

WHITE
PAPER



The Role of Data Spaces in the Digital Economy



Based on Group Caisse des Dépôts Publication
"Decoding Data Spaces at the Service of Economic
Sectors and Public Policies"

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FOREWORD

Ulrich Ahle

Chief Executive Officer, Gaia-X

Data Spaces: A Driver of Digital Sovereignty, Economic Innovation, and a Resilient European Future

In a world where data is the driving force behind innovation and competitive strength, secure and efficient sharing of information is no longer optional but essential. This white paper, “The Role of Data Spaces in the Digital Economy”, articulates our shared vision for a future where interoperability and trust serve as the pillars of a resilient, sovereign digital ecosystem.

At Gaia X, we build frameworks that break down data silos and enable safe data sharing. Working with stakeholders such as Caisse des Dépôts and Institut Mines Télécom, our goal is to equip European industries and public administrations with the tools for digital transformation, compliance, and growth.

This document demonstrates that Data Spaces are not simply technical infrastructures but dynamic economic models that drive innovation, preserve digital sovereignty, and facilitate ecological transition. Secure, federated data environments are the foundation on which Europe’s competitive edge is built, ensuring that our digital services remain both innovative and true to European values.

The strategies and insights presented here pave the way for a digital economy where data-driven collaboration is the norm. We can transform challenges into opportunities through collective effort—enhancing performance, streamlining operations, and safeguarding our digital autonomy. Gaia X is proud to be at the forefront of this transformation, championing initiatives that advance technological progress and fortify our economic sectors’ resilience and competitiveness.

I invite you to read this document and join us in forging a more interconnected, secure, and forward-looking digital future for Europe. Together, we can build an ecosystem where trust and innovation work hand in hand, supporting the needs of today while laying the groundwork for tomorrow.



FOREWORD

Olivier SICHEL

Interim Chief Executive Officer, Caisse des Dépôts Group

Trusted Data Spaces: A driver of competitiveness for our economic sectors and a tool for regional resilience at national and European scales

In early February, governments and private sector stakeholders met in Paris to discuss global harmonization of artificial intelligence (AI) governance, focusing particularly on how to leverage this technology for the common good and public interest. Europe, at the forefront of this discussion, must reduce its economic and technological dependencies while enhancing its competitiveness by fostering AI-driven innovation.

In a world where AI is becoming a powerful tool for competitiveness, data spaces have emerged as a key component to fully unlock AI's potential. Without reliable and consent-based data to train AI models, this technology will not be able to deliver on its promises—neither for our economic sectors nor for our regions.

Data have become a highly strategic resource. However, they are currently fragmented across various stakeholders and requires a trusted framework to facilitate secure sharing.

Data spaces address this need. They are not merely technological infrastructures; they serve as the foundation for secure and trusted data sharing—an essential condition for training AI models tailored to the specific needs of strategic industries and territories. By enabling the development of reliable, high-quality data-driven services within trusted ecosystems, they foster collaborative innovation while ensuring that data is used with the consent of its owners.

By facilitating the adoption of customized AI technologies and leveraging the full potential of open-source solutions, data spaces help to transform challenges into opportunities—whether in industry, agriculture, or public services.

By pooling data usage, these infrastructures also play a crucial role in addressing climate and environmental emergencies. Thanks to their ability to model complex ecosystem mechanisms, data spaces provide fertile ground for developing concrete solutions to accelerate the ecological transition, reduce emissions, and preserve biodiversity.

Moreover, data spaces contribute to digital sustainability by optimizing resource usage for specific activities. Their decentralized architecture reduces storage redundancies, thereby mitigating the environmental impact of digital technologies.

In 2025, data spaces stand out as an essential solution for tackling both environmental and economic challenges.

At Caisse des Dépôts, we firmly believe that data and AI—when orchestrated through data spaces—represent the future of the European digital economy and a strategic lever for a successful ecological transformation.

This is why we actively support the deployment of these infrastructures, which form the foundation for building a sovereign, innovative, and sustainable European economy.

White Paper: The Role of Data Spaces in the Digital Economy

Acknowledgements

The **Gaia-X White Paper**, titled “**The Role of Data Spaces in the Digital Economy**,” is rooted in the foundational work conducted by Caisse des Dépôts, as highlighted in “[Decoding Data Spaces at the Service of Economic Sectors and Public Policies](#).” This effort focuses on creating secure and decentralised systems for reliable data exchange while ensuring compliance with European regulations and maintaining data sovereignty.

Caisse des Dépôts, a French public financial institution, has been key in developing and structuring Data Spaces. Their expertise in building trusted data-sharing environments has provided valuable insights into establishing governance frameworks and infrastructure that support innovation and reduce reliance on vendor locked-in technology.

In collaboration with Gaia-X and the Institut Mines Télécom, initiatives like the TechSprint programme have promoted interoperability and the co-construction of use cases. These efforts aim to enhance technological development and support ecological transition.

This endorsement exemplifies the joint efforts of public and private sectors to build a resilient and competitive European digital economy.

1. Introduction

Data has become a strategic asset in today’s digital landscape, essential for economic competitiveness and technological innovation. However, the vast amounts of data generated across industries remain fragmented, limiting their full potential. Data Spaces offers a solution by enabling secure, federated, and interoperable data sharing among businesses, governments, and research institutions.

A Data Space is not just a technical infrastructure but an economic and governance model that ensures data sovereignty, security, and trust while enabling cross-sector collaboration. Implementing data spaces is critical for Europe’s digital sovereignty, particularly in light of global competition and the increasing dominance of non-European cloud and AI providers.

This paper explores Data Spaces’ architecture, benefits, governance, and business models, emphasising their role in Europe’s strategic digital autonomy and their potential to drive AI innovation.

2. The Value of Data Spaces

Data Spaces are trusted environments where participants can share and access data under common governance rules. Their benefits extend beyond individual organisations to entire industries and public policy domains. They facilitate a secure and structured framework that ensures compliance with regulatory frameworks while maintaining technological neutrality and business flexibility.

Data Spaces represent a fundamental shift in how organisations share, govern, and utilise data. Unlike traditional data-sharing methods, which often involve bilateral agreements and manual processes, Data Spaces introduce automated trust mechanisms, decentralised governance, and seamless interoperability. This enables efficient data exchanges across sectors, geographies, and industries, fostering economic growth and technological innovation.

2.1. Economic Competitiveness

Keeping control of data and mastering its use are the first elements of a company's competitive advantage. Organisations gain an edge by protecting customer data, trade secrets, and analytics, ensuring they understand where data comes from and how it is used. Concerns surrounding competition, quality, traceability, and transparency are among the core reasons why businesses hesitate to share data. However, the potential offered by data-sharing ecosystems—both along the value chain and in extended enterprise collaborations—is widely acknowledged as a game-changer.

Data Spaces allow businesses to access high-quality, real-time data, fostering new business models and service innovations. By enabling interoperability, they reduce data silos and allow industries to scale efficiently. For example, Catena-X enables manufacturers and suppliers to improve supply chain efficiency and sustainability in the automotive sector by seamlessly exchanging operational data. Similarly, BoostAeroSpace facilitates secure collaboration among industry leaders in aerospace, ensuring faster and safer technological advancements. Beyond these sectors, data-driven decision-making and predictive analytics are improving financial forecasting, logistics optimisation, and digital twin simulations, all powered by federated Data Spaces.

To remain competitive, companies must leverage data as a key enabler to enhance their operational efficiency and environmental sustainability. Data-driven strategies improve business outcomes through increased sales, reduced operational costs, and pooled investments in data-sharing infrastructure. For instance, industries can generate new revenue streams by selling data-driven digital services, improving customer satisfaction through enhanced value chain insights, and incorporating environmental factors into their business models. On the cost-reduction side, better data usage allows for more efficient customer-supplier data exchanges, optimised production processes, and administrative simplification. Finally, industries benefit from shared investment in data-sharing infrastructures, reducing duplication and ensuring cost-effective innovation.

Concrete examples demonstrate the transformative impact of Data Spaces. The Digital TER-X 2050 project in France aims to structure the entire construction industry by standardising data-sharing protocols, improving project coordination, and reducing costly rework due to missing data. Similarly, BoostAeroSpace has driven efficiency across the aerospace and defence industry by creating a secure and collaborative digital ecosystem. Meanwhile, EONA-X has optimised travel coordination in passenger

transport, improving safety and reducing costs by addressing structural inefficiencies in mobility networks. It has also contributed to better care of people with disabilities during their trips during the 2024 Paris Olympics.

Pooling investments in data-sharing boosts industry competitiveness, but profitability depends on industry structure. Concentrated industries see quicker returns once public funding ends, aided by standardised international ontologies that reduce adoption barriers. In fragmented industries, additional measures like environmental protection and fair access for SMEs are needed. National-level standardisation serves as a foundation for broader European or global harmonisation.

For SMEs, Data Spaces provide a crucial competitive advantage, granting access to richer ecosystems and eliminating trust barriers in data exchanges. With orchestrators ensuring compliance, SMEs can confidently protect their competitive insights, integrate cutting-edge technologies, and benefit from as-a-service solutions that lower entry barriers. This allows smaller firms to engage in high-value data transactions without needing in-depth technical expertise, accelerating innovation and expanding market opportunities.

Data Spaces empower companies to remain competitive and ensure that industries operate efficiently and sustainably. By unlocking the potential of interoperable, federated data ecosystems, businesses can enhance productivity, reduce costs, and foster new forms of digital collaboration, making them essential drivers of Europe's economic resilience and global leadership in data-driven innovation.

2.2. Securing the Supply of Qualified Data for AI Innovation

The success of AI-driven digital services relies on access to high-quality, sector-specific data, which is currently fragmented across industries and governments. Data Spaces provide the essential infrastructure for ensuring that data is available in both quantity and quality, enabling AI models to be trained on reliable, representative, and diverse datasets. By fostering secure data-sharing ecosystems, Data Spaces support the development of innovative AI-powered applications while preserving data sovereignty and compliance with European regulations.

Corporate and government datasets, unlike user-generated data, hold significant strategic value and are often inaccessible to major AI players. By making these datasets available through federated data spaces, Europe can create collaborative AI models while ensuring strong governance and ethical standards. The strategic importance of this data is highlighted by non-European companies' efforts to gain access through lobbying, regulations, and market strategies.

Data Spaces enable secure access to structured data, allowing technology providers to develop advanced AI solutions like predictive analytics, digital twins, and generative AI models. Using trusted, industry-specific data, Data Spaces delivers more effective AI solutions than generic models from hyperscalers. They also support autonomous AI execution with full auditability and traceability. Additionally, Data Spaces ensure regulatory compliance and digital sovereignty, empowering European businesses and policymakers to control their data assets and foster a competitive, ethical AI ecosystem.

2.3. Contributing to the Efficiency of Public Policies

Data Spaces are essential for economic competitiveness and AI innovation and serve as strategic tools for modernising public administration and improving policy implementation. By enabling secure, efficient, and decentralised data-sharing infrastructures, they provide governments with better decision-making capabilities, facilitate public-private collaboration, and reduce administrative costs while ensuring compliance with European digital strategies.

Governments increasingly rely on data-driven policymaking to enhance public services, improve regulatory enforcement, and optimise resource allocation. However, the fragmentation of public sector data across multiple agencies, jurisdictions, and administrative bodies leads to inefficiencies, duplication of efforts, and delays in service delivery. Data Spaces offer a solution by providing a unified and trusted framework for sharing public data across different entities, ensuring that relevant information is accessible while maintaining privacy, security, and governance controls.

Deploying sector-specific data-sharing infrastructures enables governments to improve administrative efficiency, simplify processes for businesses and citizens, and enhance policy coordination. These infrastructures provide an investment return significantly higher than their operational costs, generating substantial public sector savings. Reducing redundancies, automating regulatory compliance, and streamlining services are particularly valuable in resource-constrained budgetary environments, making data spaces a cost-effective enabler of digital transformation in public administration.

2.4. Accelerating the Implementation of the Ecological Transition

The ecological transition demands a data-driven approach to sustainability, climate adaptation, and resource optimisation. Data Spaces serve as critical infrastructure for collecting, analysing, and sharing environmental data, enhancing decision-making and reducing ecological footprints. By providing unified access to data from diverse sources—such as renewable energy monitoring, waste management, and carbon tracking—Data Spaces enable stakeholders to model risks, assess impacts, and develop sustainable policies.

A key aspect of Data Spaces in sustainability is digital sobriety, which reduces the environmental impact of digital infrastructure. Unlike traditional methods that duplicate data and increase energy use, Data Spaces allow decentralised access through APIs and controlled transactions. This minimises data processing, cuts cloud storage energy consumption, and optimises resource allocation.

As governments seek to enhance climate action strategies, public-private partnerships in Data Spaces will become key enablers of carbon neutrality, resource efficiency, and biodiversity conservation. By facilitating access to critical environmental data, standardising sustainability metrics, and improving cross-sector coordination, data spaces will be essential for achieving climate adaptation, emission reduction, and a circular economy in Europe and beyond.

2.5. Guaranteeing Digital Sovereignty and Technological Independence

In an era where data is the cornerstone of economic and technological power, ensuring digital sovereignty and technological independence has become a strategic priority for European industries. Data Spaces provide a trusted, decentralised framework that enables participants to retain full control over their data, define access and confidentiality levels, and engage in secure, value-driven exchanges while mitigating risks associated with external dependencies.

Unlike centralised data-sharing models that rely on third-party control, data spaces ensure that data remains with its rightful owners, accessible only through secure, standardised communication channels. This approach strengthens Europe's digital autonomy by ensuring that data is exchanged without compromising sovereignty, security, or compliance with European regulations.

At the heart of Data Spaces' governance models lies a framework of trust and contractual clarity, where all stakeholders agree on predefined rules for data transactions. These rules establish data usage rights, authorisation mechanisms, and consent protocols, ensuring that sensitive business data, trade secrets, and proprietary insights remain protected. Additionally, the role of a trusted orchestrator, acting as a neutral third party, ensures compliance and harmonised execution of automated data-sharing processes.

3. Data Sovereignty and Compliance with European Regulations

The Data Governance Act and the Data Act form the regulatory foundation for ensuring that Data Spaces are structured around European legal principles. Data Spaces enable automated compliance, standardised security policies, and transparent data access control by integrating privacy-by-design principles and industry-specific governance models. This ensures that businesses, public administrations, and research institutions operate within a legally sound and interoperable data-sharing ecosystem.

Beyond individual data ownership, the concept of sectoral digital sovereignty has gained prominence, particularly in light of geopolitical and extraterritorial risks. The European regulatory vision for data spaces is designed to shield European businesses and institutions from foreign data control and economic espionage. This effort is particularly crucial given the increasing use of foreign legislation to access and exploit European data assets, such as:

- The U.S. Cloud Act and Foreign Intelligence Surveillance Act (FISA): These laws enable American authorities to request access to data stored on U.S.-controlled cloud services, even when that data is hosted within Europe. This poses risks for corporate trade secrets, research data, and critical infrastructure information, making it imperative for European entities to rely on trusted, sovereign data-sharing frameworks.
- China's Economic Doctrine on Data as an Intangible Asset: China has begun valuing data as a key corporate asset on balance sheets, which positions Chinese firms to expand their dominance in global data transactions. This approach raises concerns about unbalanced competition and the potential economic dependency of European companies on Chinese data marketplaces.

By reinforcing compliance, transparency, and trust, Gaia-X and the European sectoral Data Spaces provide the necessary framework to counteract foreign control over European data assets while ensuring that digital transactions and AI models remain governed by European principles.

4. Functional Architecture

A data space operates through a decentralised and interoperable framework with the following key components:

4.1. Sector-specific: A sector-specific Data Space is a collaborative environment designed to facilitate data exchange and interoperability among various stakeholders within a particular industry. It is not a software publisher or a data platform but serves as a structured ecosystem that integrates a diverse range of participants and technologies.

4.2. Diverse Participation:

- Involves private and public entities.
- Includes data holders, data users, and technology players providing building block technologies.

4.3. Two-Level Organization:

- Strategic:
 - Manages participant relationships.
 - Defines the organisational, legal, and economic framework.
 - Develops ontologies and a semantic interoperability repository.
 - Defines use cases and pricing agreements.
- Technical Orchestration:
 - Identifies the orchestrator and defines roles.
 - Implements industry governance rules.
 - Manages technological infrastructure to secure data transactions.

4.4. Flexible Use Case Deployment:

- Allows participants to implement use cases either within a closed group or, more broadly, within the industry sector through a Data Intermediation Service Provider (DISP).

4.5. Business Problem Solving and Process Simplification:

- Focuses on practical use cases such as:
 - Improving supply chain management.
 - Routing of parts.
 - Inventory management.
 - Quality control.
 - Coordinating suppliers for large-scale projects like the Paris 2024 Olympic Games, nuclear power plants, Grand Paris Express, and aircraft manufacturing.

The Data Space aims to foster collaboration and innovation by providing a structured framework and secure infrastructure that enables seamless data exchange and interoperability. This approach enhances efficiency and drives innovation and competitiveness within the industry.

5. Economic Models

Data Spaces introduce a novel organisational and economic model where collaboration replaces centralised data ownership. Unlike platforms like Airbnb, where a single entity silos data, Data Spaces enable multiple players to share data and co-construct services that serve their collective interests.

Key elements include:

- **Collaborative Data Sharing:** A meeting point for diverse participants who engage in open innovation and share costs.
- **Balanced Economic Model:** The value lies in the synergy between use cases (handled by participants) and infrastructure management (orchestrated by a central entity).
- **Monetisation and Value Creation:** Through shared data logic and convergent interests, participants can collectively generate and distribute value, ensuring fairness and preventing monopolisation.

Governance and Regulation experts at Université Paris Dauphine and the Toulouse School of Economics are analysing the economic levers and profitability grids for data spaces. Key economic risks include:

- Assessing the value-added for participants.
- Sharing initial infrastructure costs.
- Role of public financing (subsidies, repayable advances, investment capital, public procurement).
- Guaranteeing profitability for participants and the orchestrator.
- Return on investment (ROI).
- Equitable value-sharing to prevent monopolisation.
- Monetisation of data access, usage, and orchestrator services.
- Member billing models for both founding and new participants.

The most significant challenge is financing the Build phase, which requires creating a network of players and the orchestrator until critical mass is reached. This phase demands substantial funding (between €15 million and €50 million over four years). European data space projects reveal that reaching profitability hinges on achieving critical mass in participants, data offerings, and transactions, making this phase particularly complex and cash-strapped.

6. The Role of Gaia-X in Digital Sovereignty

To implement this vision of European digital autonomy, Gaia-X provides a harmonised regulatory framework that ensures compliance with both EU-wide regulations and industry-specific governance models. The Gaia-X framework contributes to:

- Building confidence in cloud, data, and AI services by ensuring that all transactions meet strict security and compliance requirements.
- Structuring data-sharing channels with a decentralised, interoperable, and secure architecture, ensuring that data flows remain under European governance.
- Protecting European players against foreign interference and unauthorised access to sensitive data, reinforcing resilience in critical industries such as finance, healthcare, and manufacturing.
- Reducing dependency on non-European hyperscalers and technology providers, ensuring that European businesses have alternative, trusted solutions that align with their strategic interests.

By empowering industries with sovereign data-sharing infrastructures, Gaia-X and the broader European data space ecosystem enable businesses to engage in AI-driven innovation, cross-sector collaboration, and global digital transactions—all while maintaining full control over their assets.

7. Conclusion

Data spaces are critical infrastructure for Europe's digital sovereignty, AI leadership, and economic resilience. Their implementation requires technical standardisation, governance frameworks, and sustainable business models. While challenges remain, the potential benefits far outweigh the costs, positioning Data Spaces as a key enabler for the future of Europe's digital economy.

To achieve long-term success, policymakers, businesses, and research institutions must work together to scale up adoption, ensure financial sustainability, and foster global interoperability. Initiatives like Gaia-X, Data Spaces Business Alliance (DSBA), and European Data Spaces programmes are paving the way, ensuring that Data Spaces become a cornerstone of Europe's digital future.

TechSprint by Caisse des Dépôts : fostering data sharing and AI-driven innovation to accelerate the ecological transition



The TechSprint program is a data-sharing accelerator for innovative Data/AI solutions that concretely contribute to accelerating the ecological transition in key sectors such as real estate, energy, logistics, mobility, water management, and natural resource preservation.

TechSprint engages startups, large corporations—foremost among them subsidiaries of the Caisse des Dépôts Group— public institutions and operators, academic organizations, professional associations and local governments through three main initiatives:

- 1. Bringing together the ecosystem of digital players committed to ecological transition.**
This initiative fosters collaboration between public and private stakeholders to accelerate innovation and drive impactful projects.
- 2. A Call for projects to support Greentech solutions.**
TechSprint identifies and supports Greentech solutions co-developed with industry partners, with a six-month acceleration program providing access to first-class experts from French key players, and resulting in proven scaling of the solutions.
- 3. A Program supporting the development of data spaces.**
These multi-stakeholder data-sharing platforms address key national challenges in ecological transformation, such as water resource preservation ; reduction of greenhouse gas emissions in freight transport ; ecological and energy transition in the real estate sector ; territorial resilience to climate-related hazards.

Call for Applications

Applications for the TechSprint program related to data spaces are open until the end of June 2025. Interested candidates can submit their proposals or request further information by contacting us at techsprint@caissedesdepots.fr. For specific inquiries, you may also reach out to Audrey Gortana Vallet, Director of the Techsprint Program (audrey.gortanavallet@caissedesdepots.fr).



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