Data Spaces Summary Document

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Maxwell Ernst - m.ernst@student.fontys.nl

Fontys ICT | Eindhoven

DOCUMENT HISTORY

Version	Status	Date	Changes
1.0	First version	05/04/2024	
2.0	Second Version	12/04/2024	- First chapters - GSM event - EU timeline - Startup checklist - Re-ordered glossary - Table of figures

List of Terms and Abbreviations

1. Artificial Intelligence (AI)
2. Data Space for Smart and Sustainable Cities and Communities (DS4SSC)
3. Data Spaces Support Center (DSSC)
4. European Commission (EC)
5. European Union (EU)
6. Global System for Mobile (GSM)
7. Information and Communication Technology (ICT)
8. Minimal Interoperable Mechanisms (MIMs)
9. Small and medium-sized enterprises (SMEs)
10. Smart and Sustainable Cities and Communities (SSCC)

Table of Contents

1. Introduction to Data Spaces

Today data is all around, generated in large quantities. The state of big data is bigger than ever, with the common business theme today being that data is the new oil. Although Europe is standing at a crossroads, having to decide about the next evolutionary step in the digital economy. This moment can be compared to the introduction of the GSM standard in the 1980s. This was the pivotal moment for the evolution of telecommunications and paved the way for modern mobile phone technology in the 1980s. (Springer, 2022)

The European Commission published a data strategy in 2020 with the idea of creating a common market for data from the private and public sectors. To be able to do this, the common use of data spaces needs to be adopted technically but also operationally. There needs to be a collective effort at the European level from members and stakeholders to achieve the objective of a common data market. Europe wants to create a common European data space where, by nature, the data belonging to a certain domain, should also be exchanged across domains. This includes the health, agriculture, mobility, and energy sectors for instance. Since many applications do not just need data from one domain but from many domains. (academy, 2023)

This creates the need for common tools and standards which should allow interoperability not only from a single data space but across all data spaces. If this is the case for all data spaces, then it is easier for a user to get access to these data spaces and gain the benefits from it compared to having to access all the different single sector-specific data. Which takes a lot of time and costs to set up for each user or party. Of course, there are challenges to this since it’s a fairly new concept and requires data infrastructures and governance frameworks in order to facilitate the sharing of data.

The beginning stages are quite difficult since the problem of adoption needs to be overcome in order to secure public interest in developing a common ‘soft infrastructure’. Where European business can thrive and new initiatives can compete on a level playing field. This can be the starting point for everything that is being done with data in Europe.

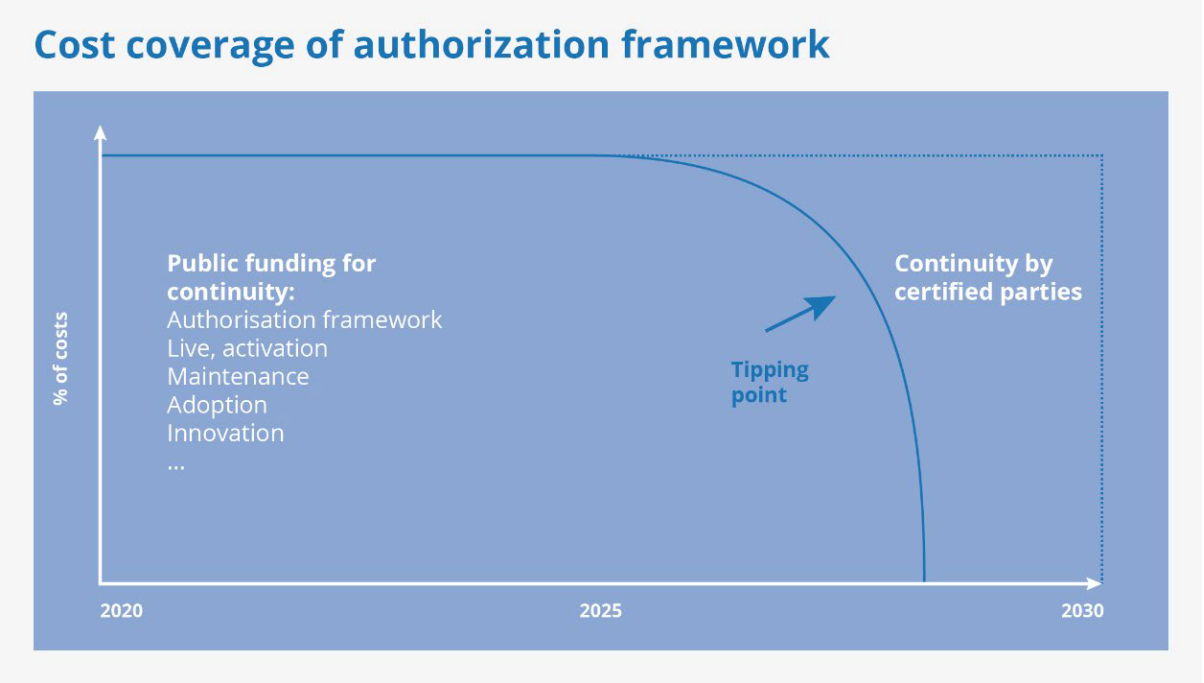

Figure 1: Cost coverage of authorization framework

As Figure 1 suggests, the initial funding must be provided by public money to accelerate the 'flywheel'. Over time the data space participants will contribute to funding, and once the break-even point is reached public funding can be reduced to zero. With a proper setup and proper funding, the tipping point could be reached within six to eight years after the project start. The vision of European data spaces and the associated 'soft infrastructure' can be turned into reality at an estimated 1.5 to 2.0 billion euros within the decade. (Design Principles for Data Spaces, 2021)

2. Overview of Key Concepts

2.1 Definition

A data space is defined by the DSSC (Data Spaces Support Center) in its glossary as "*an infrastructure that enables data transactions between different data ecosystem parties based on the governance framework of that data space. Data space should be generic enough to support the implementation of multiple use cases*" (Catalogue of Specifications, 2023).

It's designed to be flexible, and capable of supporting various use cases without needing a complete overhaul every time. Data spaces play a vital role in the development of smart and sustainable cities and communities, where the use of data is essential for addressing complex urban challenges. With the use of advanced technologies such as artificial intelligence (AI), and big data, data spaces enable stakeholders to harness the power of data to optimise integration and improve services.

In Figure 2 the traditional data sharing infrastructure consists of data connections that are custom made between each company. This infrastructure needs to be created every time a new company joins, which takes time and money to create. Whereas the data space infrastructure companies all have access to the data space, and a new company can join and have access to this data space, with the governance and compliance rules in place to prevent security and trust issues. This saves time and money compared to having to set up each individual data infrastructure.

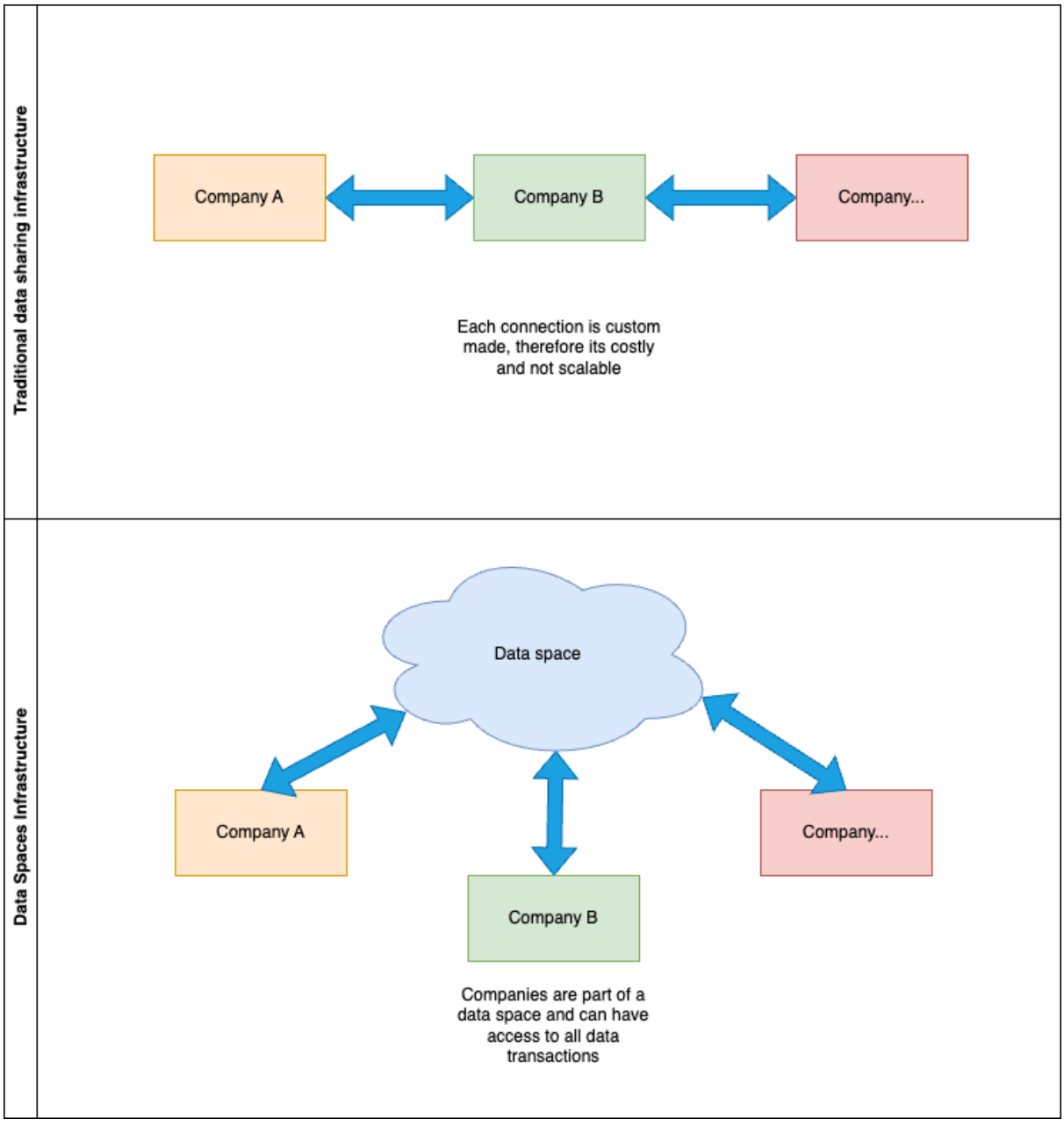

Figure 2: Data Spaces Infrastructure Comparison

2.2 Data Space Start-up Checklist

The DSSC put forward the following set of questions to answer when setting up a data space (Figure 3). These questions are categorised across five dimensions: business, legal, operational, function and technical (BLOFT framework). (Starter Kit for Data Space Designers, 2023)

Figure 3: Data Spaces start-up checklist according to the BLOFT framework

2.3 Key Characteristics

The key characteristics of a data space include:

- A secure and privacy-preserving IT infrastructure to access, process, share and use data.
- A data governance mechanism, comprised of a set of rules of administrative and contractual nature that will determine the rights to access, process, use and share the data in a trustful manner that is still compliant with existing legislation.
- The presence of vast amounts of data that are made available on a voluntary basis.
- Participation of an open number of organisations/individuals keeping in mind the rules and ensuring non-discriminatory access for all participants.

3. Building Blocks

A building block or BB is an open and reusable digital solution. It can take the form of a framework, a standard, software or software as a service (SaaS) or any combination of these. The building blocks can be divided by means of technical and governance building blocks as shown below (Figure 4).

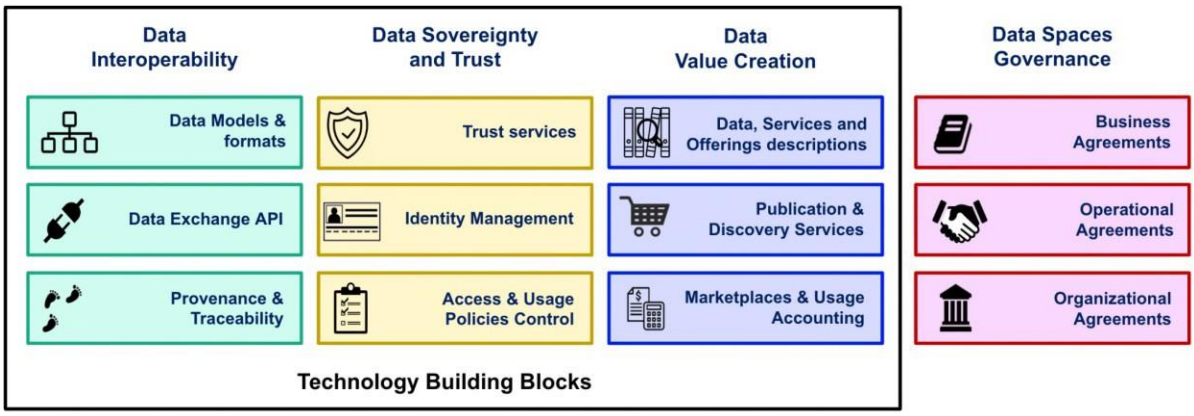

Figure 4: Building Blocks taxonomy recommended by OpenDEI and adapted by the DSBA Technical Convergence Discussion Document

These building blocks which are endorsed by the European Commission ensure that a digital service will be fully compatible with others on the market. Examples of these include eSignatue, eInvoicing, eID etc.

The European Commission has launched initiatives that are free to enable users to make use of these building blocks and have access to a support centre to provide tools, blueprints, and best practices for data spaces. Including a dataspaces starter kit that guides the relevant community resources and materials that are available. (Starter Kit for Data Space Designers, 2023)

- **Interoperability**: Different systems and participants within a dataspace can interpret data consistently, facilitating seamless exchange.
- **Trust**: Trusted access, and exchange among participants.
- **Data value**: The true value of data lies in its utilisation.
- **Governance**: A clear set of rules and guidelines.

4. MIMs

Looking deeper into dataspaces and building blocks we come across MIMs (Minimal Interoperable Mechanisms). MIMs are the minimal but sufficient capabilities which are used to achieve the interoperability of data, and systems. MIMs are vendor-neutral and technology-agnostic so that anybody can use and integrate them into their systems.

The figure below (Figure 5) shows how different MIMs can be applied or mapped to the building blocks of data spaces. A building block can consist of one or more MIMs. For example, MIM1 is about the data exchange API.

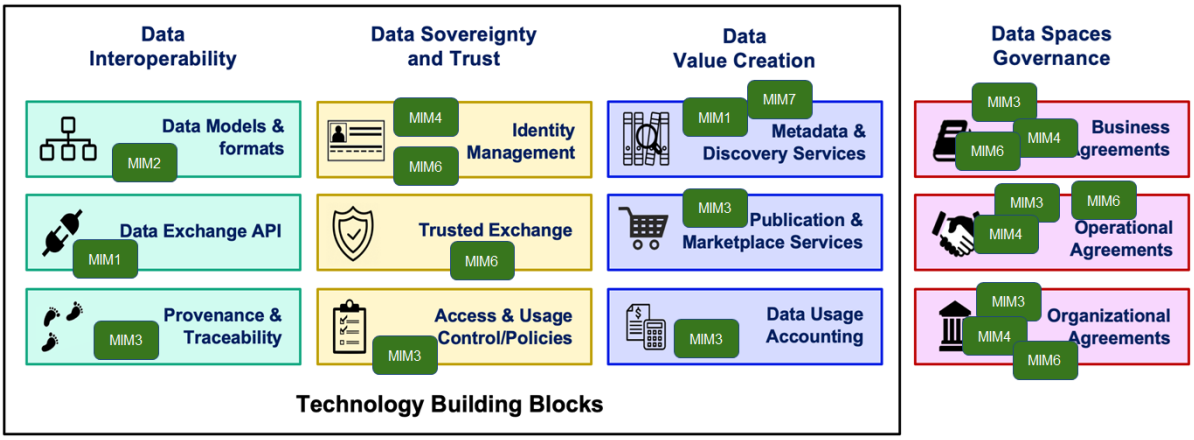

Figure 5: MIMs mapping into Data Spaces Building Blocks

The “minimal” is used to describe something that can meet a specific objective without unnecessary complexity. Enabling users to put basic implementations in place to achieve the specific objectives.

Here's a breakdown of key aspects of MIMs:

- Focus: MIMs focus on the essential data needed for a specific purpose, avoiding unnecessary complexity.
- Structure: MIMs typically define data entities, their attributes (characteristics), data types (e.g., integer, string), units of measurement (when applicable), and relationships between entities.
- Benefits: By establishing a common understanding of data, MIMs enable several advantages:
    - Interoperability: Different systems and participants within a dataspace can interpret data consistently, facilitating seamless exchange.
    - Reduced Integration Complexity: MIMs act as a common language, simplifying the process of integrating different data sources.
    - Improved Data Quality: Clear definitions ensure data is captured and represented accurately.

5. Applications and Use Cases

As mentioned before data spaces should be sector agnostic. Figure 6 is an example of the different sectors that can involve data spaces. Combining data from these different sectors within data spaces creates more benefits than compared to just focusing on one sector. Depending on the use cases of the data spaces.

Figure 6: Data Spaces Sectors

Figure 7 shows examples of the functionalities of data spaces.

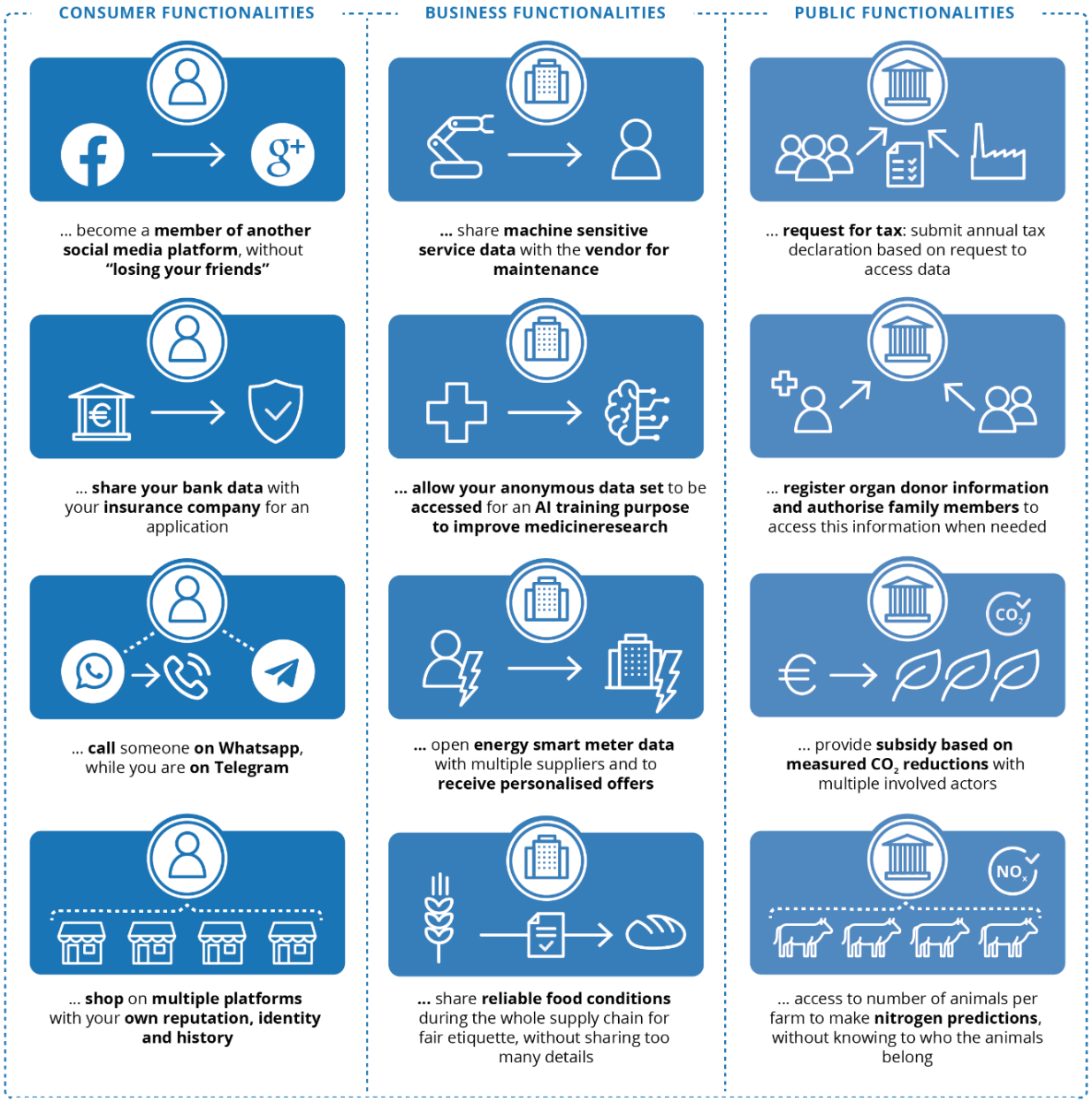

Figure 7: Some expressions of new possibilities in the data economy.

The application of MIMs can be found in various domains:

- **Smart Cities:** MIMs can standardize data exchange for traffic management, energy efficiency, and waste collection within a smart city ecosystem.
- **Environmental Monitoring:** MIMs can ensure consistent reporting of environmental data from sensors in air quality monitoring networks.
- **Manufacturing:** MIMs can facilitate data exchange between manufacturing equipment and enterprise resource planning (ERP) systems.
- **Healthcare:** MIMs can promote interoperability of patient data across different healthcare providers.

6. Challenges and Considerations

While dataspaces and MIMs offer significant benefits for data exchange and interoperability, there are challenges and considerations to address for successful implementation.

Challenges for Dataspaces:

- **Standardization and Adoption:** Reaching consensus on common MIMs across different sectors and stakeholders can be complex. Proprietary data formats and existing infrastructure may create resistance to adoption.
- **Data Governance and Security:** Dataspaces involve data from various sources, raising concerns about data ownership, access control, and security. Establishing robust data governance frameworks is crucial.
- **Data Quality and Consistency:** Ensuring consistent data quality across diverse data sources within a dataspace remains a challenge. Data cleaning, normalization, and validation processes are essential.
- **Technical Complexity:** Integrating data from disparate systems and managing data exchange protocols can be technically complex, requiring expertise and resources.

7. Conclusion

The potential applications of data spaces are vast, involving various sectors like smart cities, environmental monitoring, and healthcare. By enabling the combination of data from these domains, data spaces offer even greater benefits compared to individual sector data combinations.

However, challenges remain in implementing data spaces successfully. Achieving consensus on standardized MIMs across different stakeholders and addressing concerns about data governance, security, and quality are crucial aspects to consider.

In conclusion, understanding data spaces is essential for navigating the future data landscape. This document serves as a foundation for further exploration and research in the data spaces field.

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Table of Figures