



## Farm Data Spaces and the Corporate Sustainability Reporting Directive (CSRD)

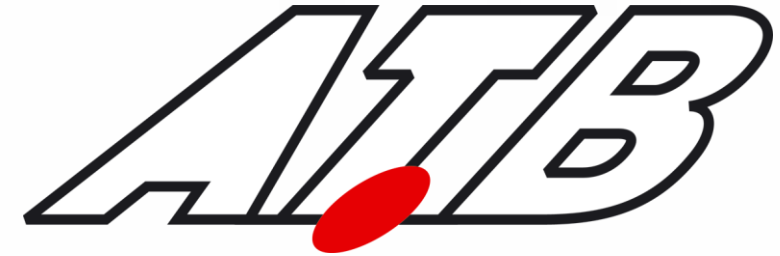
Harald Sundmaeker (ATB)



ATB Institute for Applied  
Systems Technology  
Bremen GmbH



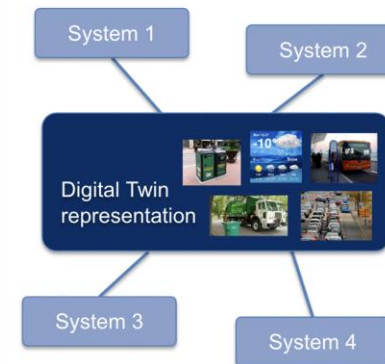
- ATB Institute for Applied Systems Technology Bremen GmbH
  - Non-profit research organisation, founded by local Government and Daimler AG in 1991
  - Current shareholders are Bremen University & local industry
    - OAS AG – digital weighing systems
    - OHB AG – building satellites & related services
    - Atlas Elektronik – Marine Systems
  - Focus on Applied Research & System Development
  - Active in EU funded projects and direct research with diverse partners related to AI, Big Data, Data Spaces and IoT
  - Key business domains:
    - Agri-Food chain
    - Automotive
    - Manufacturing
    - Robotics



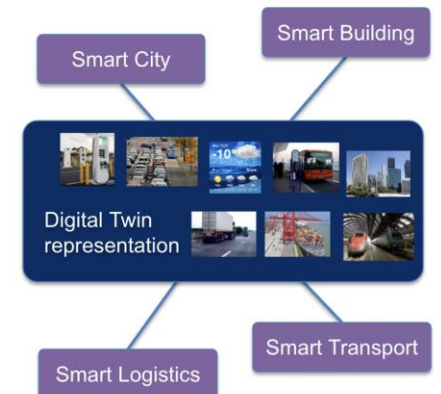
- A curated framework of Open-Source Software components to accelerate the development of Smart Solutions
- Build an open sustainable ecosystem around public, royalty-free and implementation-driven open-source software:
  - Open Source Software
  - Smart usage of data - Smart Data Models program
  - Smart Solutions & Services with adoption in diverse domains (smart city, manufacturing, agrifood, mobility, ports, water, energy, ...)
- FIWARE Smart Agri-Food Mission Support Committee is the contact point for the discussion of Agri-Food related open-source initiatives.
- Data Spaces: the next natural step in digitalization following a Digital Twin based system of systems approach
- Upcoming FIWARE Global Summit –September 18-19, 2024, Naples, Italy



**Integrating systems and sharing data within organizations**

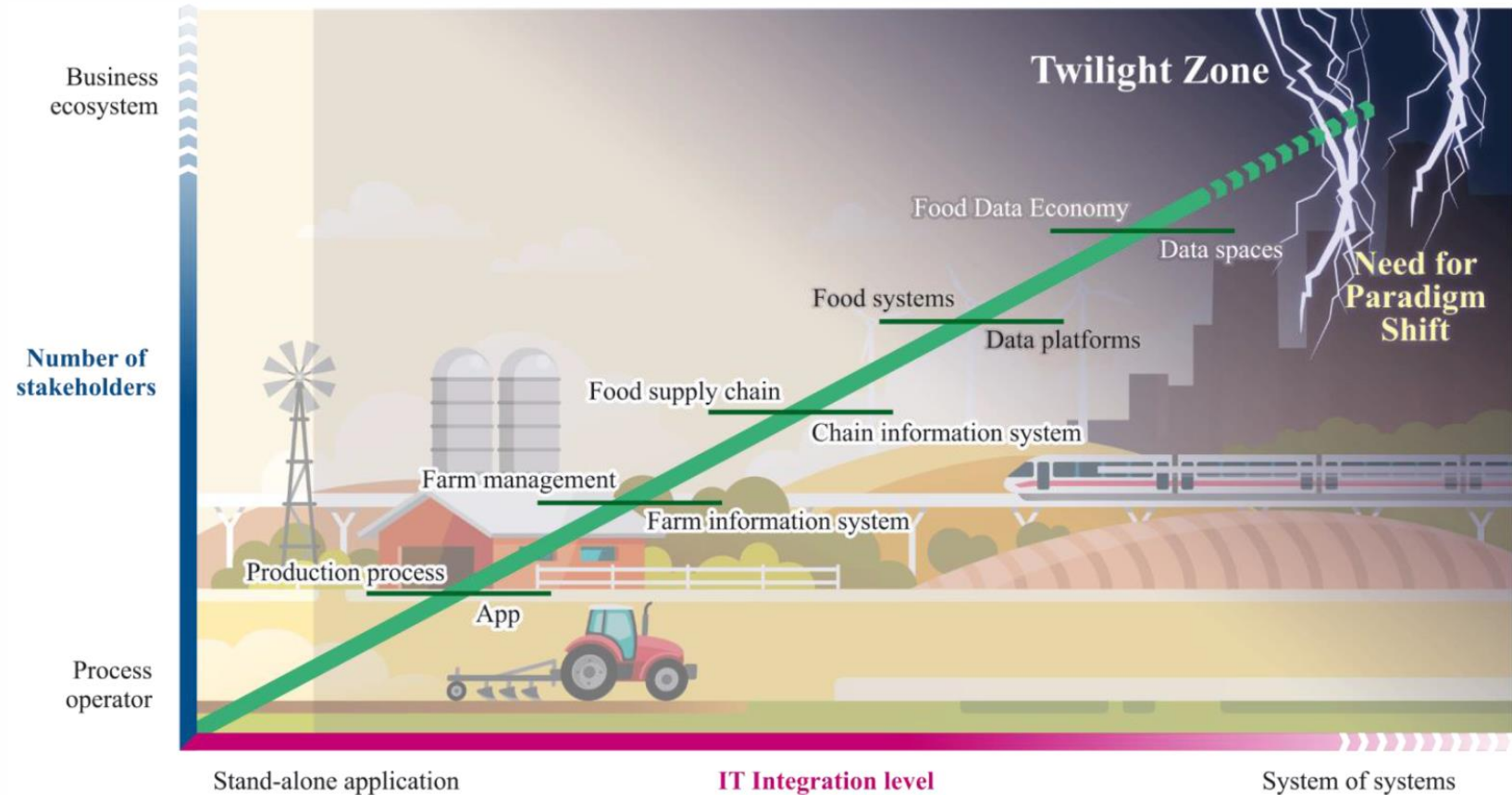


**Integrating systems and sharing data across organizations (data spaces)**



# Data Spaces & the Data Economy

- IT Integration level offers new opportunities for the Data Economy
- Willingness to share data is key for digital innovations
- The Twilight Zone:
  - Lack of clarity and pitfalls.
  - Requires scaling up and bridging gap between technological possibilities and willingness of users to engage with it.



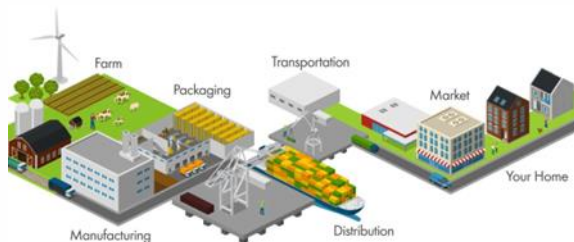
Sjaak Wolfert; Navigating the Twilight Zone - Pathways towards digital transformation of food systems  
Mansholt Lecture: Digitisation of Food Systems, Brussels, 22 Sep. 2021

## 9 Case Studies

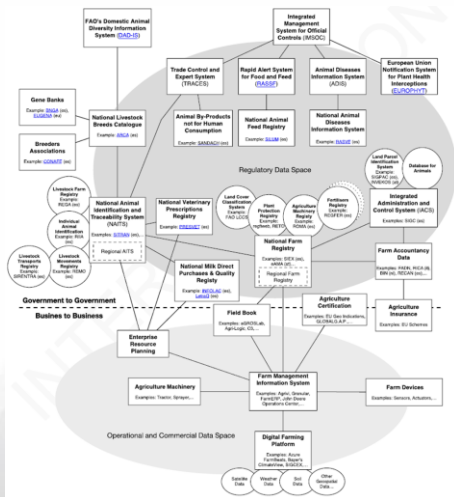
- 1 Grain
- 2 Pork
- 3 Arable, Dairy, Pig and Wine
- 4 Food Loss & Waste
- 5 Fruits & Vegetables Transport
- 6 Global Sustainability Insights for 45 Food Product Categories
- 7 Wine and Almonds
- 8 Retail of Regional Products
- 9 Smart Circular Food City



# Analyzing potentials of Data Spaces



Supply chain scope



## Fair Data Sharing in Short SC

Food Production

**Premium Grain Chain (PGC)  
Arable/Grain**

Developed Sitra **Fair Data Economy Rulebook** model to facilitate data network building.  
Cooperation of Members of the **AgriFood Data Space Finland (AFDSF)** ecosystem.  
How to manage data flows & infrastructure for data categories: sustainability, food quality, traceability & farm cooperatives. To realise Premium Grain Chain **data-enabled quality label**.

## Food System Development

**From Farmers to Consumers (PIGLink)  
Pork**

Diverse **data is collected on pig farms** like animal perform., veterinary treatment & initial T&T data.  
Farmer organizations, 5 equipment manufacturers, ICT, butcher pork association, 3 pig breeders as direct partners & 10,000 pig breeders as stakeholders affected.  
How to measure sanitary actions' impact from available data and use measured consumer expectations for farmers' daily management.

## From Decision Support to Governance

**AgData-Interoperability (TEUDS)  
Arable, Dairy, Pig, Wine**

**DJustConnect** operation is enhanced by collab. with EU AgData platforms for EU interoperability.  
Coop. with **JoinData (NL)**, **WALLESMART (BE)**, **API-agro (FR)**, **DKE Agrirouter (DE)**, **IDDEN (Scandinavia)**, & **GAIA-X, FIWARE, BDVA**.  
How to enable **full interoperability** of relevant systems and different data sharing architectural patterns (centralized & decentralized).

Food Supply chain

**Short Food Supply Chain (ZeroFLW)  
Public Food Supply, HORECA**

Installed **short food supply chain marketplace** for local food & produce focusing on reduction of food loss and waste (FLW) with strict quality control.  
Connecting **all Pomurje regional small stakeholders** to Hotel, Restaurant, Catering (HoReCa) and all public food demand.  
How to regionally join forces for **systematic data aggregation** helping vegetable producers and SC to optimize farms and reduce significantly **FLW in the local food system**.

**RealTime-FreshData (DIRECT)  
Fruits & Vegetables**

Leading service provider operates open pool with **>200 Mio. Returnable Trade Items (RTIs/boxes)**, partly with smart sensors & SigFox à Smart RTI.  
Thousands customers from F2F, provide, trade, transport & retail F&V in these RTIs. Services for F&V chains in **27 European countries** provided.  
How to **extend use of operational real time data** (e.g. location, temp., acceleration) with item travelling via multiple potential data owners.

**GlobalSust. Assessm (THESIS)  
Assessing products for retail all chain up/down**

TSC repository of **400 product categories**, with assessments from thousands of suppliers, to communicate, monetize & improve sustainability.  
'The Sustainability Consortium' (TSC) with **>100 large global food chain stakeholders** (e.g. BASF, Bayer, HSBC, PepsiCo, Unilever, Walmart, WWF)  
How to unlock sustainability performance data of food to facilitate integration in B2Retail, B2Finance, BtG and B2B decision making.

Circular

**CircularEconomy4Tourism (I4Data)  
Wine & Almonds**

Complete chain covered with stakeholders, working in circular ecosystem; tempted to fully share data allowing a **circular economy for Tourists**.  
29 agri-food cooperatives with **>6000 farmers of 4 Balearic islands** & 2 wine Designation of Origin.  
How to improve and make old local production methods more efficient based on full chain data including reduction of environmental impact for a **circular economy**.

**LocalSupplyData (DaaS)  
Retail of regional products (Fruits&Veg., wine)**

Data available at producers, transport, tourism, regional planning, regional socio-economic dev. & retail **aiming at involving consumers**.  
**10 social farms & 500 SMEs in short chain, CZ**  
Agriculture Association & Uhlava o.p.s.  
How to enable an **inter-sectorial data use** with Data as a Service, focusing on sustainable & socio-economic development of the region.

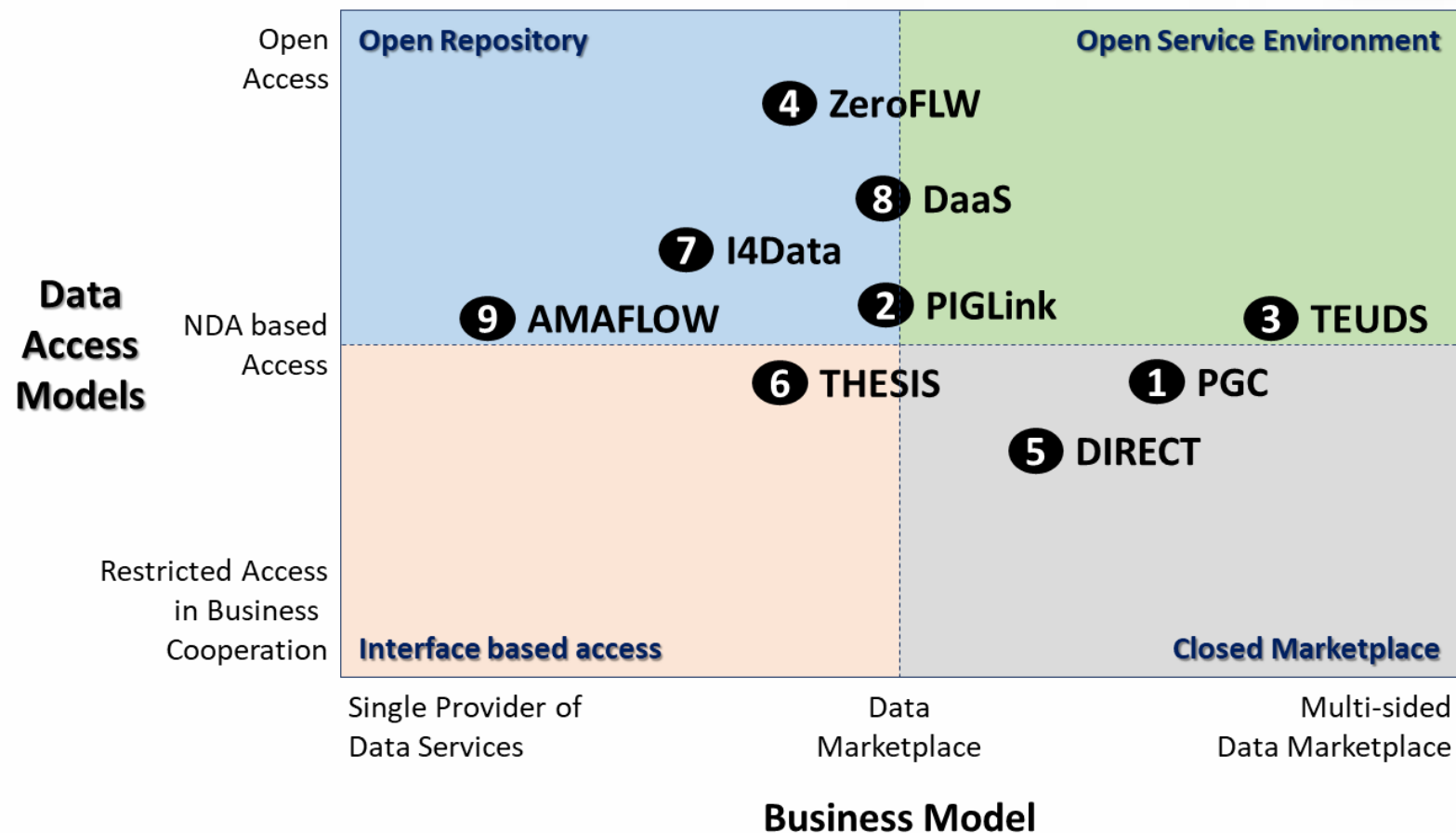
**UrbanFoodWaste (AMAFLOW)  
Municipality / SmartCircularFoodCity**

Amsterdam works on the strategic objective to become **fully circular** by 2050.  
**Amsterdam Metropolitan Area (AMA)**, municipality & food waste collection companies, food companies in AMA.  
How to **valorize food waste stream data** to create economic, social, and environmental benefits for the stakeholders and facilitate data economy advancement in AMA.

Data economy potentials for the food system aspects addressed

# Challenges of Data Access Management

- Data Access Models build on existing business relations.
- Case Studies are carefully managing access to data, according to stakeholder needs.
- Usage of data by third parties is a challenge in terms of consent and user management.



# State-of-the-Art Analysis of the AgriDataSpaces Project

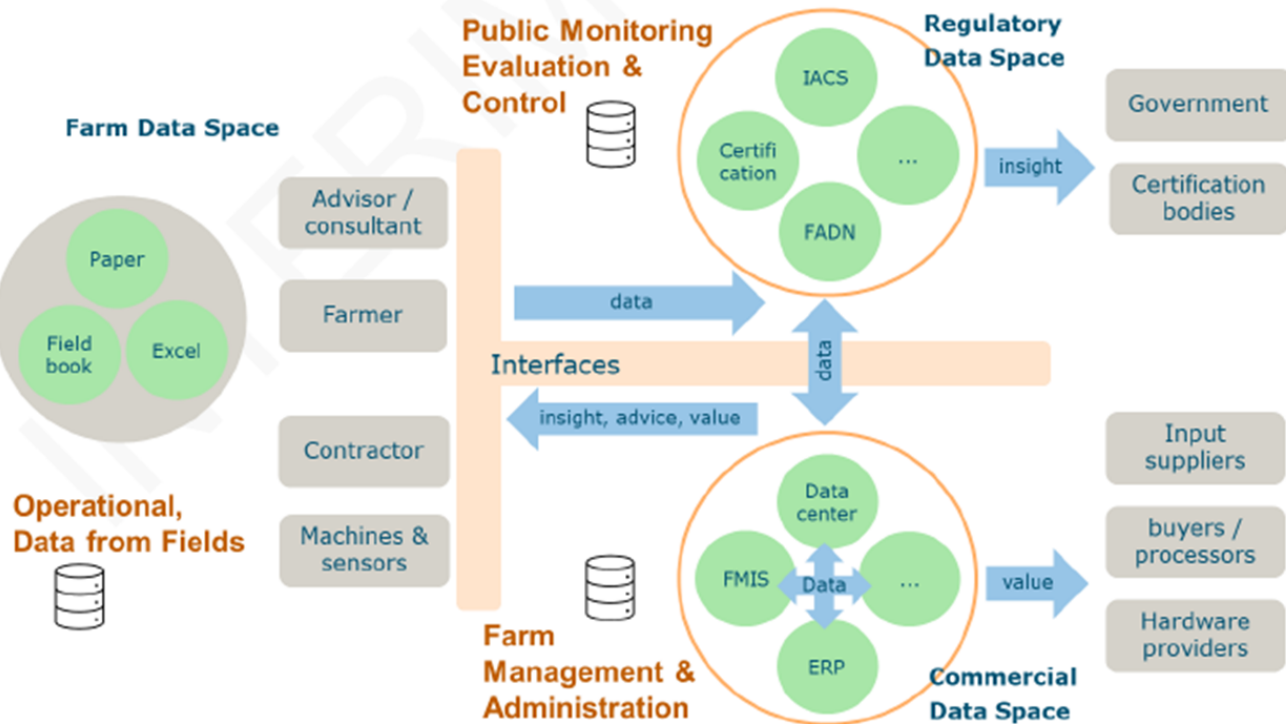


Figure 1 - Overview of the main kinds of data spaces in agriculture and flows among them

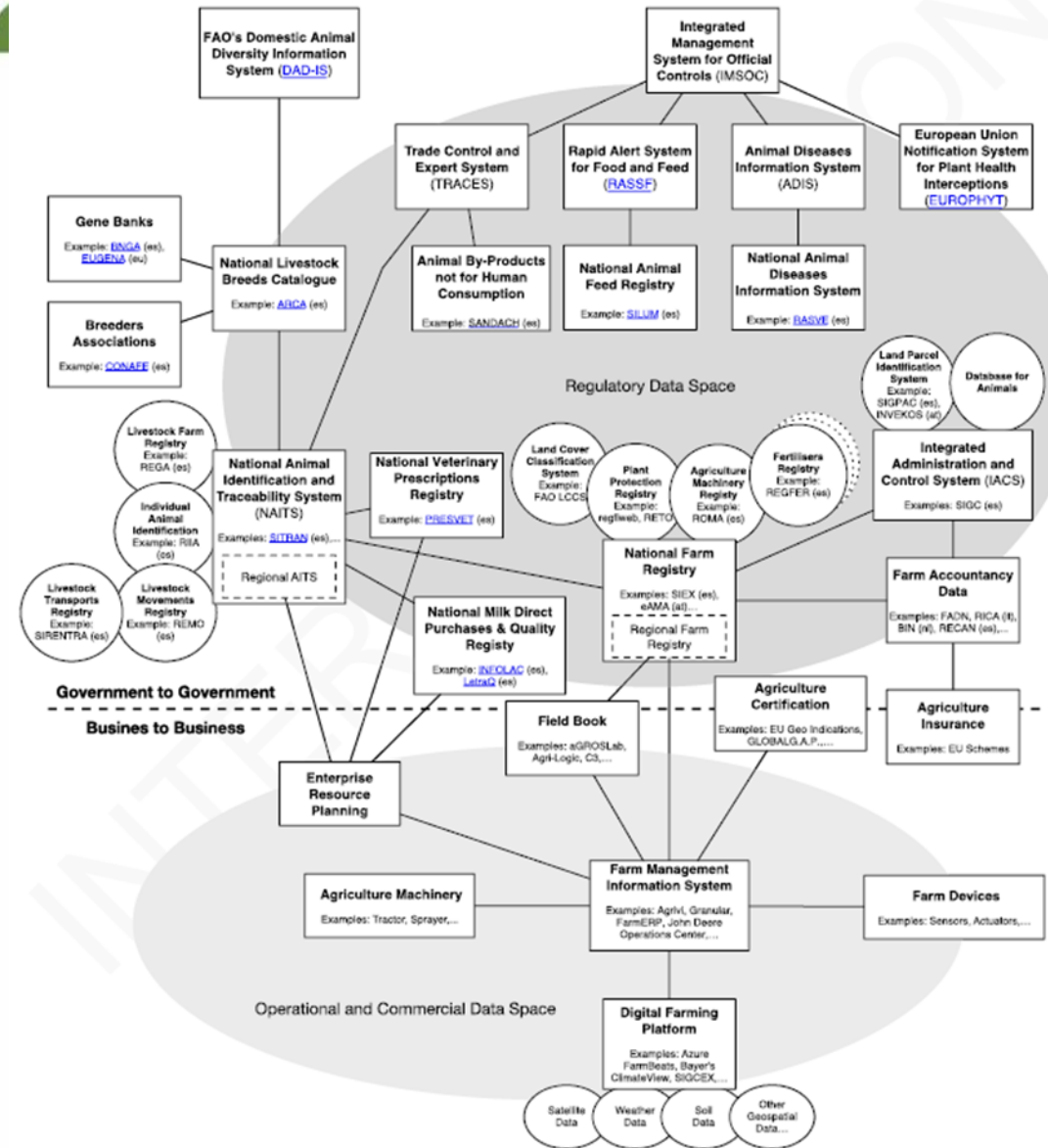


Figure 3 - Overview of Data Systems in EU Agriculture, non-exhaustive and highlighting potential relationships among them, B2B, G2G and B2G



# Challenges and Opportunities

- Data Economy for Food Systems – diverse challenges to be handled for realising Data Spaces

- **Key opportunities of Data Spaces:**

- Reduce/share costs
- Speed up implementation
- Align data models
- Share data along the chain
- Enable realisation of value-added services not possible before, due to missing data



# Data Economy vs. Reporting Directives

- **Common European Data Space** – EC initiative, promoting interoperability and public availability of data to facilitate offerings of the Data Economy
- Initiatives towards the realisation of data spaces
  - Public or private data
  - Facilitating data exchange between organisations via a common governance framework and a technical infrastructure to facilitate interoperability
- Key regulation/policy in Germany and the EU
  - Lieferkettensorgfaltspflichtengesetz (LkSG) -> **Supply Chain Due Diligence Act in Germany** effective since January 2023
  - **Corporate Sustainability Reporting Directive (CSRD)** – specifically affecting preparation of annual reports of large organisations – effective since January 2023 and to be implemented after July 2024 the latest. The directive aims to ensure that companies disclose information about the sustainability risks and opportunities they face, as well as the impacts they have on people and the environment.
  - **Corporate Sustainability Due Diligence Directive (CSDD)**, EU parliament decision in June 2023 to continue implementation -> expected effect on the overall supply chain reporting/information exchange on human rights and environmental aspects

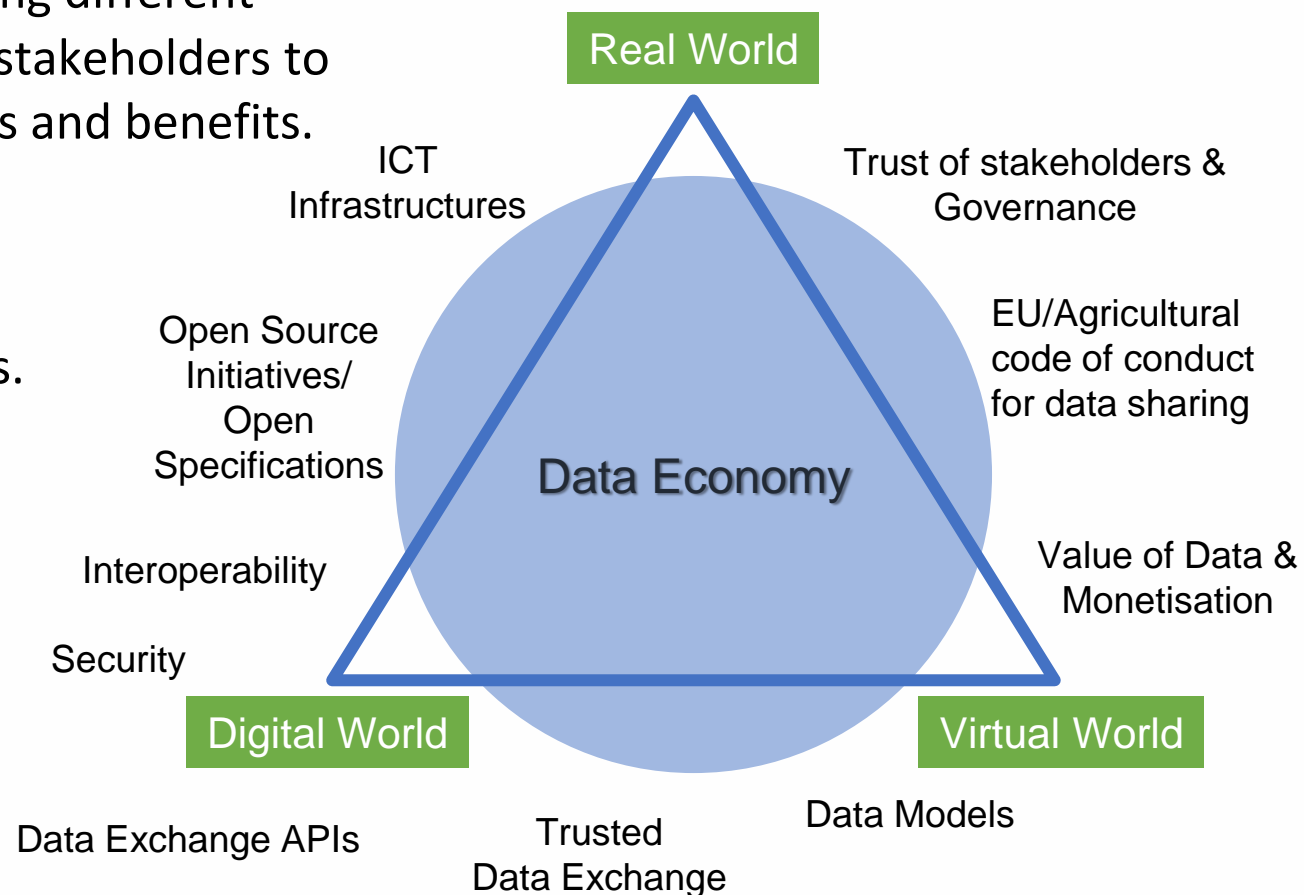


# Corporate Sustainability Reporting Directive

- The CSRD is extending the “Non-Financial Reporting Directive” – the NFRD is active since 2014 for specific organisations of public interest in the EU.
- Increased number of organisations need to report – from 11,600 before to 49,000 in the EU, namely
  - “Large” enterprises
  - Small and medium enterprises that are capital market-oriented
  - Enterprises from third countries with turnover >150 Mio. Euro in the EU
- Using the „European Single Electronic Format“ (ESEF) – XHTML-Format with XBRL-Tags and extending it accordingly. Publishing a specific XBRL-Taxonomy extending reporting towards sustainability.  
(<https://www.efrag.org/Lab4>)

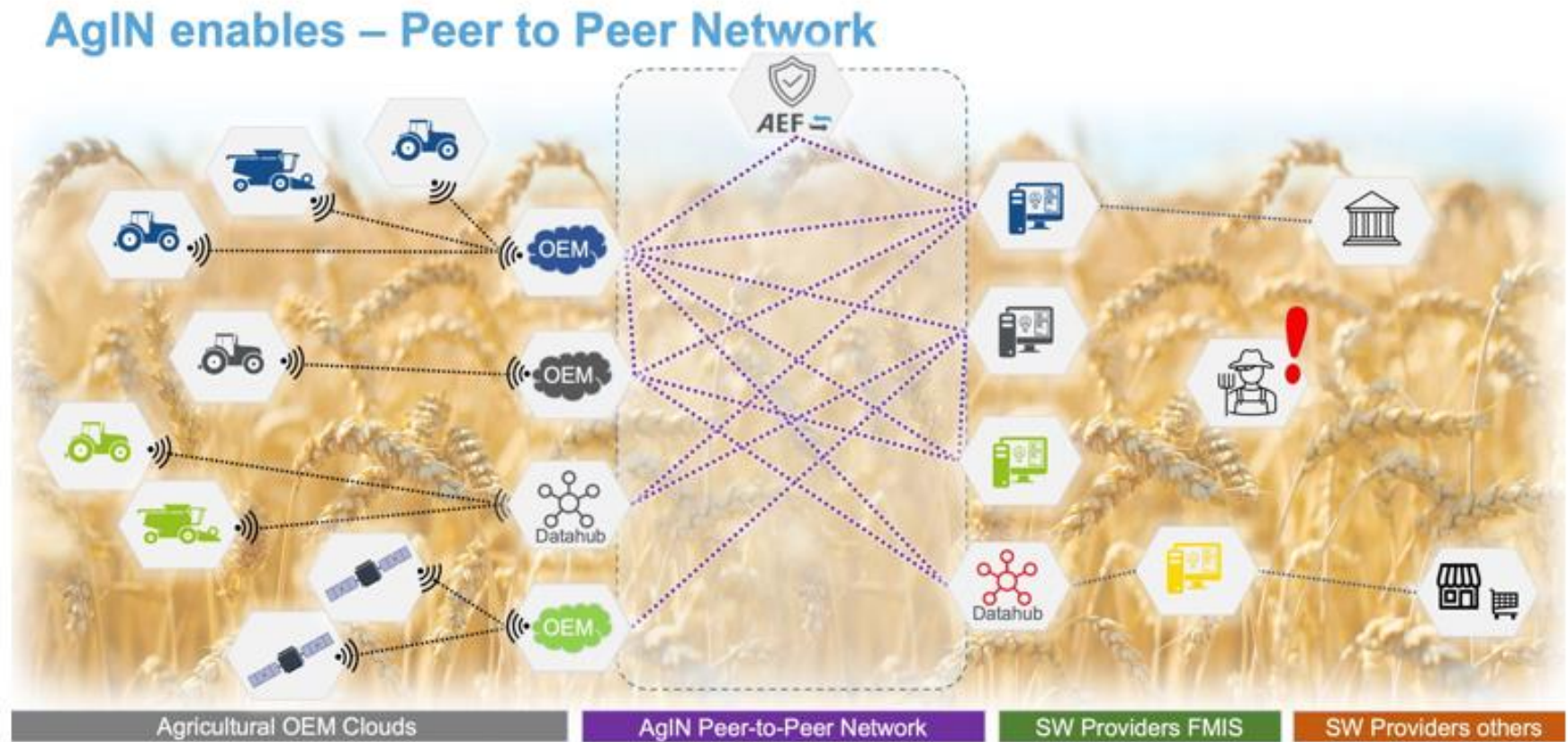
# Towards Common EU Data Spaces

- Decisions on business, legal, technical, or also ethical aspects require a **transdisciplinary approach**, involving different perspectives as well as involvement of all related stakeholders to ensure acceptance as well as a fair sharing of costs and benefits.
- A **lack of trust** could undermine the realisation of initially defined solutions and jeopardise later collaboration of business partners.



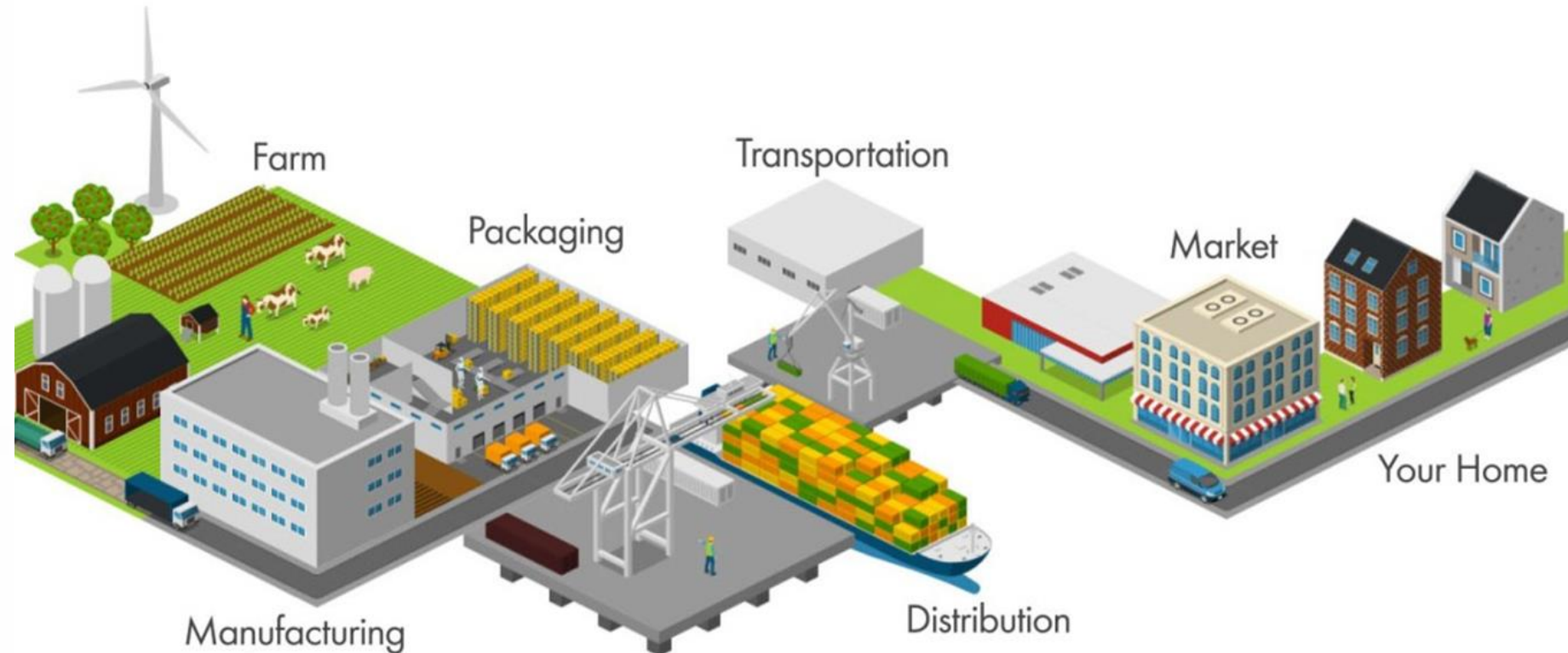
# Agriculture Data Space

- The Agricultural Interoperable Network is an excellent enabler to provide data to other Data Spaces



# Extended Perspective

- Agriculture as source of information for the overall Food System and beyond
- Impact on transport & logistics, food processing, trade, retail, consumers' choice, personal health, smart cities, energy, water, equipment manufacturing, waste management as well as circular economy



# Data Spaces beyond Agriculture

- Key elements to realise a data space
  - Configurable data broker platform, marketplace
  - Enabling to connect N data sources with M applications that are using the data
  - Publish-subscribe mechanism
  - Consent management, integrated with user management
- The Data Spaces Business Alliance elaborated a common reference technology framework for creation of Data Spaces
- The FIWARE Open Source Foundation, developed a so called Data Space Connector to realise a decentralised user access control



## Data Spaces Business Alliance



# Data Spaces Business Alliance (DSBA): joining forces

BDVA, FIWARE, GAIA-X and IDSA launched the [Data Spaces Business Alliance \(DSBA\)](#) to accelerate Business Transformation in the Data Economy (Sep 23<sup>rd</sup>, 2021)

- **One voice and a common framework** to make interoperable Data Spaces happen;
- Together, **the Alliance's founding organizations** represent **1,000+** leading key industry players;
- With its combined **cross-industry expertise, resources and know-how**, the Alliance drives awareness and rely on **more than 100 Hubs** for dissemination

## [Technical Convergence discussions](#)

towards common reference technology framework for creation of Data Spaces



### Data Spaces Business Alliance

Unleashing the Data Economy



### Technical Convergence

Discussion Document

Version 2.0  
2023-04-21

## Data Spaces Business Alliance

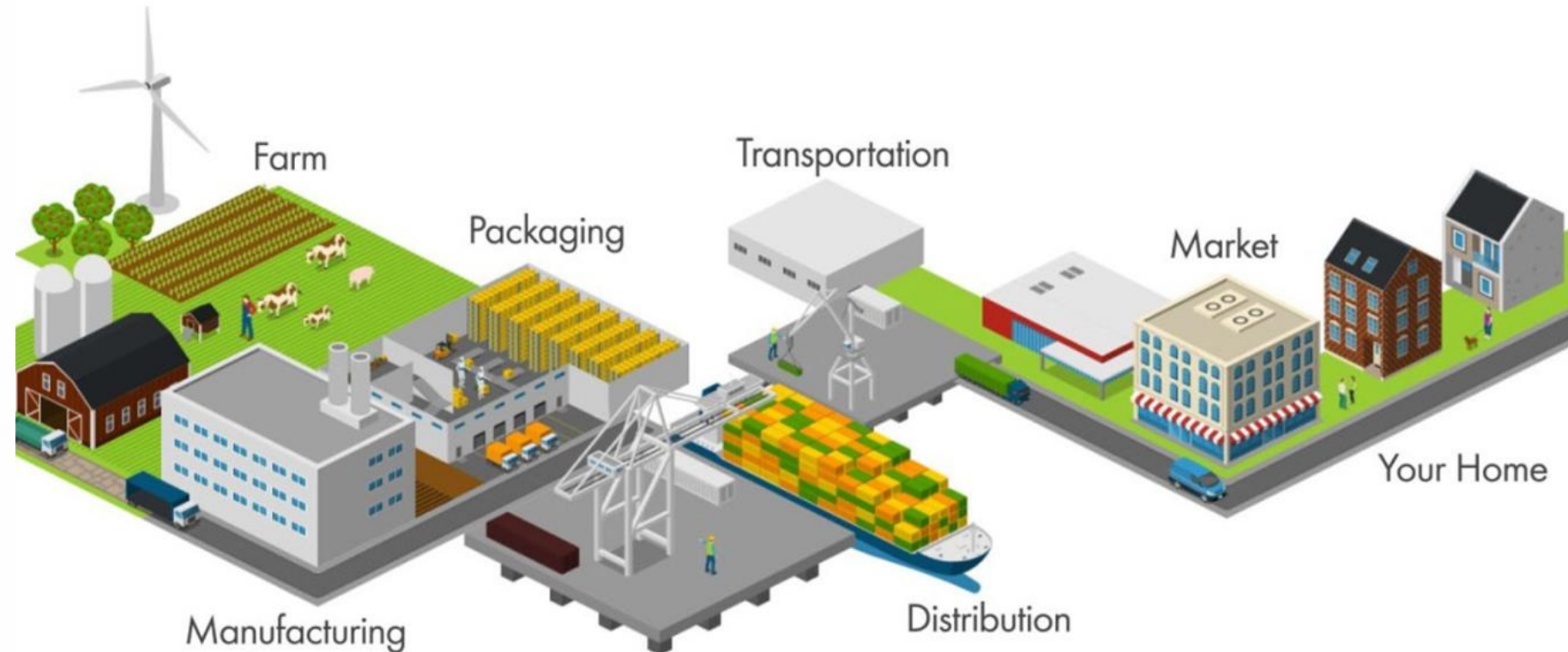


<https://data-spaces-business-alliance.eu/>



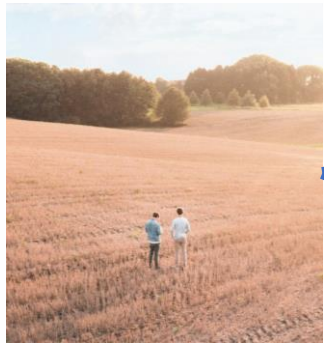
# Key Challenge

- How to align with other business domains?
- Effort for managing the data access by large amount of end-users in single organizations on the food chain side (e.g. food processors & retailers)

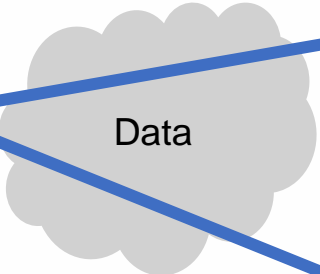


# Key Challenge

- Supply chains with dynamic business relations
- Effort for managing the data access by large amount of end-users in single organizations on the food chain side (e.g. food processors & retailers)



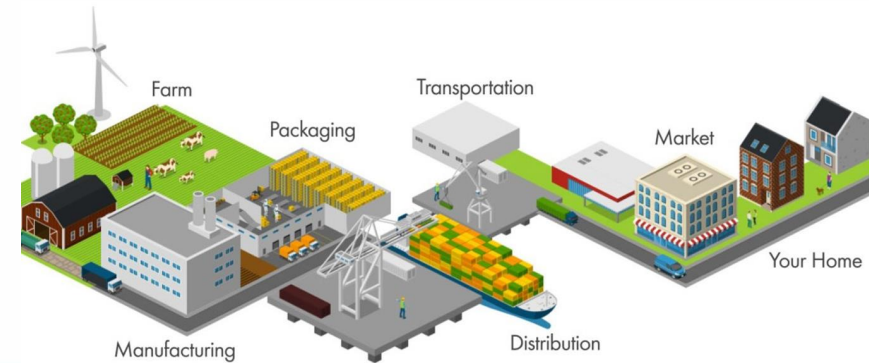
Agriculture/  
Farmer

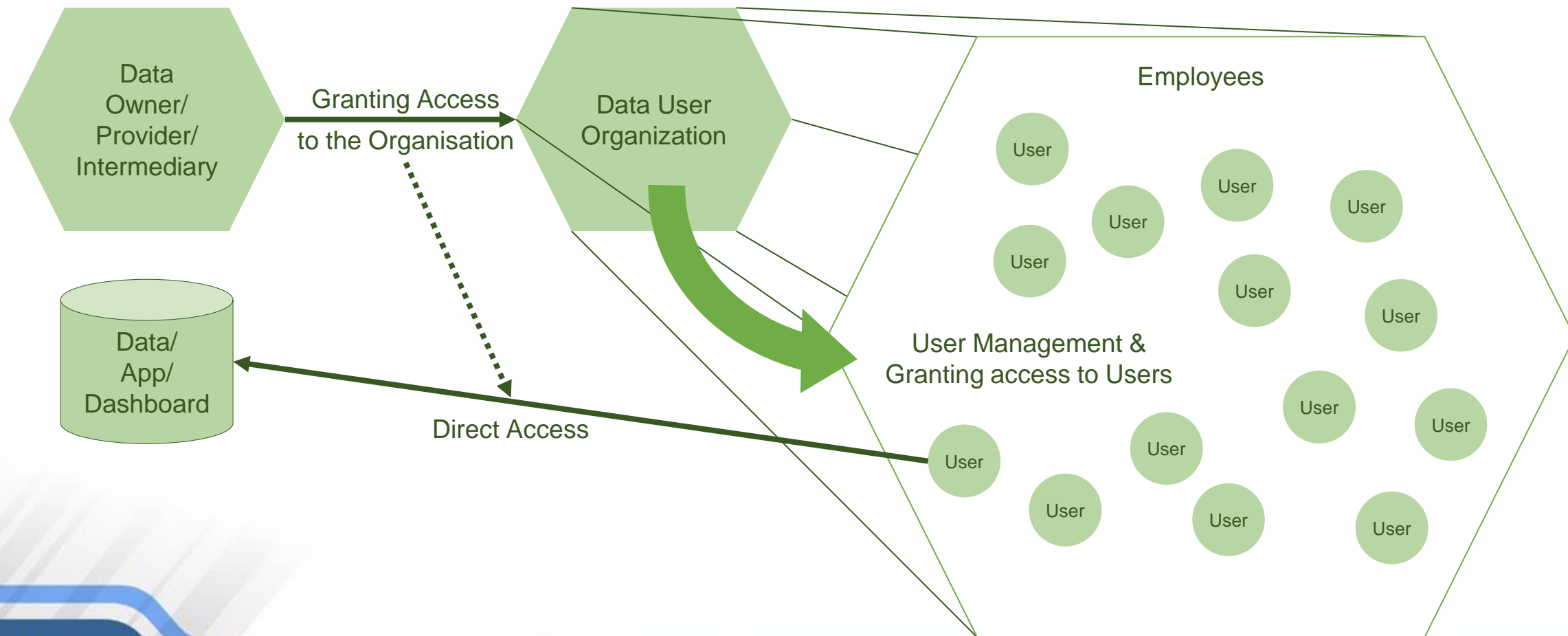


Trade &  
Production

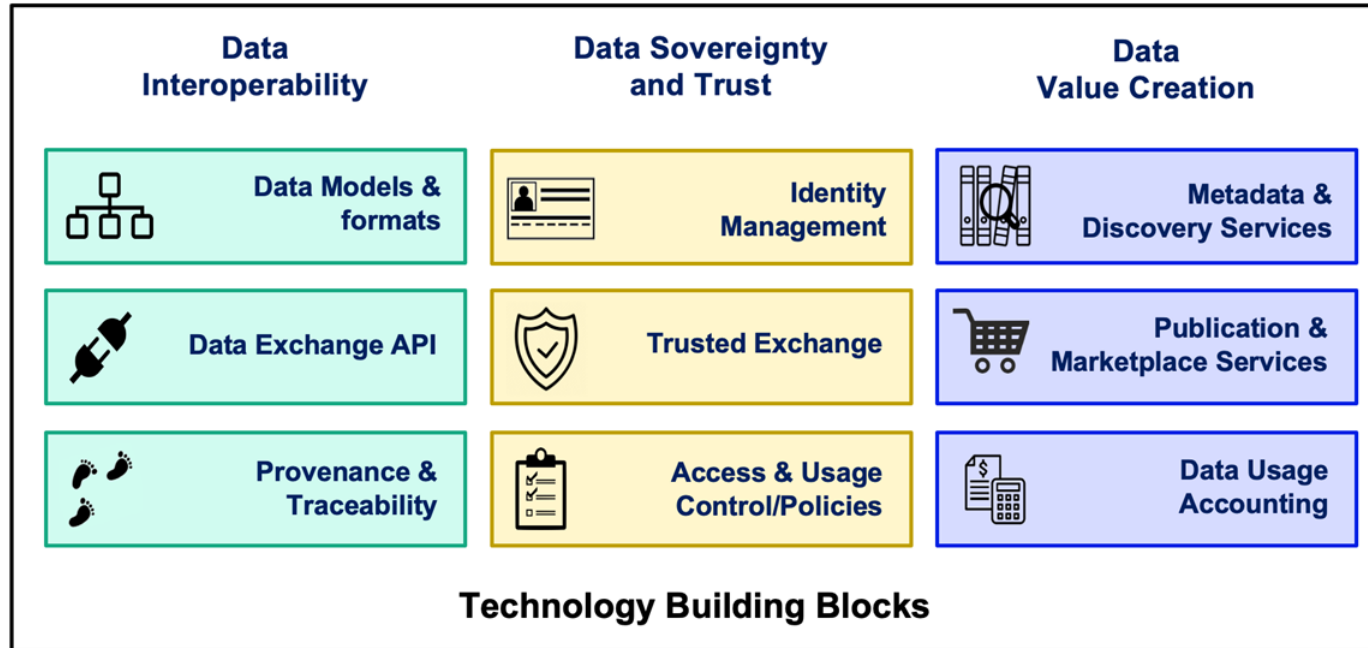


Retail, Supermarkets,  
Shops, Consumers





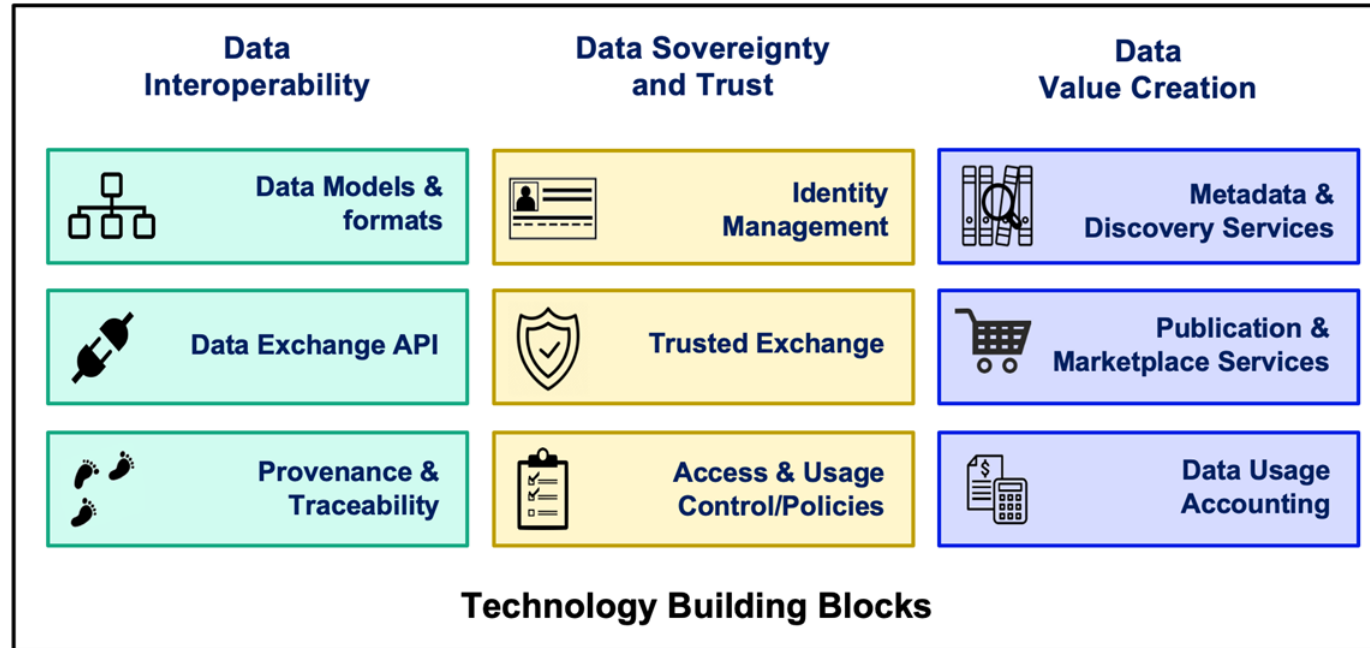
# Data Spaces Building Blocks



## Data Spaces Governance



# Creating interoperable data spaces requires taking options



**MATERIALIZING DATA SPACES REQUIRES TO TAKE OPTIONS AND ADOPT A MINIMUM BUT ENOUGH SET OF TECHNOLOGY STANDARDS**



# FIWARE has been working towards solving how relevant standards can be implemented and integrated for data spaces

Collaboration with iSHARE Foundation under the umbrella of [i4Trust program](#) and active participation in Gaia-X IAM WG (co-chairs)

- Trust Services APIs aligned with EBSI
- Support to DID+VC/VPs + SIOPv2 and OIDC4VP

Experience implementing IDS Connector functions (TRUE Connector)

DCAT-compliant Idra component used in several market solutions

Marketplace Services open source components based on TM Forum industry standards used in i4Trust and now taken as baseline in DOME project

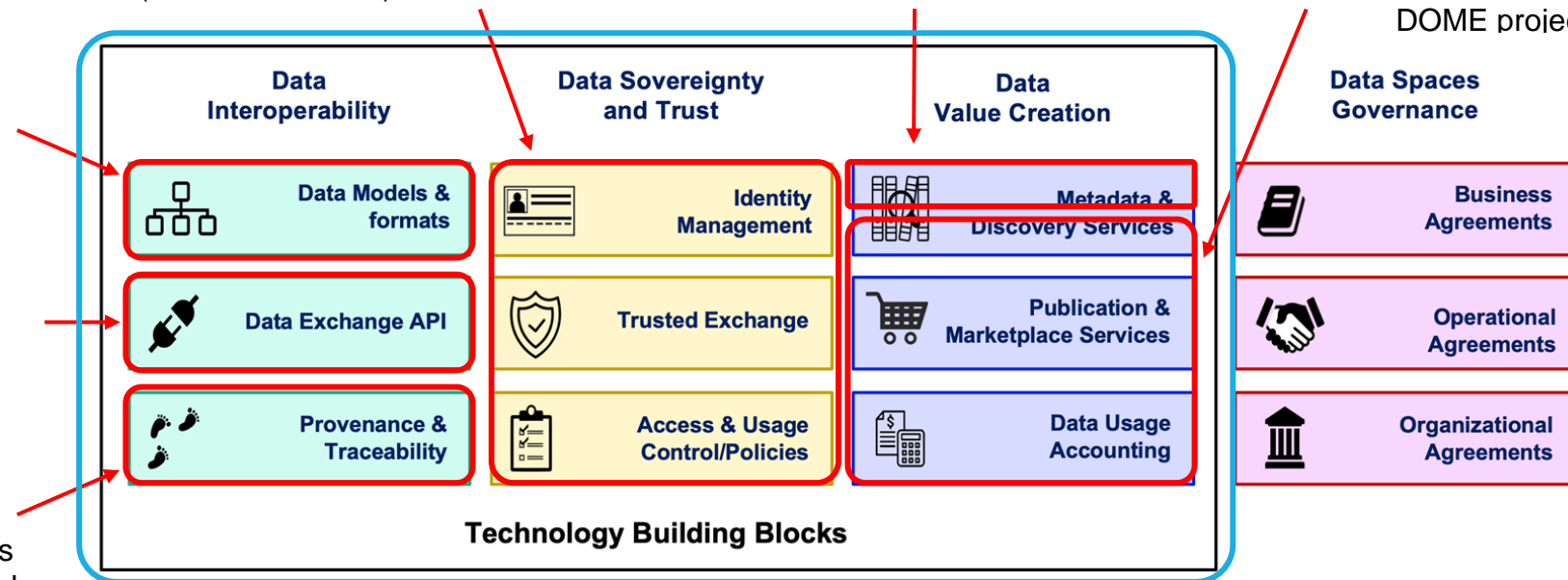
Driving fast-growing library of smart data models for developers ([website](#), [github](#)) following open agile approach

- 1000+ data models,
- 14K+ terms
- 100+ contributors

Driving standardization of API for context / digital twin data exchange: [ETSI NGS-LD](#):

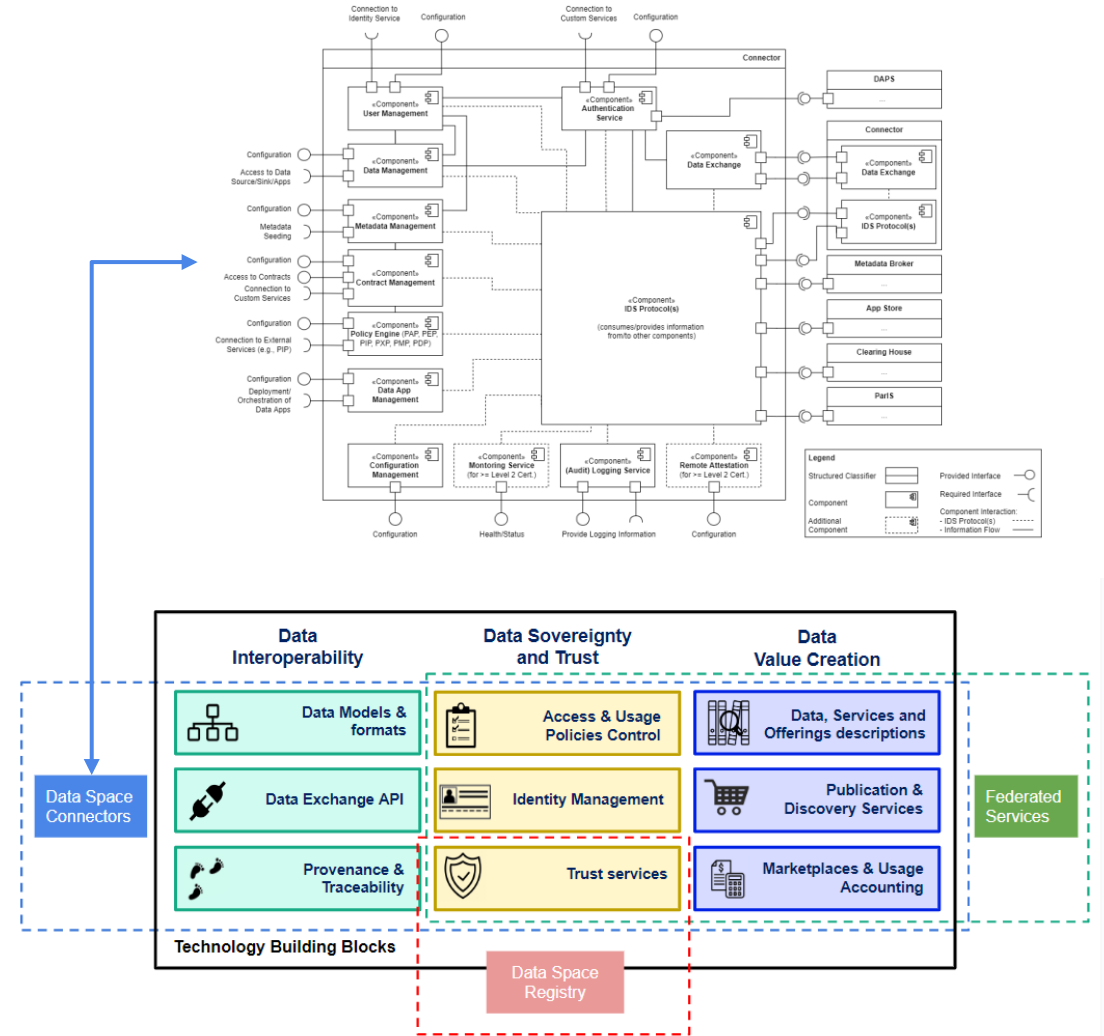
- de-facto for cities, growing adoption in other domains
- adopted beyond Europe

[Collaboration with Alastria](#) towards EBSI-compatible no-code approach for storing logs on context / digital twin data transactions on blockchain networks



# Evolution of Data Space Connector concept

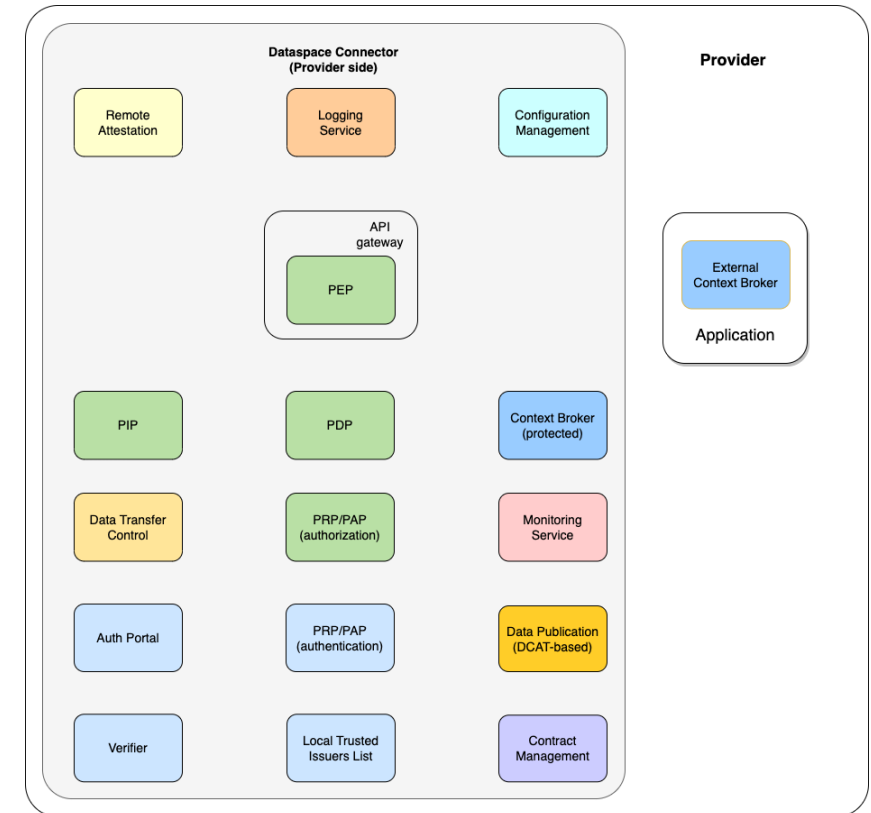
- The concept of Data Space Connector has evolved to match the idea of an integrated suite of components every organization participating in a data space should deploy to “connect” to the data space
- These components would implement a number of services:
  - Authentication (including the interface to trust services)
  - Authorization (policy enforcement)
  - Connection to Data Exchange APIs
  - Data resources publication (Metadata Management)
  - Contract Management
  - Logging
  - Remote Attestation
  - ...
- The concept of [Data Space Connector in IDS RAM 4.0](#) has evolved to support this vision



# FIWARE Data Space Connector

- A first release of FIWARE Data Space Connector components together with recipes for their deployment has been released on the basis of combining the following components which already align with DSBA TC recommendations:
  - Context Broker technology for Data Exchange/Transfer
  - Trust and Identity & Access Mgt (IAM) components implementing W3C Decentralized Identifiers (DID) + Verifiable Credentials (VCs) and Verifiable Presentations (VP) standards,
  - Self-Issued OpenID Provider v2 (SIOPv2)/OpenID Connect for VP (OIDC4VP) protocols and interface to trust services based on extended European Blockchain Services Infrastructure (EBSI) APIs (DID-registry, Trusted Issuers Registry)
  - Business API Ecosystem (BAE) modules implementing TM Forum APIs for contract negotiation

<https://github.com/FIWARE/data-space-connector>

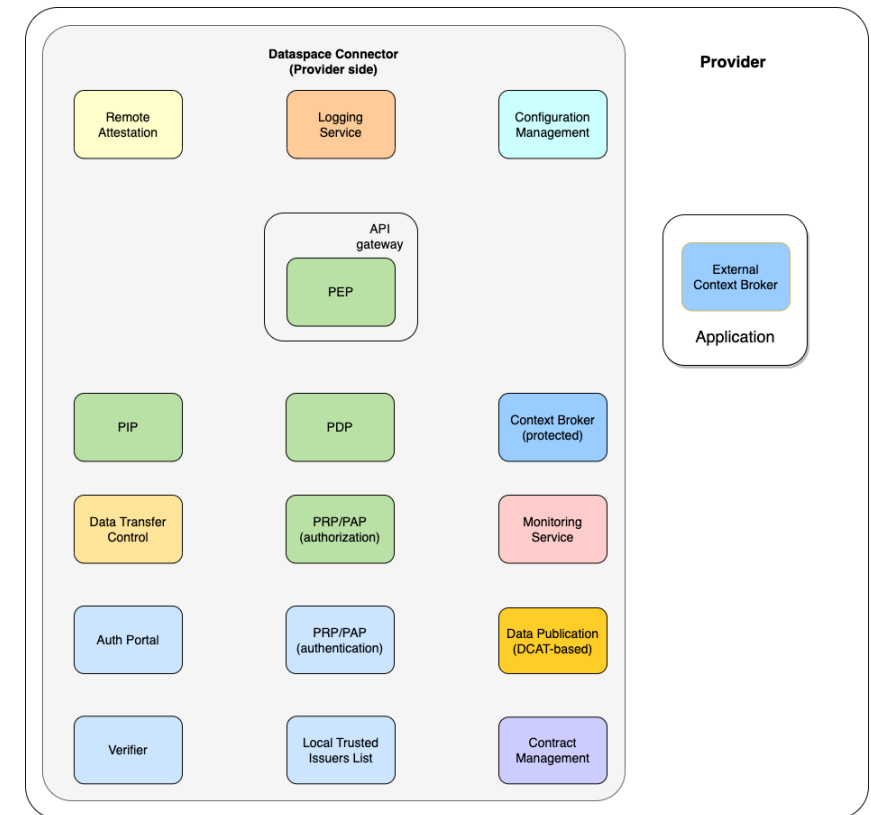




# FIWARE Data Space Connector

- For future releases, following modules will be incorporated:
  - Personal Data Consent Management modules (based on CaPE (Consent based Personal Data Suite) product from Engineering).
  - Idra product from Engineering as DCAT-compliant data resources catalog function for Metadata Management
  - Logging modules based on either BAE/marketplace functions for logging or, if we want to rely on blockchain, Cannis Major
- The FIWARE Data Space Connector will be the best aligned with DSBA recommendations available in the market

<https://github.com/FIWARE/data-space-connector>



Policy Management (Authorization Service)

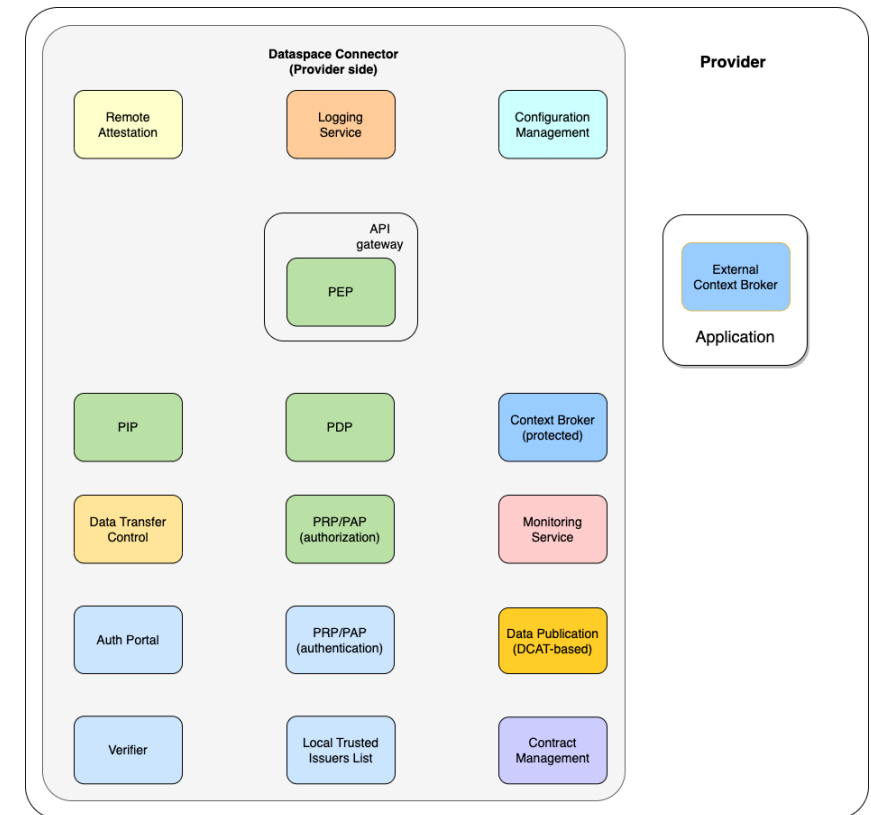
Authentication Service



# FIWARE Data Space Connector

- EUs CSRD reporting has created an opportunity to break the information silos.
- Information is arranged in silos and no single data format.
- EU CSRD reporting requires information and data from various sources to be aggregated in a harmonized format, requiring a robust data exchange framework.
- FIWARE Data Space Connector Components and Smart Data Models can facilitate this process.
- With more than 1000 data models, Smart Data Models can harmonize data from different formats to NGS-ILD.
- FIWARE Data Space Connector components can be fully or partially used to ensure the secure data exchange between multiple data platforms to aggregate the data for further reporting.

<https://github.com/FIWARE/data-space-connector>



Legend:  
Green box: Policy Management (Authorization Service)  
Blue box: Authentication Service

# Conclusions

- Collaboration & willingness of stakeholders is of key importance
- Upcoming regulations will cause a need for reporting, while related data input/exchange along the overall supply chain/ circular economy is still missing
- Data Spaces are offering an opportunity to facilitate data exchange between organisations
- Current initiatives and Open Source developments are offering an enabler to facilitate implementation.



- Reduce/share costs
- Speed up implementation
- Align data models
- Share data along the chain
- Enable realisation of value-added services not possible before, due to missing data

# Thank You!



Premium Grain Chain (PGC)



From Farmers to Consumers (PIGLink)



AgData Interoperability – Towards a European Data Space (TEUDS)



Short Food Supply Chain (Zero FLW)



Real-Time Fresh Data (DIRECT)



The Sustainability Insight System (THEISIS)



Circular Economy 4 Tourism (I4DATA)



Inter-Sectorial Data as a Service (ISDaas)



Mapping and valorizing food loss and waste data in the Amsterdam Metropolitan Area to improve the circular economy (AMAFLOW)