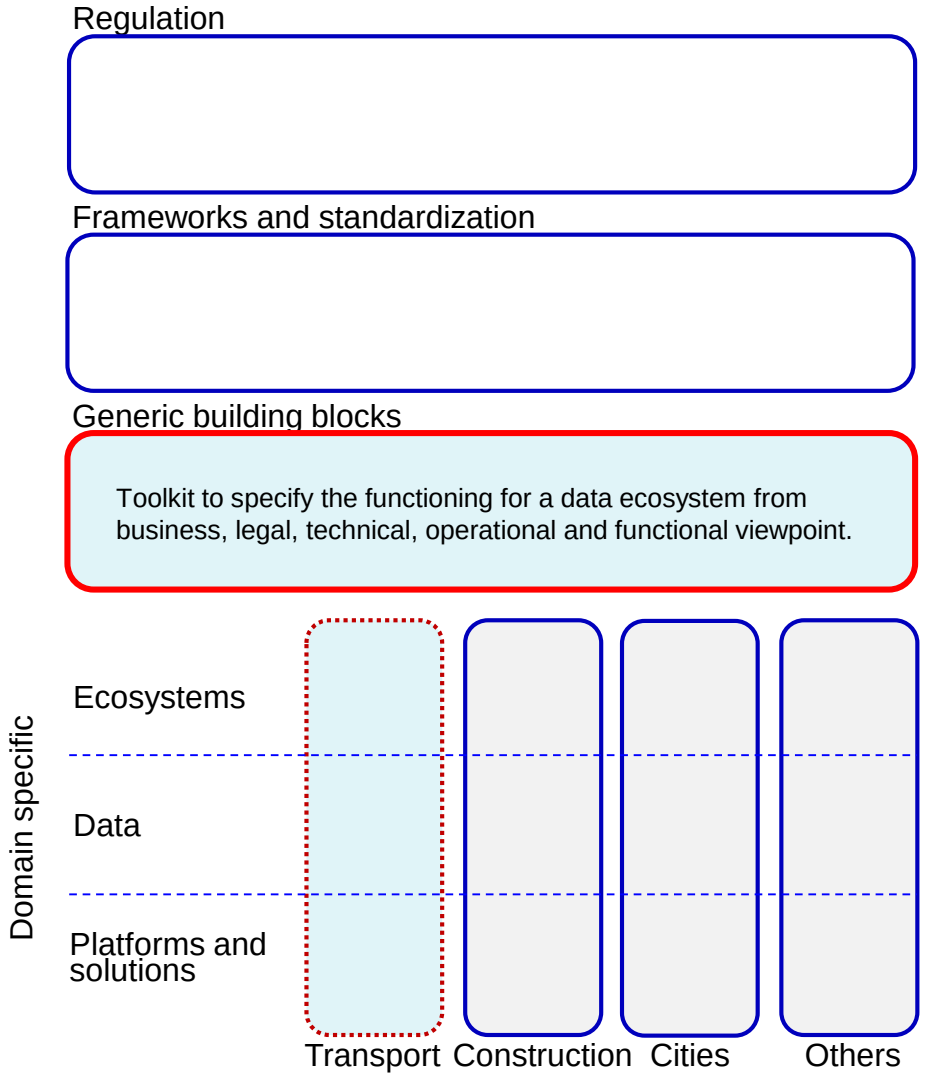
- Designed to guide forming of trust-based data sharing networks with a common mission, vision and values.
- Diverse workgroup of 30+ volunteers as authors – Sitra (initiator), industry, academia, authorities
- Rulebook template includes: checklists that cover business, technology, data, legal and ethical dimensions, data ecosystem design tools, contractual framework.
- Recommended to be used as a template for IDS use cases in IDSA Rule Book 1.0.



SITRA

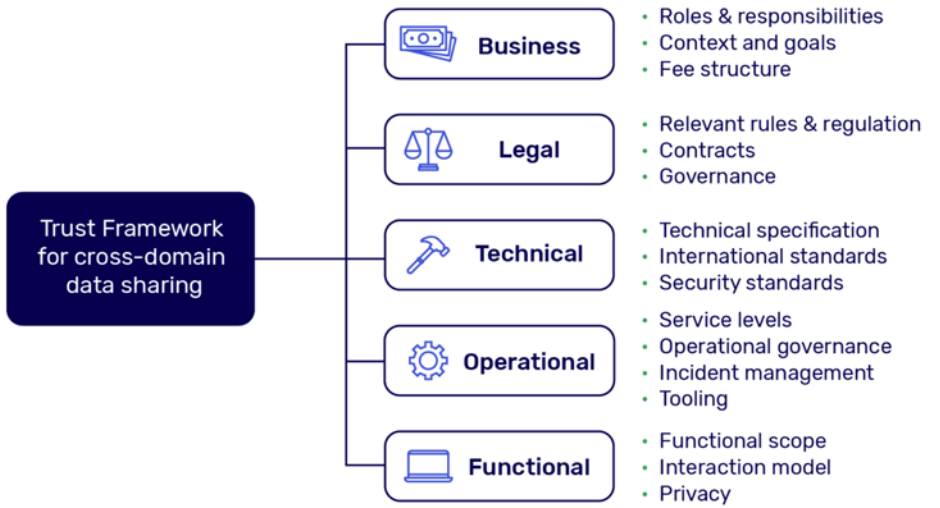
https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/

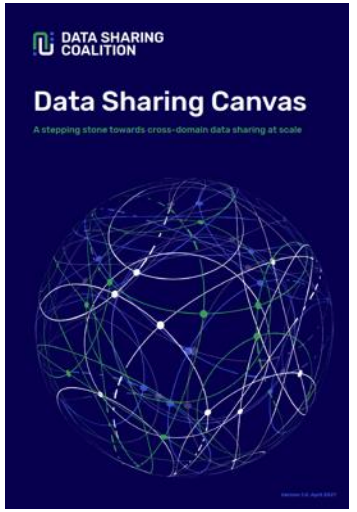
Data Sharing Canvas



Key facts

- Data Sharing Canvas is a generic toolset that helps in defining harmonised agreements for data sharing at scale
- Can be applied for any type of data space instance.
- Initiated by the Data Sharing Coalition based in The Netherlands.





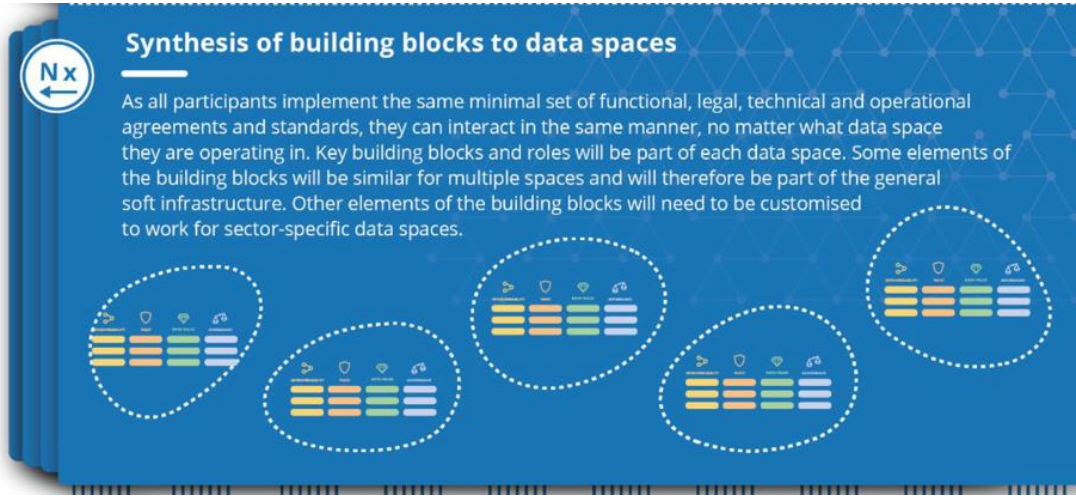
👉 https://datasharingcoalition.eu/

5. Data Spaces as Commons

Common governance structures
Domain-specific requirements and resources

Governance for Data Spaces as Commons

- Provide guidelines on how to implement **common data spaces governance**
- Definition of **the governance for data spaces interoperability** (inter-data spaces governance)
- **Cross-sectoral data availability by** combining horizontal regulatory approach with scalable sector-specific specifications.
- **Access to data of public interest** for critical use purposes by setting obligations and requirements for data holders.
- A minimum viable set of **metadata** is needed to increase findability and structured data for machine readability.
- For some domains we need a data governance that work at **domain-specific** level such as the European health data spaces governance.



European Data Innovation Board & Data Innovation Advisory Council

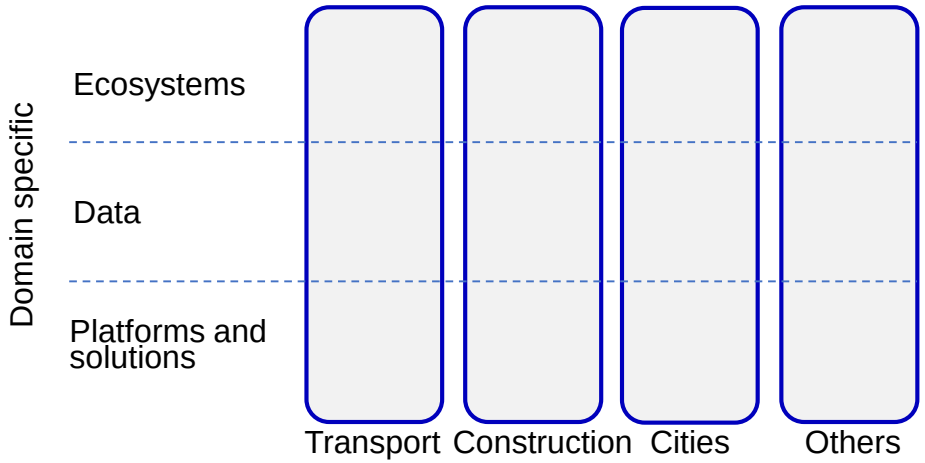
Regulation

Planned to be initiated s part of the DGA, the role of these bodies is primarily to oversee that the regulation is implemented as intended and giving guidance also to national authorities regarding interpretattion of the data related regulation.

Frameworks and standardization

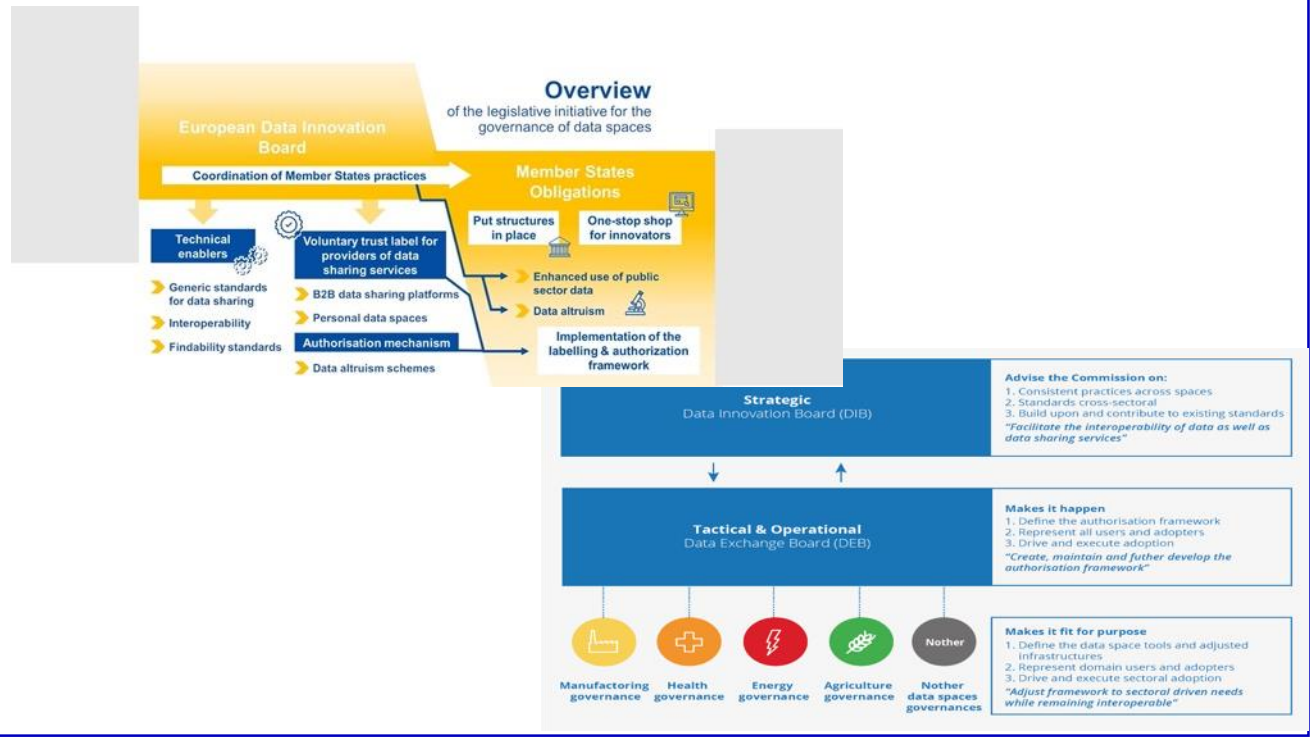
Board will work towards increasing interoperability and creating common standards to avoid the fragmentation of the internal market, as well as fostering the creation of Common European Data Spaces

Generic building blocks



Key facts

- Data Governance Act (DGA) aims to establish the **European Data Innovation Board** to oversee implementation of data regulation.
- EU Parliament has proposed establishment of the **Data Innovation Advisory Council (DAIC)**, as a subgroup of the board.
- The proposal to establish DAIC was inspired by the Data Exchange Board proposal by the Data Sovereignty Now! Initiative, and presented in the OPEN DEI White Paper as below.



TEHDAS - European Health Data Space

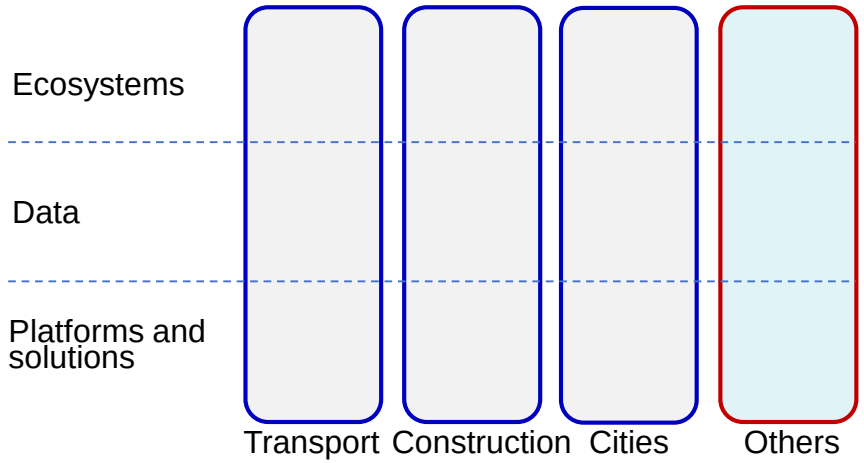
Regulation

Project has a strong focus on existing and future regulation, and especially the secondary use of health data.

Frameworks and standardization

The project is defining the domain-specific needs for data spaces from the viewpoint of health sector.

Generic building blocks



TEHDAS

Towards European Health Data Space

Coordination by SITRA

What is our goal?
Our goal is that in the future European citizens, communities and companies will benefit from secure and seamless access to health data regardless of where it is stored.

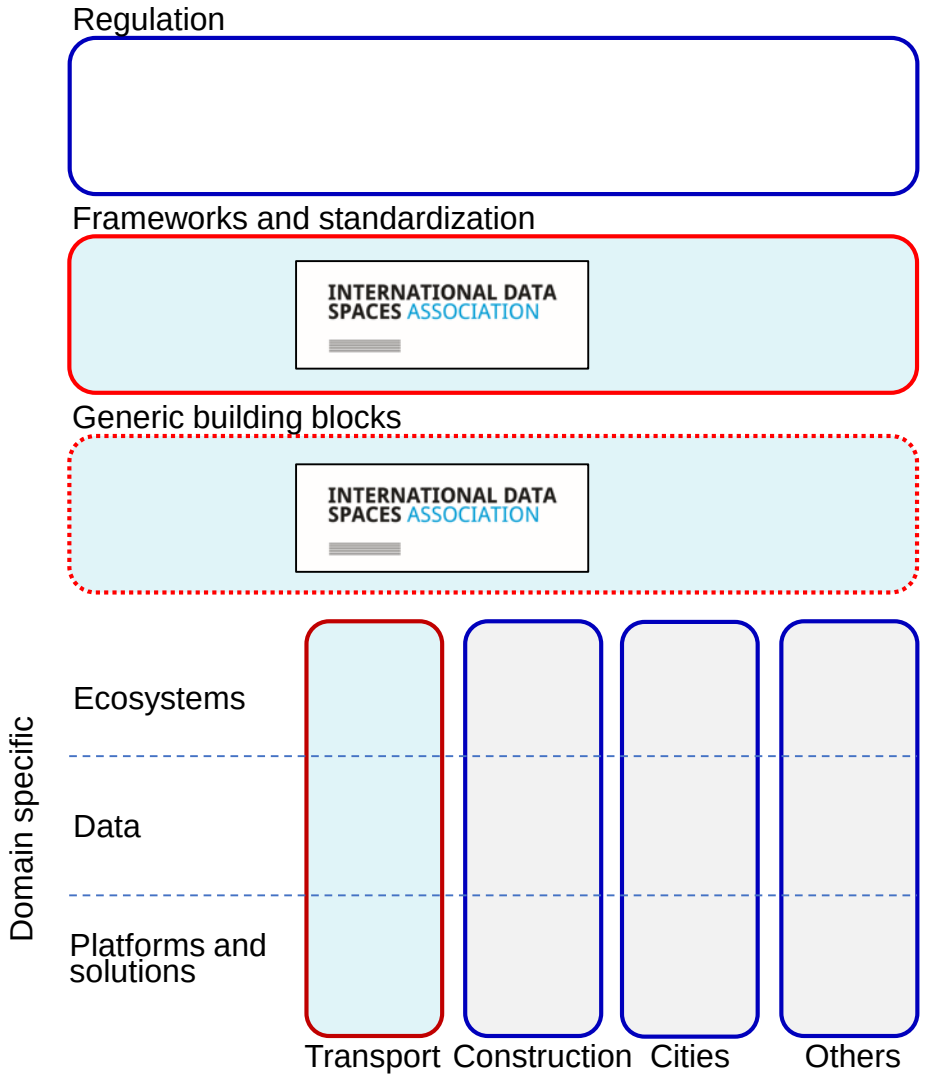
What are we doing?
TEHDAS supports the European Commission in building a European Health Data Space by developing principles for the cross-border secondary use of health data. The data space will form the legal bases for data use. The secondary use of health data means using health data for purposes other than the primary reason for which they were originally collected.

What are the benefits?
The benefits include providing better healthcare services and personalised care for people, advancing innovations such as developing new medicines and boosting knowledge-based policy-making.

Who is involved?
The project is being carried out by 25 European countries. Stakeholders across Europe are invited to provide input to the work.

”In order to make informed decisions on preventive and protective measures, we need high-quality, timely and interoperable health data.” Jyrki Katainen, the President of Sitra

Mobility Data Space



Key facts

- Originally German initiative funded by acatech and BMWi
- Broad participation from public and private sector
- Different forms of mobility involved
- Aims to be a role model for European Mobility Data Space

Participants: Municipalities, Deutscher Wetterdienst, Deutsche Telekom, Fraunhofer, HERE, Door2Door, Schenker, DHL, GDV, Deutsche Bahn, Bosch, Continental, BMW, Volkswagen, Daimler, ZF, Kühne + Nagel, etc.

☞ **https://mobility-dataspace.eu/**

"Mobility Data Space is a unique demonstration of how IDS-compliant data sharing across varied markets and sectors can translate into real value for customers." Lars Nagel, CEO, IDSA

iSHARE

Regulation

Frameworks and standardization

iSHARE is an example of a more general Dutch concept ”afsprakenstelsel” or ”trust scheme”. iSHARE also provides well-designed governance model to safeguard supervision and quality of data exchange.

Generic building blocks

iSHARE was originally separate from IDS. but is currently positioned to be compliant with IDS reference model.

INTERNATIONAL DATA SPACES ASSOCIATION

Domain specific

Ecosystems

Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- Initially logistics-focused initiative originating from the Netherlands.
- iSHARE is a coherent model (”Trust Scheme”) of functional, technical and legal agreements and standards that are used within the Dutch transport and logistics sector to exchange data.
- The core of the model consists of agreements and standards focusing on identification, authentication and authorization, which are intended to standardize and thus to significantly facilitate the exchange of data between organizations.
- Compliance of the model is ensured and its continuous development achieved by the independent iSHARE Foundation that was specifically established for this purpose.

https://www.ishareworks.org/

”iSHARE scheme includes Functional, Technical, Legal, and Operational agreements, co-created by the sector itself. Because all parties adhere to the same agreements, signing a contract with the iSHARE Foundation, iSHARE significantly lowers barriers to new data sharing relationships.” Mariane ter Veen, Innopay

Nordic Smart Government

Regulation

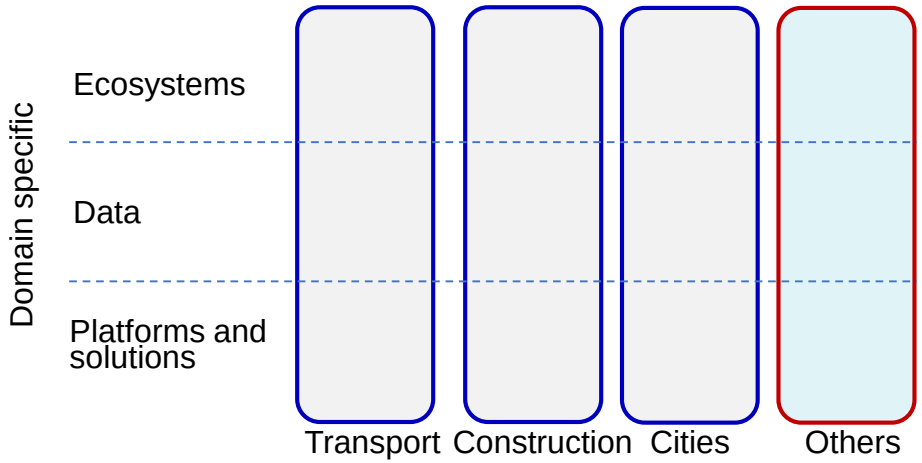
Countries may need legal amendments towards the vision of NSG. E.g. increase digital business document adoption, because of a lack of other incentives.

Frameworks and standardization

Strong support for standardized solutions.

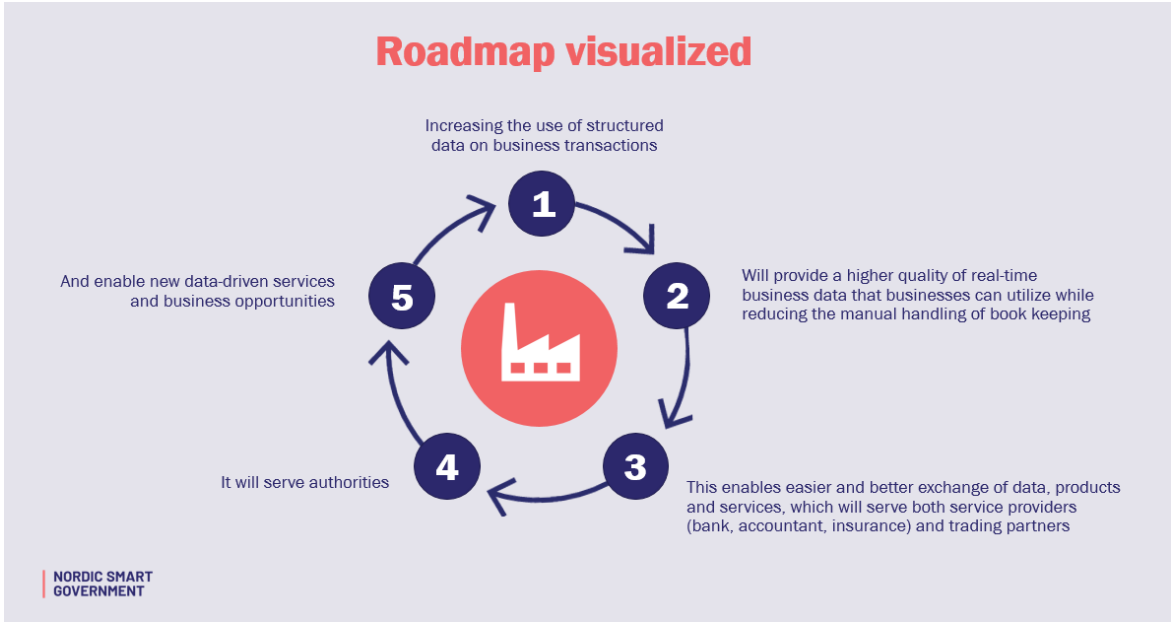
Generic building blocks

Emphasizes that the development of solution building blocks must be coordinated.



Key facts

- Nordic Smart Government is a collaboration between a number of Nordic organisations, and many more organisations, public and private, are expected to join.
- Real-time economy
- Create value for the SMEs by making real time business data accessible and usable for innovation and growth across the region, in an automatic, consent based and secure manner



👉https://nordicsmartgovernment.org/

Sector-specific metadata: standards, data models and formats (examples)

Domain Data Standard	Provides the syntax and semantics for data exchange and data sharing on different levels	In manufacturing data spaces, a combination of different standards is used to describe the syntax and semantics of data transactions (e.g. ISO 10303, Asset Administration Shell, eCl@ss).
Data Models and Formats	Facilitates a common format for data model specifications and representation of data	The Smart Agrifood domain needs a common representation of agronomic data (e.g. crops, senso data from the field, multispectral imagery from UAVs, geolocation data, fertilisation logs, ...). This common data model shall be used for all data exchanged between software components.

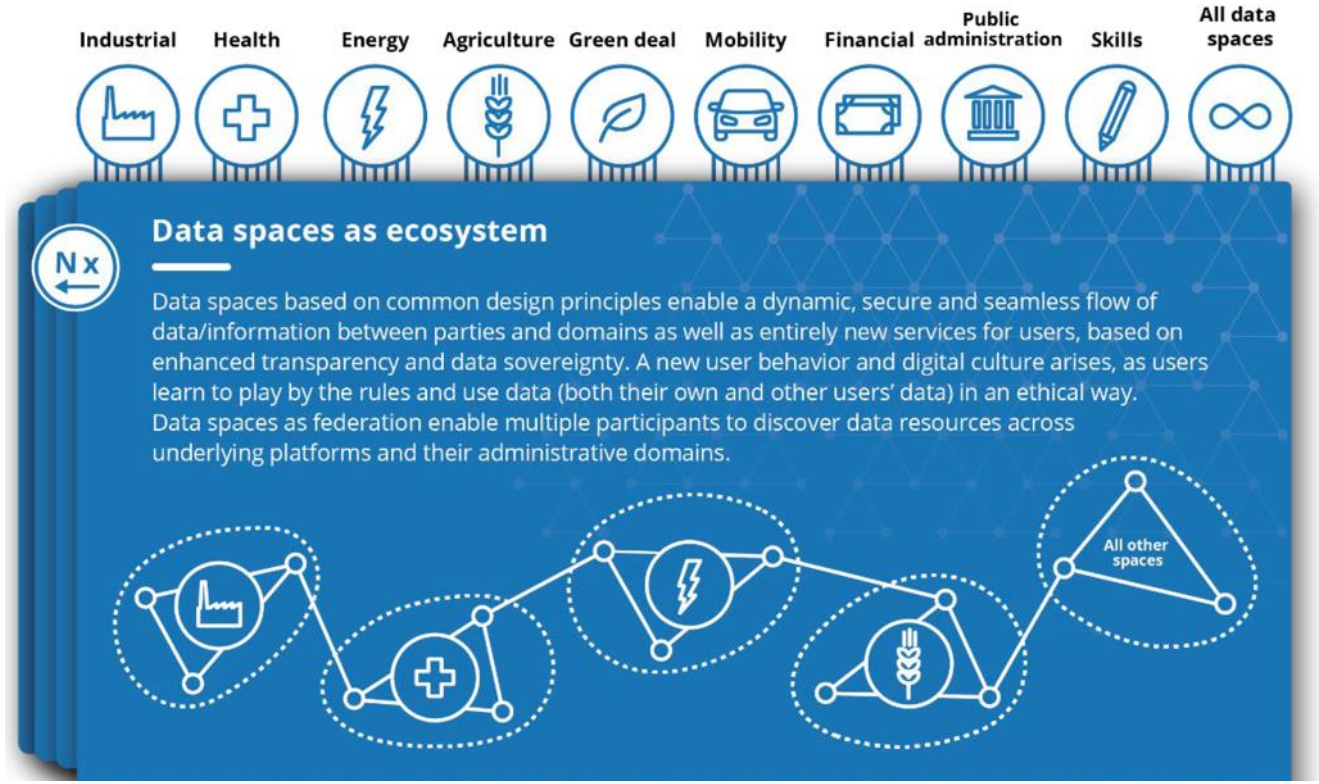
OPENDEI

6. Data Spaces as Ecosystems

Data space instances, use cases, cross-domain examples

Governance for Data Spaces as Ecosystems

- Governance for **data space instances.**
- **Ecosystems data governance (industrial ecosystems such as Catena-X).**
- Public-private data governance (example **MyData for Cities).**
- **Data marketplace** governance.
- Implementation of **cross-domain** data governance principles.
- **Data portability by strengthening individual's rights** to re-purpose data and efficient data transfers between systems and services for business users.



Catena-X

Regulation

Frameworks and standardization

gaia-x

Generic building blocks

INTERNATIONAL DATA SPACES ASSOCIATION

gaia-x

Domain specific

Ecosystems

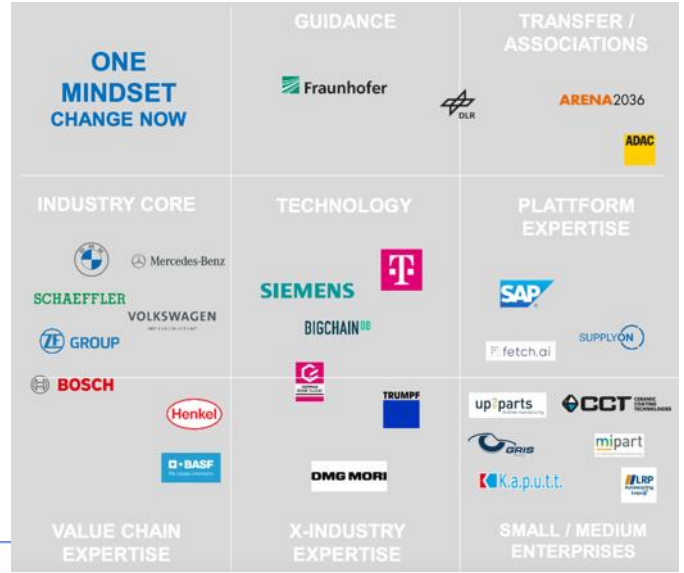
Data

Platforms and solutions

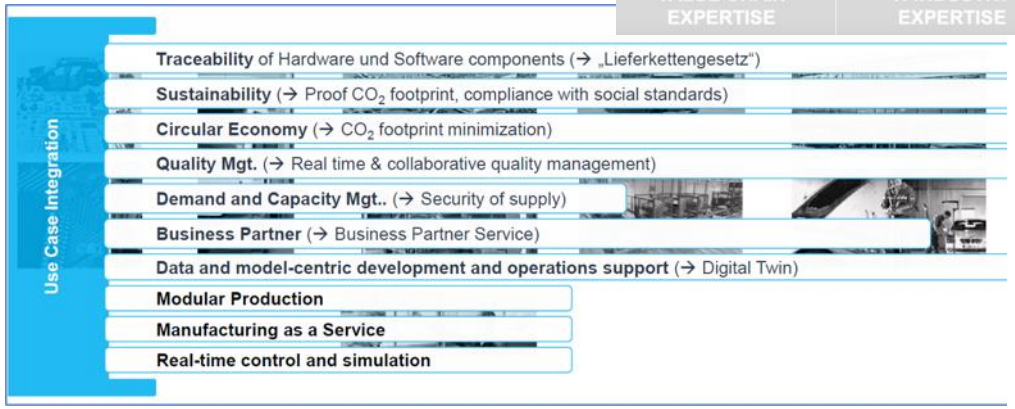
Transport | Construction | Cities | Others

Key facts

- **Catena-X** is positioned to be the leading data space initiative for the automotive sector.
- Establishment & use of the first “data driven value chain” for the automotive industry → from intra- to inter-company.
- **Goal:** A uniform standard for continuous data exchange along the entire automotive value chain
- **Breakthrough target**: 1000 Catena-X member organizations in 2022



Use cases



👉https://catena-x.net/en/

“With Catena-X, the automotive industry is taking another big step in its digital transformation. The aim is to achieve secure data transfer between companies to enhance efficiency, transparency and sustainability along the entire value chain. The integration of SMEs also strengthens innovative power and digitalization of our industry. Together we have the chance to take a leading position in technology and innovation for Germany and Europe. And that’s exactly what we do now.”
Ola Källenius - Chairman of the Board of Management of Daimler AG and Mercedes-Benz AG

SICK - Logistics Chain Collaboration

Regulation

Frameworks and standardization

SICK is one of the founding members of IDSA and has strongly promoted the data space approach for supply chain logistics.

INTERNATIONAL DATA SPACES ASSOCIATION

Generic building blocks

Domain specific

Ecosystems

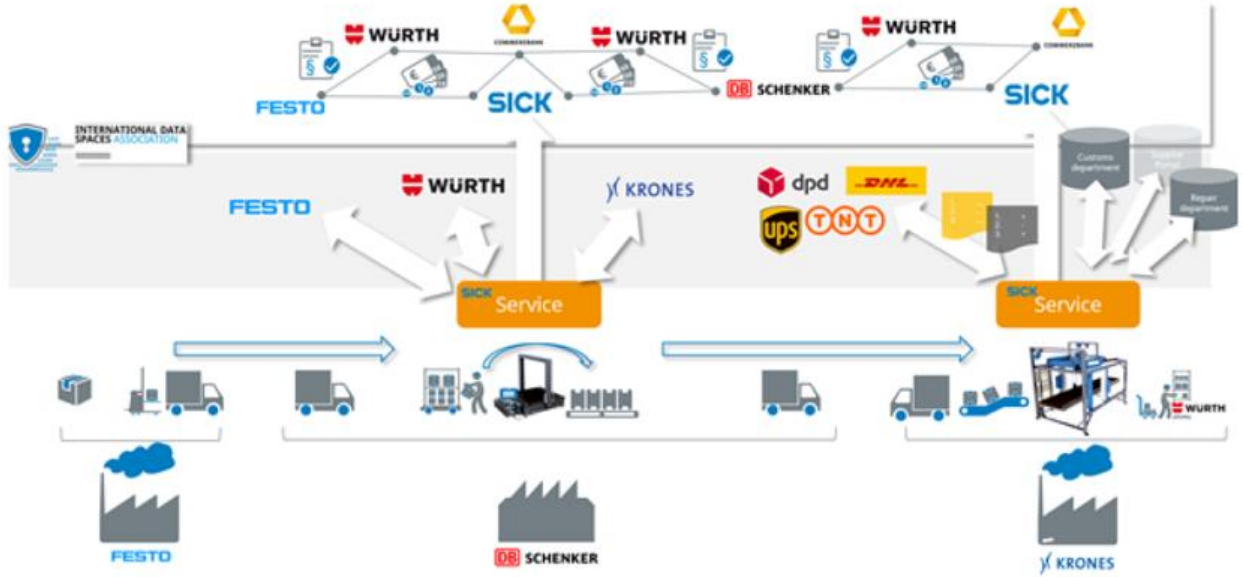
Data

Platforms and solutions

Transport | Construction | Cities | Others

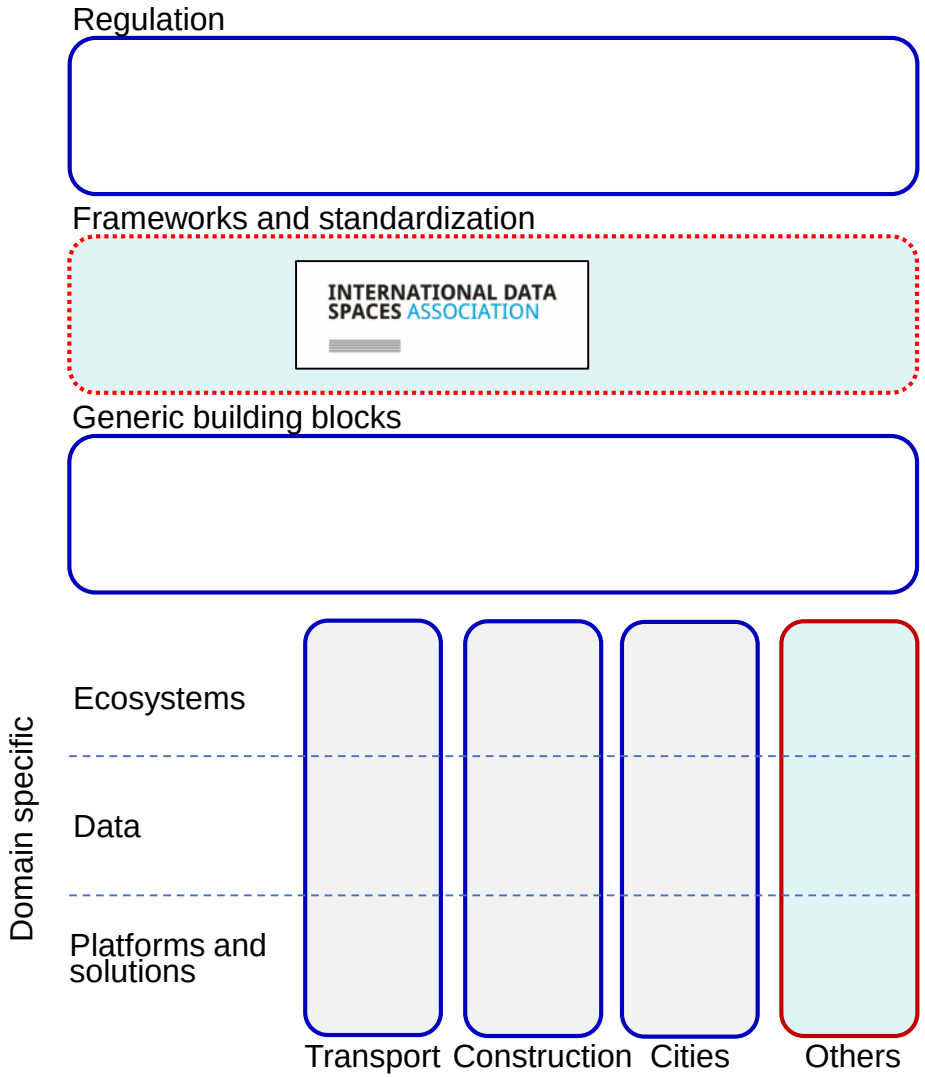
Key facts

- Packing and logistics system that automatically keeps track all the materials moved by in the entire supply chain.
- Material flows and intralogistics processes must be optimally coordinated with each other at all times.
- Each shipped items location and current status is tracked and shared with the concerned participants of the supply chain.
- Fully transparent supply line.



https://www.sick.com/se/en/logistics-gets-smart-greater-efficiency-in-the-entire-supply-chain-/w/smart-logistics/

Smart Connected Supplier Network (SCSN)



Key facts

- Manufacturing companies joining forces in managing complex multi-tiered supply chains.
- SCSN is a communication standard enabling the machine building industry to share data across company borders in an easier, safer, and more reliable way
- Connect once, communicate with the entire supply chain.
- SCSN works for the OEM, 1st, 2nd and 3rd suppliers, wholesalers and steel producers and works with most available ERP software.
- Manufacturing companies in control over their own data all the time.

How does it work?

Service Providers:
- Digital platforms, interconnected using IDS
- Independent 'address book' for routing communication
- Several providers. Choose the most suitable for your business

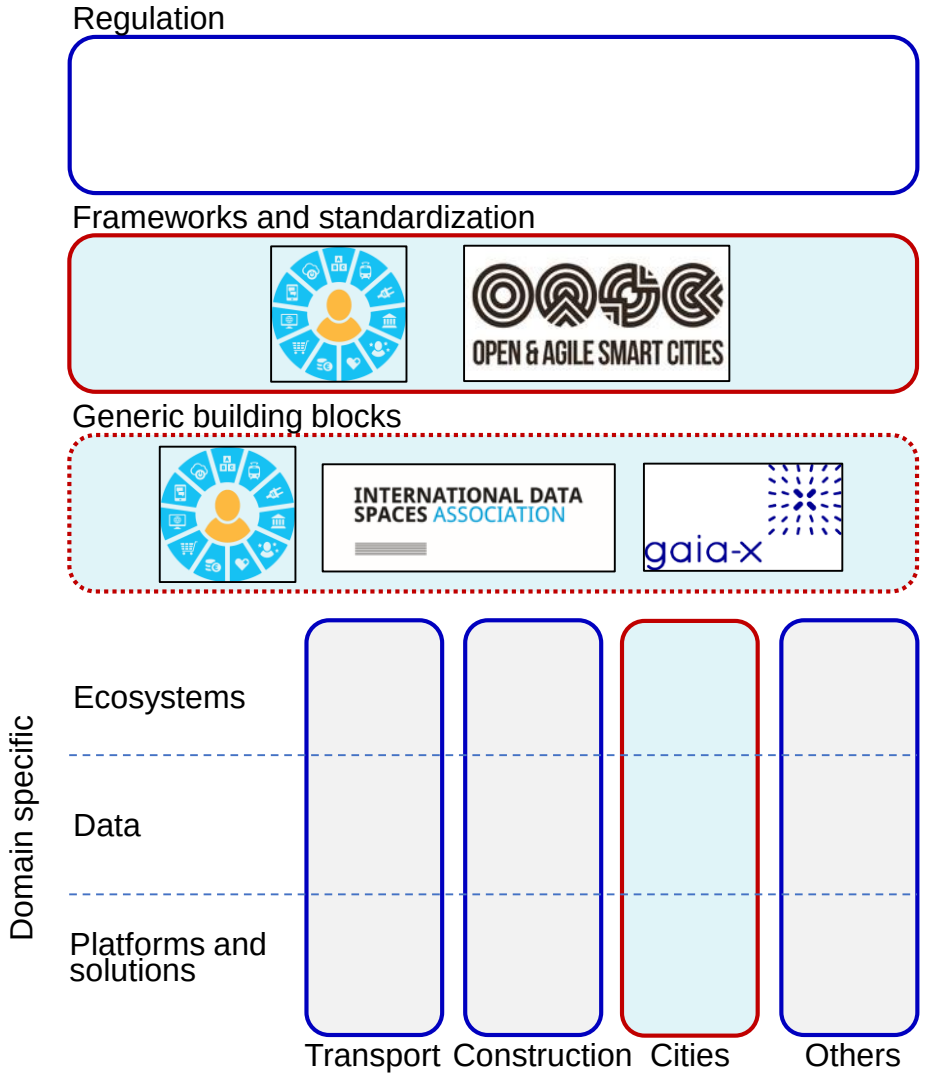
Manufacturing companies:
- One-time integration with own ERP system
- Registration in the SCSN address book

ERP systems:
- A manufacturing company can choose their preferred ERP system.

👉 https://smart-connected.nl/

"Smart Connected Supplier Network increases productivity in the supply chain. The SCSN is one of the most promising use cases based on IDS components.." -- Matthijs Punter, TNO

MyData for Cities



MyData for Cities Model

- Global model for **personal data management** for cities and their service ecosystems
- **MyData Operator functionalities:** consent management, personal data wallet, secure data connectors, …
- **MyData for Cities Rulebook**
- MIM4 Open and Agile Smart Cities (OASC) specification
- IDS connectivity planned

Example use cases

- Driving permission authorization
- Automated benefits
- CO2-based reduced parking fees
- Employment services
- Asset check for city-owned rental apartments
- Multi-modal mobility services across cities (MaaS roaming)

City of Helsinki

vastuu group

mydata share

OULU

TURKU

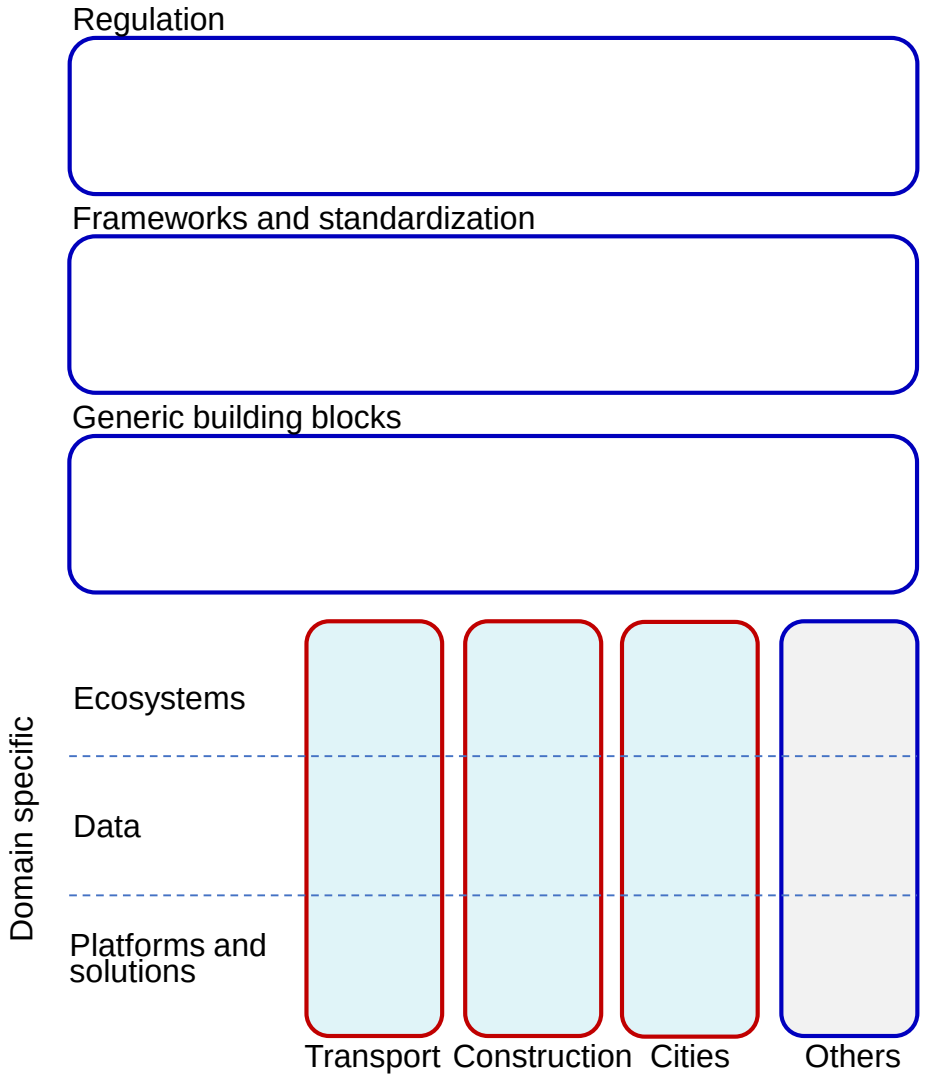
ESPOO ESBO

10 01 LAKES

OPEN & AGILE SMART CITIES

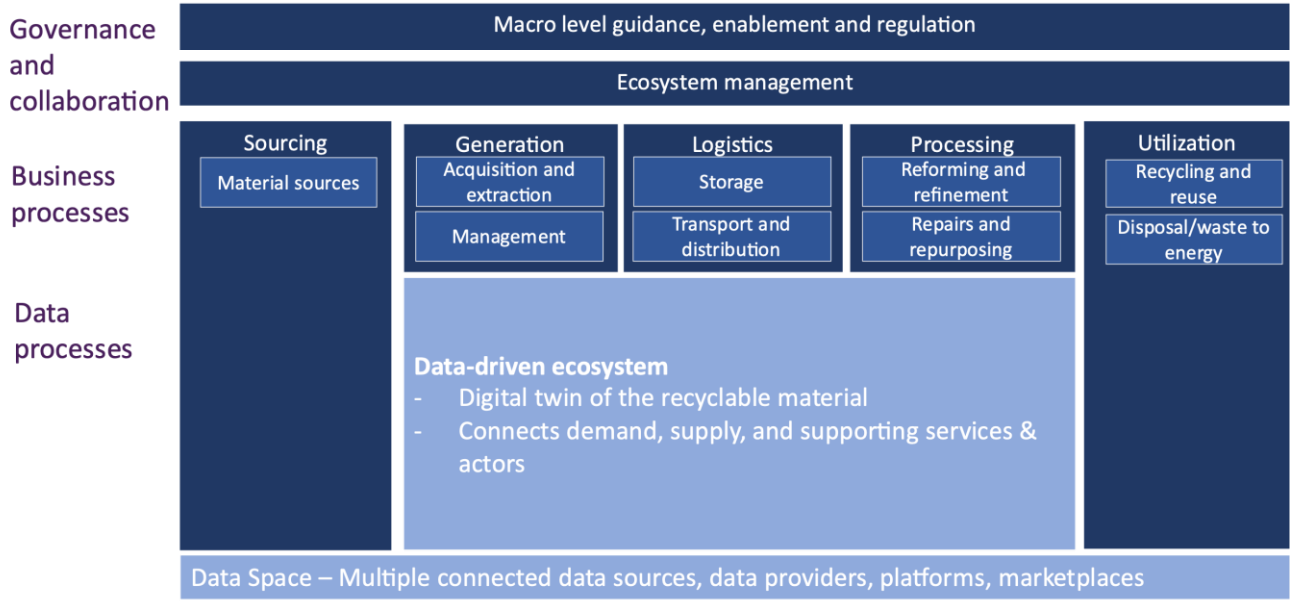
”Almost all data sharing use cases can be traced back to individuals, and so personal data may be involved.” Mika Huhtamäki, Vastuu Group

Circular Economy Data Space and Ecosystem



Key facts

- Circular ecosystem for construction and demolition sector
- Improves utilization rate of recyclable materials
- Improves collaboration and value creation within circular ecosystem
- Enables value creation also for other platforms and market places



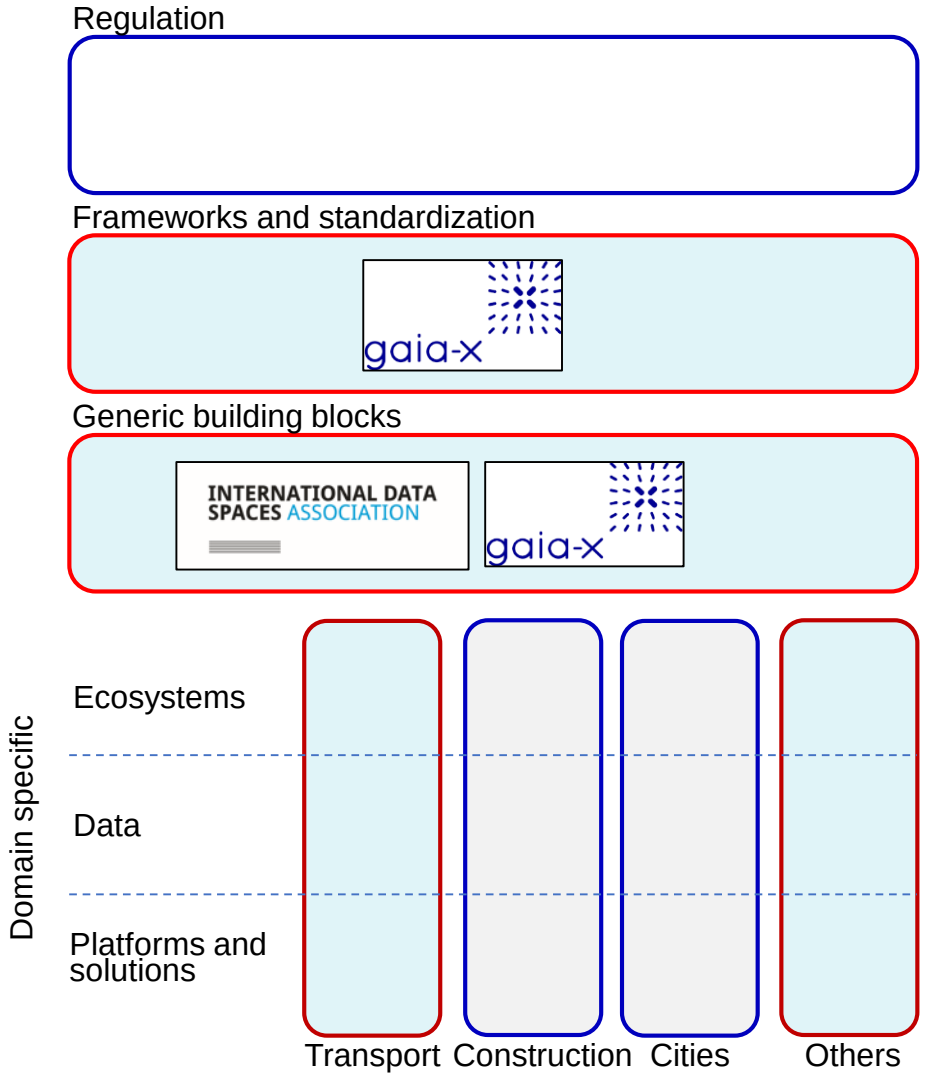
Construction and waste management industries

TAMPERE. FINLAND

City of Helsinki

Motiva Services

AgriFood Data Space Finland

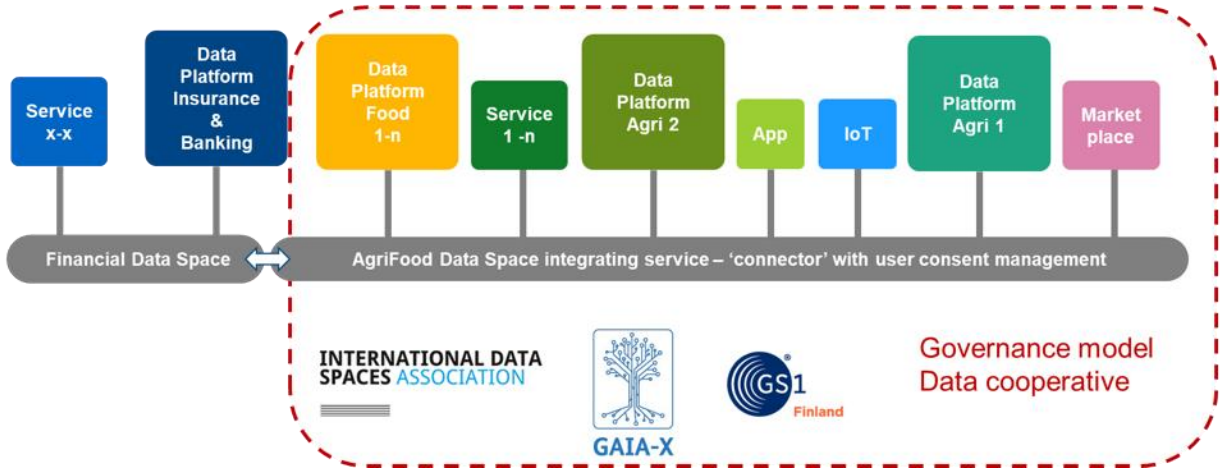


Key facts

- Finnish initiative covering broadly the AgriFood sector
- Example use case in Gaia-X Agriculture domain working group
- Connected to possible agriculture growth engine (BF)
- Core actors: Luke, Cinia, GS1, MTK, Pellervo, 1001 Lakes, …

AgriFood Data Space

Connecting platforms, services, data storages, apps, IoT systems and sensors to a data space where data connections are easy and cost-efficient to establish data flows – also for cross-sectoral data flows.



Metsään.fi

Regulation

Frameworks and standardization

Generic building blocks

Domain specific

Ecosystems

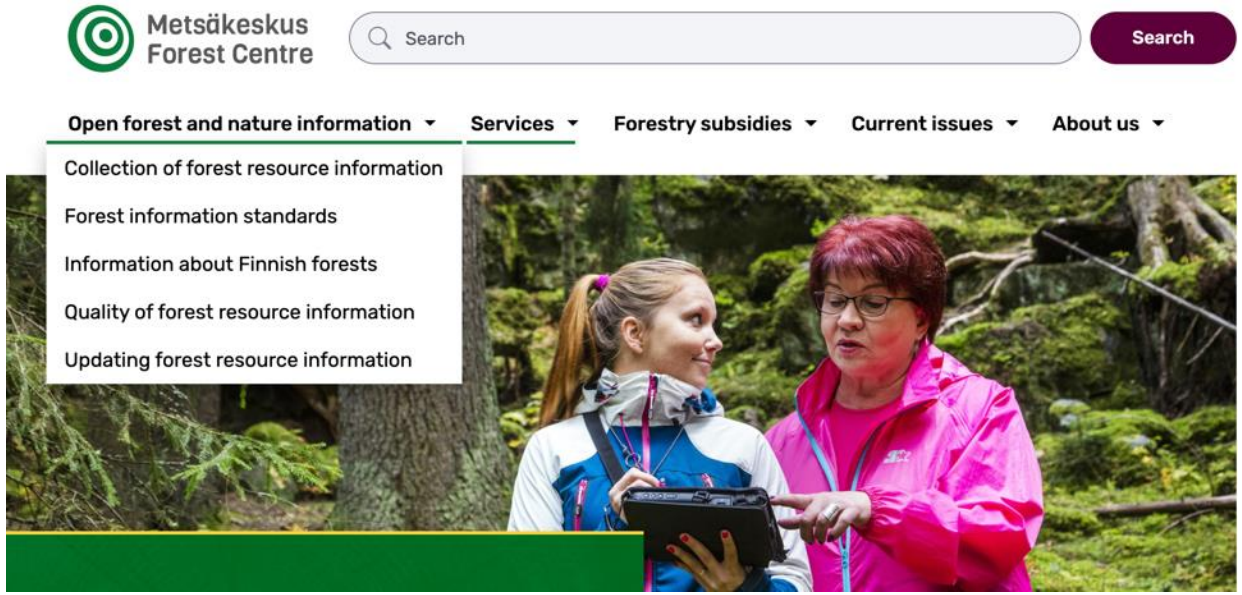
Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- Forestry market data sharing allows for better estimation of value of assets for public sector, market makers and forest owners,
- The use case of shared forestry market data arised from the needs of forest owners, and was brought to life by a small real estate broker SME specializing in forest ownership.



👉 https://metsään.fi/

”Data space innovations may arise from surprising sources and most added value can be found from unexpected combinations.” -- Jyrki Suokas, Taival Advisory

Rokkiparkki

Regulation

Frameworks and standardization

Generic building blocks

Domain specific

Ecosystems

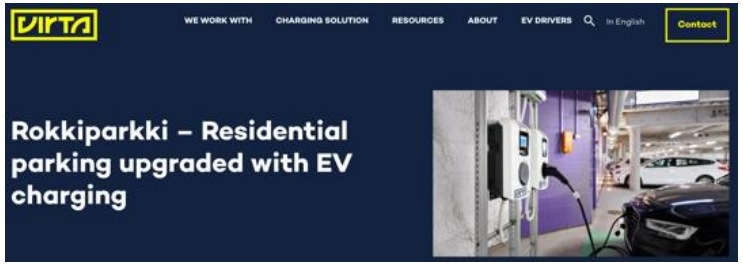
Data

Platforms and solutions

Transport Construction Cities Others

Key facts

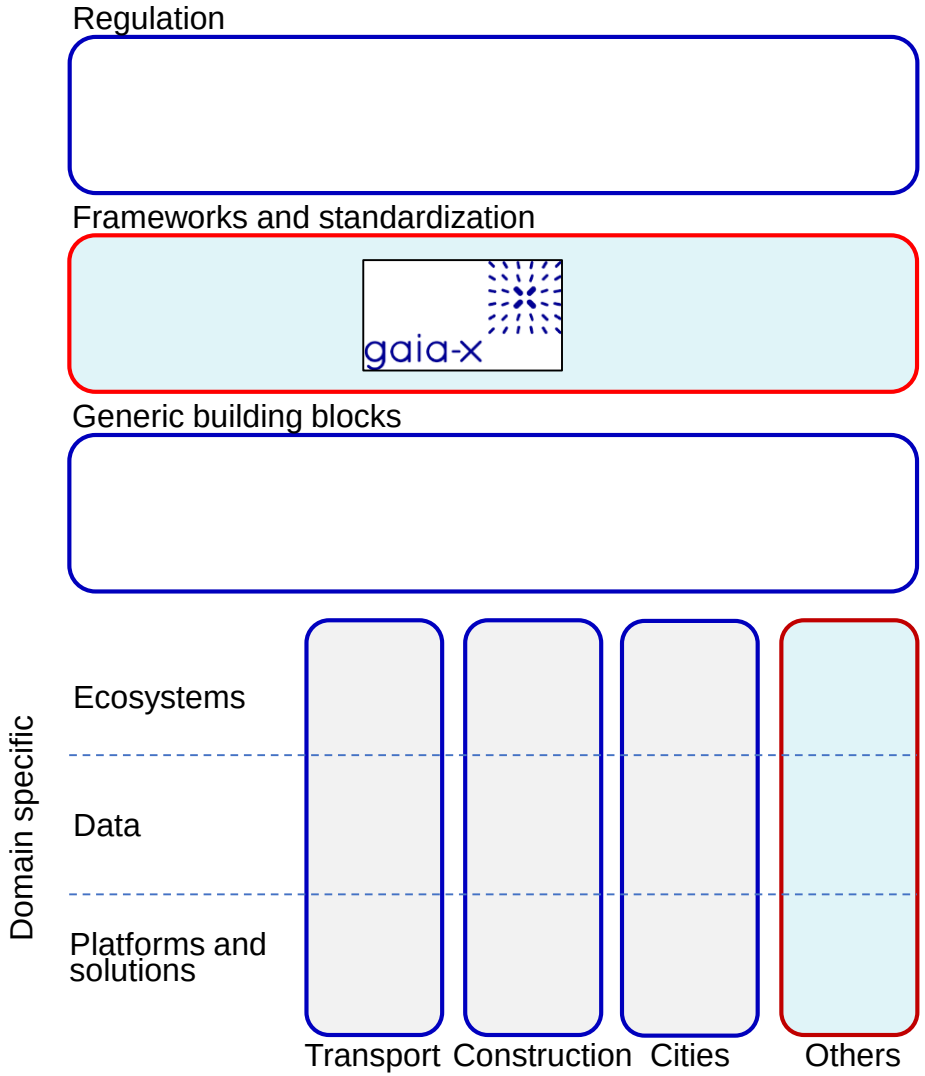
- Rokkiparkki is a non-profit parking garage in Jätkäsaari, Helsinki. Rokkiparkki has invested in electric car charging services. Rokkiparkki needed a service that meets the demand for faster charging by residents and fits into parking operator's cost model, where residents themselves pay the costs of charging their cars based on the actual cost of electricity.
- Virta is a company specialised in cloud-connected high-capacity electric charging service provider.
- The participants have aimed at conditioned and consented data sharing of residents' electric charging data between the electricity company, residents' associations, car manufacturers, electric car rental companies, Virta and parking operator in accordance with the MyData principles.



https://rokkiparkki.fi/

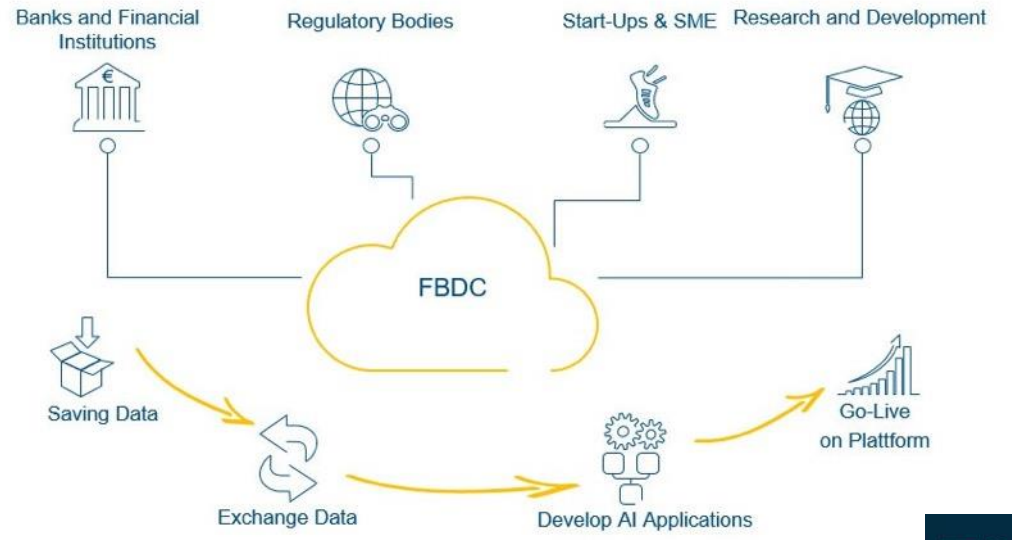
"By providing a more dynamic and interoperable physical and soft infrastructure, we can create more and better services in the local ecosystem." -- Pekka Koponen, Forum Virium Helsinki

Financial Big Data Cluster



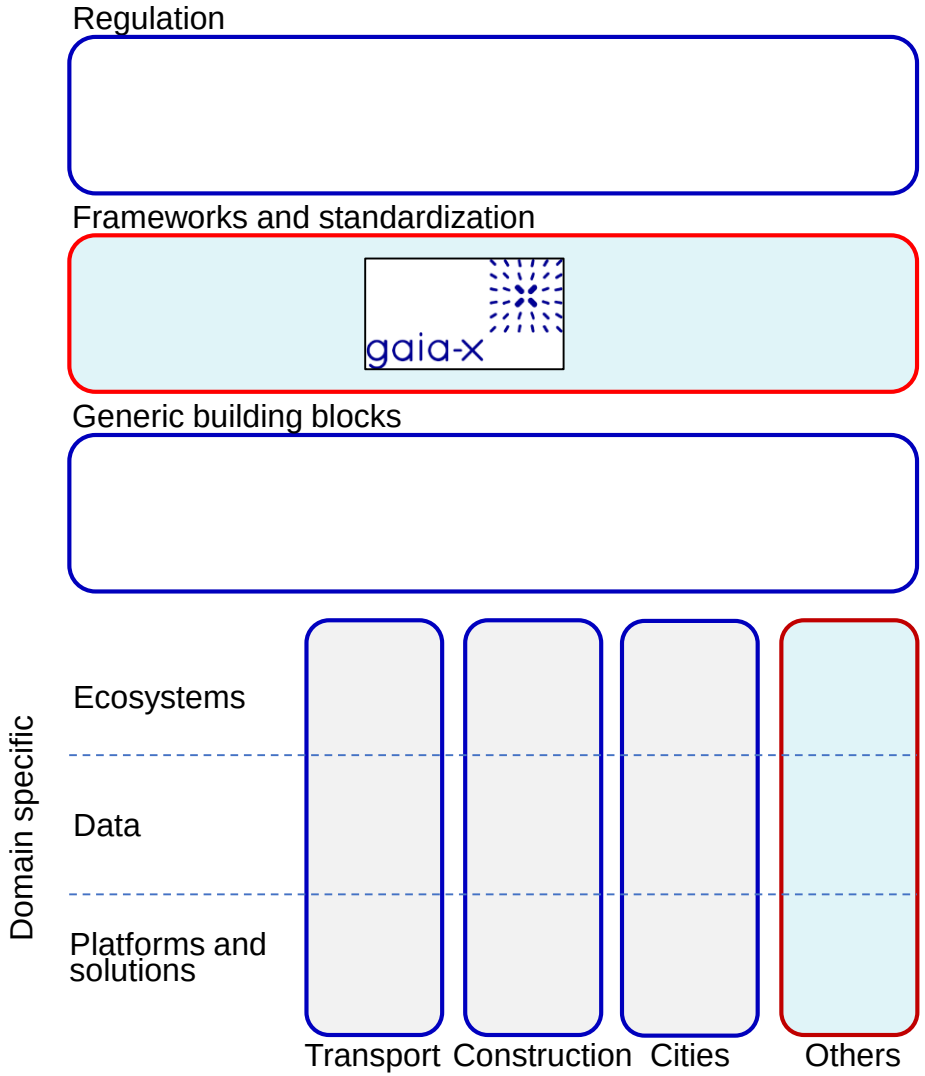
Key facts

- Enable sovereign data exchange to better data & analytics for thefinancial sector
- Sustainability risk analysis (ESG, i.e. Environmental, Social, Governance)
- Market integrity
- Monetary policy decision optimization
- Anti-money laundering (AML)



DEUTSCHE BUNDESBANK EUROSYSTEM
DEUTSCHE BÖRSE GROUP
Frankfurt School
TQ TechQuartier
hawk:AI
TECHNISCHE UNIVERSITÄT DARMSTADT

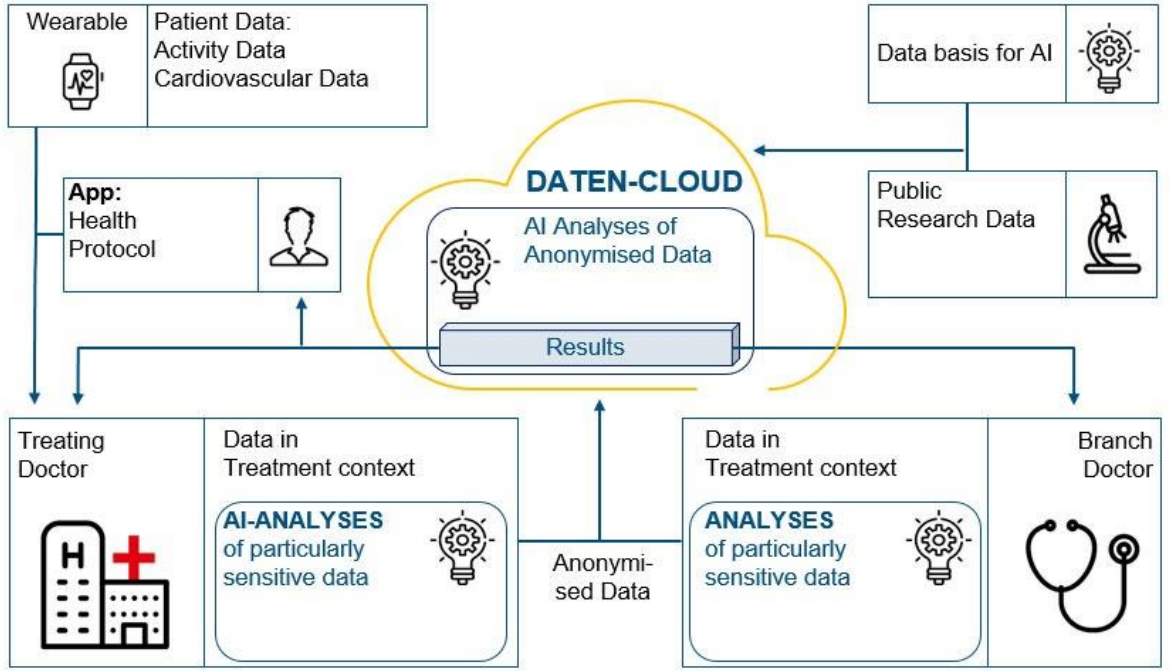
Smart Health Connect



Key facts

- Continously monitored patient conditions using wearables
- Collect sufficient data in a GDPR compliant, privacy preserving way to develop AI
- Predict and detect critical situations
- Integrative analysis data of wearables and clinical institutes

CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN



Smart Otaniemi

Regulation

Frameworks and standardization

VTT hosts the IDSA hub in Finland. Smart Otaniemi provides a large cross-domain IDS testbed.

INTERNATIONAL DATA SPACES ASSOCIATION

Generic building blocks

Domain specific

Ecosystems

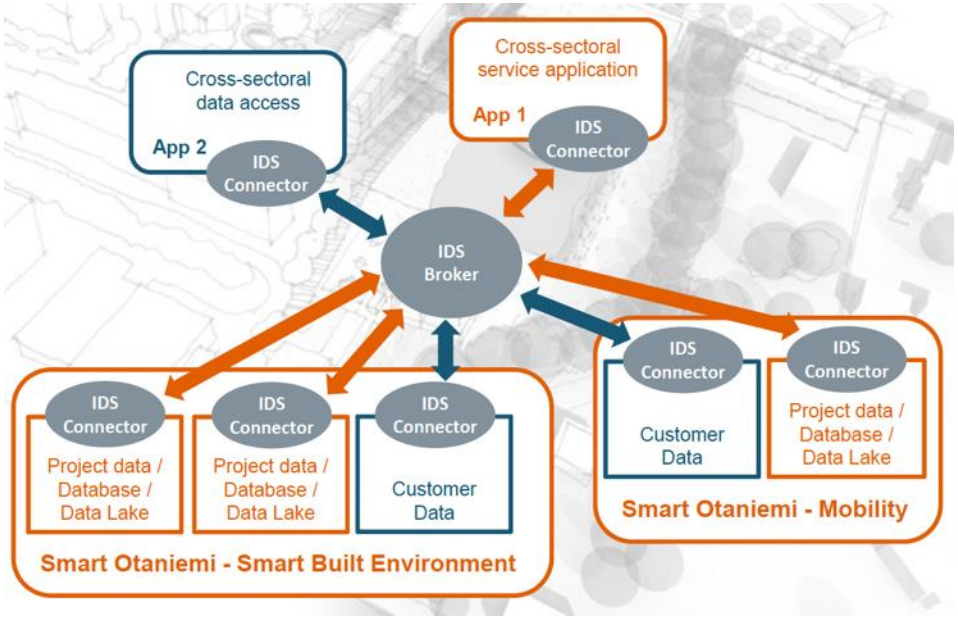
Data

Platforms and solutions

Transport | Construction | Cities | Others

Key facts

- Smart Otaniemi is an innovation ecosystem in Espoo, Finland that focuses on smart energy to promote sustainability and cost-efficiency that connects experts, organisations, technologies and pilot projects.
- Currently, more than 100 organisations (e.g. ABB, Nokia, Fortum, Enerim, Fingrid) are members of the Smart Otaniemi network.
- Cross-sectoral VTT Research Data Space focuses on novel applications based on the access to different data silos.



https://smartotaniemi.fi/

7. Summary

Key findings and messages

Evolution of data spaces

- Data spaces implement our common **distributed soft infrastructure**.
- We are in **early stages** of data space evolution moving from defining the generic principles, architecting the frameworks and identifying the potential value in pilots **towards wide scale industrial adoption**.
- There is a broad **international consensus** on the need for fair data access and sharing and this **momentum should be used to accelerate the developments**.
- Although EU-driven data space initiatives have often been presented as an attempt to create a counter-force to hyperscalers (Amazon, Google, Microsoft), a **more balanced collaborative model between European and US-based industry players is more likely to emerge**.

Data Space Design Guidelines

Fair • Data spaces as commons: adhere to FAIR principles (Findable, Interoperable, Accessible, Reusable). • Data spaces as ecosystems: fair to all participants in terms of value creation (FRAND-like terms and conditions).	**Trust** • Facilitate trusted data exchange among participants, reassure participants identity, and compliance with defined rules/agreements. • Achieved by organisational measures (e.g. certification or verified credentials) or technical measures (e.g. remote attestation).
Human-centric • Include individuals as active subjects in data space development. • Recognize that almost all data space domains and use cases involve data about individuals in one form or another.	**Data value** • Create new data value chains based on data provided by existing participants • Extend existing data value chains, thus bringing about innovation by exploiting value not foreseen initially.
Responsible • Promote ethical business practices related to data sharing. • Contribute to solving the societal and environmental sustainability challenges of our time.	**Real-time** • Build capability to exchange and to act on data as real-time as possible. • Big benefits to be gained, for example in the public sector collaboration.

Thank you!

lvm.fi/en Twitter: @lvmfi

MINISTRY OF TRANSPORT AND COMMUNICATIONS