

data.europa.eu and the European Common Data Spaces

A report on challenges and opportunities

data.europa.eu

The official portal for European data

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Last updated 2 May 2022

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Luxembourg: Publications Office of the European Union, 2022
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OA-07-13-207-EN-N

ISBN: 978-92-78-42939-3

doi: 10.2830/91050



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This is the first in a series of two reports that analyse the role that data.europa.eu could play in the context of the emerging common EU data spaces envisaged in the European strategy for data. We report on desk research on documentation relating to the European strategy for data, and emerging technical and business case documents related to various initiatives across Europe that are working on data space implementation. We also conducted interviews with members of some of the teams implementing these data spaces.

The second report, which will be delivered after data space implementation reports become available, will explore three data space scenarios in which data.europa.eu is a data holder or intermediary and will discuss in detail challenges and opportunities for data.europa.eu in the context of these developments.

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Executive summary

Data spaces are central to the European strategy for data. The strategy envisages ‘a European data space as a genuine single market for data where personal and non-personal data, including sensitive business data, are secure and businesses have easy access to high-quality industrial data, boosting growth and creating value’.

This report explores existing and emerging developments and initiatives around data sharing using data spaces (from the International Data Spaces Association, Gaia-X and Open DEI). Our aim is twofold: to identify holders of open data who are involved in ongoing data space implementation and to reflect on the role that open data portals (with a special focus on data.europa.eu) could play in this implementation.

Having undertaken desk research and carried out interviews with developers of data spaces and data space architectures, we discuss how data.europa.eu could position itself in emerging European common data spaces in the core areas discussed in European policy papers, as well as in other data spaces that are currently under development at city and regional levels in various European countries.

Although this is just the first of two studies, and no fully fledged data spaces are yet available, we can draw the following far-reaching conclusions.

1. **Open data are commonly mentioned alongside private and personal data as a core type of data source.** However, open data holders are not well positioned or involved in initiatives developing data space reference architectures or implementation approaches. If this state of affairs persists, the use and impact of open data could be reduced owing to the friction that may occur when combining the use of data shared in data spaces and the use of data published in open government portals.
2. **Open data holders have extensive experience in data publishing, metadata management, data quality, dataset discovery and data federation, as well as tried-and-tested standards (e.g. Data Catalog Vocabulary) and technologies.** There seems to be very little knowledge/technology transfer from the open data community to the data spaces community, which is a missed opportunity. Data spaces should not reinvent methods that the open data community has already developed, tested and used extensively.
3. **Whether the data are private, shared or open, using data from multiple sources requires interoperability at several levels, from identity providers to vocabulary providers.** The question of which data intermediaries will act as neutral agents to ensure interoperability is underexplored in the data spaces context. Public administrations, building on their experience of publishing open data, are best placed to take on such roles.

In a follow-up report, expected in 2023, we will undertake an in-depth case study analysis, based on the actual implementation of data spaces, to verify these initial findings and discuss challenges and opportunities for data.europa.eu in greater detail.

1. Introduction

A data space can be defined as a ‘type of data relationship between trusted partners, each of whom apply the same high standards and rules to the storage and sharing of their data ... In data spaces, data are not stored centrally but at source and are therefore only shared (via semantic interoperability) when necessary.’⁽¹⁾

Many similar definitions to this have been issued by ongoing initiatives in Europe and worldwide that aim to develop the foundations of data spaces in specific sectors (energy, mobility, manufacturing, etc.), as well as across sectors.

Data spaces are at the core of the European strategy for data, which envisages ‘a European data space as a genuine single market for data where personal and non-personal data, including sensitive business data, are secure and businesses have easy access to high-quality industrial data, boosting growth and creating value’ (European Commission, 2021a).

In this policy context, the European strategy for data announced the development of an initial set of nine sectoral data spaces, with more sectors to be added in due time. These initial European common data spaces are:

- an **industrial/manufacturing data space**, supporting the competitiveness and performance of the EU’s industries;
- a **Green Deal data space**, to use the major potential of data to support the Green Deal priority actions on issues such as climate change, a circular economy, pollution, biodiversity and deforestation;
- a **mobility data space**, to position Europe at the forefront of developing an intelligent transport system;
- a **health data space**, essential for advances in preventing, detecting and treating diseases as well as for informed, evidence-based decision-making to improve healthcare systems;
- a **financial data space**, to promote innovation, market transparency and sustainable finance, as well as access to finance for European businesses and a more integrated market;
- an **energy data space**, to promote the stronger availability and cross-sector sharing of data, in a customer-centric, secure and trustworthy manner;
- an **agriculture data space**, to enhance the sustainability performance and competitiveness of the agricultural sector through processing and analysing data;
- **data spaces for public administrations**, to improve the transparency of and accountability for public spending and spending quality, fighting corruption, both at EU and national levels;
- a **skills data space**, to reduce the skills mismatches between the education and training systems and labour market needs.

⁽¹⁾ <https://www.gaia-x.eu/what-is-gaia-x/data-spaces>, last accessed: 28 February 2022.

Besides these nine initial European common data spaces, there are also some references to the European Open Science Cloud as another strategic field that is relevant to the development of data spaces.

The recently released *Commission Staff Working Document on Common European Data Spaces* (European Commission, 2022) highlights some of the key features that a common European data space should have:

- a secure and privacy-preserving infrastructure to pool, access, share, process and use data;
- a clear and practical structure for accessing and using data in a fair, transparent, proportionate and non-discriminatory manner, and clear and trustworthy data governance mechanisms;
- European rules and values, in particular personal data protection, consumer protection legislation and competition law, are fully respected;
- data holders have the opportunity, in the data space, to grant access to or to share certain personal or non-personal data under their control;
- data that is made available can be reused without compensation, including remuneration, or for free;
- participation of an unlimited number of organisations/individuals.

As a result of all these developments, several work programmes and calls for proposals in the digital Europe programme (European Commission, 2021b) have already started asking for project proposals to run preparatory actions to create data spaces, with deadlines for submission in the first half of 2022. This includes a list of data spaces that is slightly different (although overlapping) with the initial nine, including the **Green Deal** data space (European Commission, 2021b, Section 2.2.1.1) and a data space for **smart communities** (European Commission, 2021b, Section 2.2.1.2), as well as data spaces for **mobility** (European Commission, 2021b, Section 2.2.1.3), **manufacturing** (European Commission, 2021b, Section 2.2.1.4), **agriculture** (European Commission, 2021b, Section 2.2.1.5), **cultural heritage** (European Commission, 2021b, Section 2.2.1.6), **health (genomics)** (European Commission, 2021b, Section 2.2.1.7), the **media** (European Commission, 2021b, Section 2.2.1.8), **finances** (European Commission, 2021b, Section 2.2.1.9), **skills** (European Commission, 2021b, Section 2.2.1.10), **languages** (European Commission, 2021b, Section 2.2.1.11), **public procurement** and **security and law enforcement** (European Commission, 2021b, Section 2.2.1.12), **tourism** (European Commission, 2021b, Section 2.2.1.13) and **energy** ⁽²⁾. After these preparatory actions, the European Commission expects the corresponding data spaces to be deployed, with support from the Data Spaces Support Centre. Figure 1, taken from the European Commission (2021b), summarises some of the main activities funded through calls due in the first half of 2022.

⁽²⁾ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2021-d3-01-01>, last accessed: 28 February 2022.

Data spaces	Preparatory actions for the Green Deal data space
	Preparatory actions for the data space for smart communities
	Preparatory actions for the data space for mobility
	Preparatory actions for the data space for agriculture
	Health data space
	Preparatory actions for the data space for manufacturing
	Preparatory actions for the data space for skills
	Preparatory actions for the data space for tourism
	Data spaces Support Centre

Figure 1. Some of the preparatory actions for the European common data spaces.

A common theme among these data spaces is around public sector open data for artificial intelligence and open data platforms (European Commission, 2021b, Section 2.2.2.2). Both aim to increase the availability, quality and usability of public and private sector information in compliance with the open data directive (European Parliament and the Council of the EU, 2019) and in relation to the high-value datasets that are being identified in the implementation acts. These datasets are considered to contain highly ‘relevant data that will feed into the different data spaces’ (European Commission, 2022).

In fact, a large share of public datasets that may be relevant to these emerging data spaces is already available and catalogued in data.europa.eu, which could act as a central point of access to these sectoral data spaces, bringing together resources from the public sector. For example, at the time of writing there are around 48 000 datasets on transport, potentially useful for the European mobility data space or for any other local mobility data spaces being created in Europe. In addition, there are, among others, more than 300 000 datasets on agriculture, fisheries and forestry; more than 260 000 datasets on the environment; and approximately 185 000 datasets on justice and legal systems. Most preparatory actions discussed previously will generate priority lists of datasets that are relevant to the corresponding data space. They will also put in place sustainable data governance schemes to connect existing local, regional, national and supranational data ecosystems and enable public and private stakeholders to access the data they need to develop data services within and across sectors.

Data spaces will have to consider the needs and expectations of all their stakeholders (data holders, users and intermediaries), and will need to explicitly state the rules covering data sovereignty to ensure that they are trusted. Data spaces will consist of both public and private (shared) data and reference architectures for data spaces, and their implementation could capitalise on the huge body of knowledge and experiences of the open data movement in relation to data federation in open data portals. However, when reviewing the documentation of ongoing data space initiatives beyond those that are directly linked to the digital Europe programme (e.g. those reported as business cases or

examples from the International Data Spaces Association (IDSA)⁽³⁾ or Gaia-X⁽⁴⁾, it quickly becomes clear that public administrations (and data.europa.eu) could have a stronger voice in the thinking and planning that is going on in data spaces. If this situation persists, there is a risk that open (government) data, with its unique sociotechnical challenges and opportunities, will be only an afterthought to the European ‘single market for data’ (European Commission, 2021a).

This observation is the starting point for two reports that aim to explore challenges and opportunities that open (government) data and data.europa.eu – probably the world’s largest public investment in open government data to date – could play in European common data spaces and their city and regional counterparts across Europe. In this first report, we want to map the current landscape and assess progress towards reference architectures and implementation.

Based on desk research and interviews with key stakeholders in fledgling data space projects, we discuss the current and potential roles of data.europa.eu in data spaces, and offer suggestions for how the content and capabilities of data.europa.eu could help tackle their specific demands.

2. Methodology

2.1. Step 1: desk research

- We undertook desk research for four reasons: (1) to identify data spaces (existing and under development) across Europe, in all sectors; (2) to select stakeholders to interview; (3) to pinpoint use cases and uses of open data sources; and (4) to map out public administrations involved. In order to start the process, we used the following information sources.
 - Use cases and data spaces identified in the **International Data Space Radar**⁽⁵⁾, maintained by the IDSA. At the time of writing, the radar contained 57 use cases and data spaces, 7 of which were already live/in production in the domains of smart cities (4), manufacturing (7), energy (4), mobility (7), automotive (4), supply chains (8) and cross-sector/other (24). Figure 2 shows a snapshot of the IDSA’s radar.
 - The catalogue of use cases of the **Gaia-X initiative**⁽⁶⁾. At the time of writing, the catalogue consisted of 78 use case descriptions, distributed among the following areas: agriculture (4), energy (9), finance (3), geoinformation (5), health (22), industry 4.0 (14), mobility (5), the public sector (10), smart cities (1) and smart living (5).

⁽³⁾ The IDSA (<https://internationaldataspaces.org/>, last accessed: 28 February 2022) is a not-for-profit organisation that represents dozens of industry sectors based in 22 countries across the EU and the world, with the objective of developing a reference architecture for data spaces, including a governance model and an adoption strategy.

⁽⁴⁾ Gaia-X (<https://gaia-x.eu/>, last accessed: 28 February 2022) is a European international non-profit association (AISBL) with more than 300 members, whose goal is to develop technical solutions and regulatory frameworks and ensure the necessary central facilities as well key federation services to guarantee a federated data infrastructure.

⁽⁵⁾ <https://internationaldataspaces.org/adopt/data-space-radar/>, last accessed: 28 February 2022.

⁽⁶⁾ <https://www.data-infrastructure.eu/GAIAX/> and <https://www.gaia-x.eu/use-cases>, last accessed: 28 February 2022.

- The Gaia-X position papers for these domains. These papers summarise the main characteristics of the previous use cases: agriculture (Gaia-X, 2021a), energy (Gaia-X, 2021b), finance (Gaia-X, 2021c), geoinformation (Gaia-X, 2021d), health (Gaia-X, 2021e), industry 4.0 (Gaia-X, 2021f), mobility (Gaia-X, 2021g), the public sector (Gaia-X, 2021h), smart cities / smart regions (Gaia-X, 2021i) and smart living (Gaia-X, 2021j).
- The projects identified by the Open DEI initiative ^(?) in the areas of manufacturing (7), agriculture (6), energy (8) and healthcare (13). The Open DEI initiative is responsible for the position paper on the design principles for data spaces (1.0) (Nagel and Lycklama, 2021).

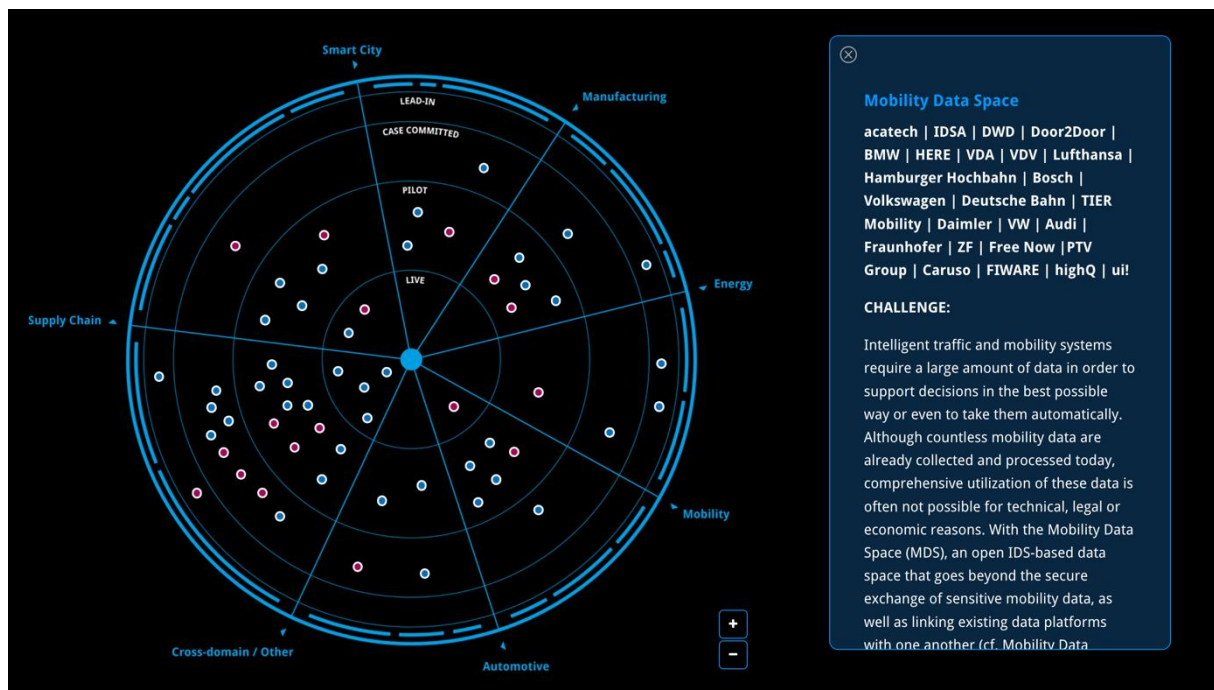


Figure 2. Snapshot of the IDSA's radar on data spaces. Different colours are used for data spaces (red) and use cases (blue), and the closer to the centre of the circle, the more mature the initiative is.

We checked if these resources mentioned or used open data from any source or portal, and if they engaged actively with key open data stakeholders, such as the public administrations that act as data publishers or intermediaries in open government data portals (including data.europa.eu). We discarded all data spaces and data space use cases from the IDSA's radar that referred to commercial technologies that can be used for data space delivery or to enterprise (or internal) data spaces that benefit individual organisations.

For each resource we provided its URL, and answered the following questions and subquestions.

1. Does the data space, use case or initiative report on the usage of open (government) data?
 - a. If yes, are the data coming from the open data catalogue of data.europa.eu?

^(?) <https://www.opendei.eu/>, last accessed: 28 February 2022.

2. Are open data providers involved in the data space, use case or initiative?

The results are displayed in the table in Annex 2.

2.2. Step 2: interviews with selected stakeholders

Several types of stakeholders are identified in the context of data spaces, as discussed in some of the main references for data space architectures and governance models. For instance, the International Data Spaces Reference Architecture Model (version 3.0) (Otto et al., 2019) identifies the following roles organised in four categories.

- Category 1 – core participants:
 - a **data owner** holds all legal rights of and has complete control over its data, and usually a participant acting as a data owner automatically assumes the role of the data provider as well;
 - a **data provider** makes data available for exchange between a data owner and a data consumer;
 - a **data consumer** receives data from a data provider;
 - a **data user** is the legal entity that has the legal right to use the data of a data owner as specified by the usage policy;
 - **app providers** develop data apps to be used in data spaces.
- Category 2 – intermediaries:
 - a **broker service provider** is an intermediary that stores and manages information about the data sources (e.g. metadata) available in data spaces;
 - a **clearing house** is an intermediary that provides clearing and settlement services for all financial and data exchange transactions;
 - an **identity provider** offers a service to create, maintain, manage and validate identity information of and for participants in a data space;
 - an **app store provider** provides data apps, that is applications that can be deployed in a data space to facilitate data processing workflows. Data apps may be certified by a certification body;
 - a **vocabulary provider** manages and offers vocabularies (i.e. ontologies, reference data models or metadata elements) that can be used to annotate and describe datasets.
- Category 3 – software and service providers:
 - a **software provider** provides software for implementing the functionality required by the data space (not just apps, as for app providers);
 - a **service provider** hosts the data space infrastructure required by other organisations, if they do not deploy it themselves.
- Category 4 – governing bodies:
 - the **certification body**, together with selected **evaluation facilities**, is in charge of the certification of the participants and the core technical components;
 - it also considers the **IDSA**.

We looked for stakeholders of these types among those identified in the data spaces, use cases or initiatives found in step 1 to recruit for interviews. The protocol for the semi-structured interviews is provided in Annex 1. We used purposive sampling to curate a list of diverse stakeholders of different types and working on different data domains and in different countries. We contacted participants through email or spoke with them at selected events relating to data spaces. Interviews were semi-structured and lasted a maximum of 30 minutes. They were recorded and transcribed. Two researchers analysed them thematically, first independently and then jointly to cluster similar themes (following a bottom-up approach) and agree on terminology.

In total, we conducted 12 interviews (from an initial set of 19 people that were contacted), including a varied range of stakeholders from the private sector (data owners, providers and users, vocabulary providers, software providers and broker service providers) on a good selection of domains: mobility, industry 4.0, energy, the Green Deal and smart cities. A pseudo-anonymised summary of the interviewees is provided in Table 1.

ID	Domain	Country	Type of stakeholder	Gender
P1	Mobility	Spain	Data owner Data user	Male
P2	Health	France	Software provider	Male
P3	Cross-domain	Germany	Software provider	Male
P4	Public sector	Belgium	Vocabulary provider	Female
P5	Industry 4.0	Spain	Data provider	Prefer not to say
P6	Geoinformation Public sector	Italy	Service provider	Male
P7	Public sector	Italy	Broker service	Female
P8	Agriculture	Poland	Vocabulary provider Data provider	Female
P9	Cross domain	Spain	Identity provider	Male
P10	Cross domain	France	Software provider	Male
P11	Mobility	France	Data provider	Female
P12	Supply chain and logistics	Netherlands	Vocabulary provider	Male

Table 1. Summary of interviewees.

3. Findings

This section summarises the results obtained from our analysis of the role that open data, in general, and data.europa.eu, in particular, play in the context of the emerging data spaces. Our main objective is to ensure that this analysis can serve those in charge of open data portals, who normally act as a combination of data owners and data providers, in taking decisions with regard to the positioning that their technological infrastructures and their content need to have to support this concept. We expect these conclusions to also be relevant as inputs for the upcoming preparatory actions that will be funded by the digital Europe programme in order to set up the bases and foundations for the further development of the European common data spaces, and for the Data Spaces Support Centre.

3.1. Desk research

The detailed results from our desk research can be found in Annex 2. In Table 2, we provide a summary of the main findings organised per domain. We considered a total of 151 initiatives. A total of 21 of them use open data; 2 mention data.europa.eu; and 19 involve public stakeholders.

Domain	Initiatives where open data are used	Initiatives where data.europa.eu is mentioned	Initiatives with public stakeholders involved	Total number of initiatives
Agriculture/agri-food	2	1	0	9
Automotive	0	0	0	4
Energy	2	0	3	21
Finance	1	0	1	3
Geoinformation	5	1	0	5
Health	0	0	7	37
Industry 4.0/ manufacturing	0	0	0	27
Mobility	5	0	4	10
Public sector	1	0	1	9
Smart living / smart cities	5	0	3	10
Supply chain and logistics	0	0	0	8
Other	0	0	0	8
Total	21	2	19	151

Table 2. Summary of desk research findings by domain.

3.1.1. General findings

Priorities for data space development among the most prominent initiatives in this space overlap, but are not entirely aligned: the digital Europe and horizon Europe work programmes, which are part of the European strategy for data; Gaia-X; the IDSA; and Open DEI. Table 3 shows the list of domains for the data spaces that are identified in these different initiatives.

European common data spaces (source: digital Europe work programme)	Domains for data spaces identified by Gaia-X, IDSA and Open DEI
Green Deal	Geoinformation (partial)
Smart communities	Smart living and smart cities
Mobility	Mobility
Manufacturing/industrial	Industry 4.0/manufacturing/automotive
Agriculture	Agriculture/agri-food
Cultural heritage	—
Health (focus on cancer and genomics)	Health
Media	—
Financial	Finance
Skills	—
Language	—
Public procurement	Public sector (wider coverage and public procurement not explicitly considered)
Security and law enforcement	Public sector (wider coverage and security and law enforcement not explicitly considered)
Tourism	—
Energy	Energy
—	Supply chain and logistics

Table 3. Matching between the European common data spaces identified in different parts of the horizon Europe and digital Europe work programmes, and the domains identified in initiatives such as Gaia-X, IDSA and Open DEI.

The differences in domains seem to suggest that the one of data spaces is an area that is still in the process of consolidation. Alternatively, they may be indicative of the diversification of priorities at

different administrative levels, depending on the actors involved in each initiative (e.g. private versus public, regions, countries and EU).

As a result, several of the European common data spaces identified in the current digital Europe and horizon Europe calls have not been dealt with in the most relevant initiatives around data spaces. These are related to the Green Deal data space (only partially addressed within the domain of geoinformation identified in Gaia-X), and the data spaces relating to cultural heritage, the media, skills, language and tourism. With the exception of tourism, it is reasonable to assume that the organisations driving these spaces will probably come from the public sector. This is not the focus of Gaia-X, the IDSA or Open DEI, which are mostly industry driven.

The European common data spaces on public procurement and security and law enforcement, which would belong to Gaia-X's public sector domain, are not referenced in sources beyond the EU ones.

Finally, the supply chain and logistics domain that can be found in the IDSA's radar does not appear explicitly among the list of European common data spaces.

3.1.2. Sector-specific findings

Most of the initiatives (use cases and data spaces) that are included in the IDSA's radar and Gaia-X are still strongly related to consortia with **a majority of French and German organisations, despite the international-by-default nature of these two initiatives**. This is a function of the strong support that the governments of both countries have provided to the promotion of the concept of data sharing and data spaces, as part of the roll-out of the European strategy for data. We expect that in the near future (2022–2023) more use cases and data spaces will come from other regions in Europe (and in the world), especially with the creation of Gaia-X⁽⁸⁾ and the different national hubs that are being established at the time of writing. For instance, in countries such as Spain the Gaia-X developments are only very recent (happening in the second half of 2021) and the Spanish Gaia-X association was only formally created in March 2022. This bias is a limitation of this study. Yet we hope that this will become less of an issue for our follow-up report, as the collection of use cases and implementations will have better geographical coverage.

Only three domains (geoinformation, mobility and smart cities) identify in the majority of the initiatives the use of open data sources in the data spaces / use cases. However, in most of these cases, **the specific open data portals, where such data will be retrieved, are not identified**, including data.europa.eu.

Even in cases where data spaces include open data, the consortia associated with those **data spaces do not include public data owners or data providers explicitly**.

The initiatives described in Gaia-X, the IDSA's radar and Open DEI **do not provide a clear catalogue of the datasets** (open and/or closed) that are being or will be used. In many cases, it is implied that open data will be used (e.g. in the domains of agriculture and energy). However, the current descriptions of

⁽⁸⁾ <https://www.gaia-x.eu/>, last accessed: 28 February 2022.

those data spaces or use cases **neither explicitly mention the use of open data sources**, nor discuss how the open data providers will be involved, if they are involved at all.

In the **agriculture/agri-food sectors**, the analysis of ongoing and recently finished initiatives (e.g. those described in Gaia-X and in Open DEI-related projects) shows a clear intention to focus on the digitalisation of the sector, and data play an extremely important role in this. Most use cases are characterised in subdomains associated with the types of products derived from the activities carried out (e.g. animal production, aquaculture, arable, dairy, fruit, novel foods and vegetables). In most of the cases, there are references to publicly available Earth observation data, as well as other sources of data (including *in situ* measurements) that need to be made interoperable to promote better data sharing (including references in some cases to sources complying with the infrastructure for spatial information in Europe directive). Surprisingly, these descriptions do not contain open data sources to be used or organisations that will act as open data providers in these data sharing contexts. We could not find any evidence of public administrations ⁽⁹⁾ directly involved in any of these use cases, data spaces or projects.

In the **energy** sector, there are only a few mentions of open data, including the Gaia-X use case on municipal open data for business models in the energy industry, and no cases referencing data that are available in data.europa.eu. There are many openly available datasets in use in energy applications: for instance, meteorological data that is relevant to understanding and predicting, among other things, energy production and consumption; energy consumption data published by public administrations; and energy efficiency data relating to buildings (e.g. construction dates and energy certificates). Even though many of the initiatives draw on different stakeholders (e.g. distribution system operators, energy service companies, transmission system operators, associations, market operators and research institutions), only a few of them directly involve public administrations as stakeholders. In most cases, these public administrations are municipalities (e.g. Málaga, Uppsala and Rome), and just one case concerns a national agency associated with the energy sector (the Spanish Institute for the Diversification and Saving of Energy).

The **finance** sector is less represented in terms of use cases and available data spaces, as there are only three initiatives identified in the domain of finance in Gaia-X, and none in the other sources we surveyed. As expected, not much attention is paid to the inclusion of open data in those data spaces, as many of the initiatives are focused on securing data exchange and sharing in specific transactions (e.g. in the supply chain). That said, one of the use cases (on the creation of a financial big data cluster) does mention open data, but the specific types of data to be included are not discussed. This use case also encompasses several public administrations among the stakeholders.

In the **geoinformation** sector covered by Gaia-X, it is very interesting to see that all initiatives (use cases or data spaces) consider different types of open data (e.g. Earth observation data from satellites, and infrastructure such as roads, rail and neighbourhoods). However, plans to involve relevant public sector stakeholders are missing from these initiatives.

⁽⁹⁾ For example, local or regional governments, or ministries or agencies in the areas of agriculture or food.

The **health** sector is most well represented, with a total of 37 initiatives (counting data spaces, use cases, and ongoing and closed projects). In all cases, except for the COVID-19 dashboard and hub, none of the initiatives deals with open data or involves open data providers as direct stakeholders. This is not surprising, as health data spaces are expected to handle very sensitive data for which not much open data are available, not even in an anonymised format. Although some cases include public hospitals and regional or national health services, these do not provide open data for the data spaces.

With regard to **manufacturing and industry 4.0**, as expected, there are no clear mentions of the use of open data from public administrations. Most of the use cases and data spaces are focused on having shared data schemes among manufacturers of machines used in factories, factories that are using those machines and interconnected factories, among others. Some of these projects make some datasets openly available, but these are not registered as open government data or present in open data portals of public administrations. Public administrations are not involved either.

The analysis is similar in the specific case of the **automotive** sector, which may be considered a special case within the manufacturing and industry 4.0 sector applying to vehicles.

Another sector that is identified on the IDSA's radar is **supply chain and logistics**, with eight initiatives (including data spaces and use cases). As in the previous case of industry, manufacturing and the automotive sector, much of the data used in this context belong to private organisations involved in the data spaces. However, our initial expectation was that some of these initiatives would use open data – for example in relation to infrastructures (roads, railways, ports, airports, etc.) – and hence would involve public administrations providing this type of data. However, the analysis of the identified initiatives suggests that this is not the case.

Very related to the case of supply chains and logistics, but mainly focused on the transport of goods and people, is the case of **mobility**. This sector, of all those that have been analysed in this work, has the largest number of public administrations identified as stakeholders, and not only as data providers. One relevant example is that of the international Mobility Data Space, led by Germany, which requires public administrations to supply data or to facilitate of some of the tests that need to be done in this space.

The most surprising case in this study relates to the **public sector** use cases in Gaia-X. Although substantial involvement of public administrations as data providers and other stakeholder roles was expected, none of the public sector use cases seems to involve any specific public administrations or be driven by industries willing to offer services to public administrations. This may imply that public administrations are in general still far from being more than mere open data providers and participate as active stakeholders in the development of data spaces.

With regard to **smart cities and smart living**, we found two groups of initiatives: those that are focused on offering better services in cities (e.g. parking) as well as allowing different forms of data sharing across companies participating in the development of cities; and those that are more focused on having citizens as some of the main data providers (e.g. by providing personal data on energy consumption in their households). For the first group, the initiatives generally identify local public administrations or communities of local public administrations both as data providers and as other

types of stakeholders. For the second case, however, no explicit references are provided to the open data that may be offered by local municipalities or by other public administrations (e.g. relating to housing), and neither local municipalities nor public administrations seem to be explicitly involved in the initiatives.

3.2. Interviews with selected stakeholders

The findings from the previous section were primarily based on our analysis of the documentation of key initiatives around data sharing and data spaces. Here we summarise additional findings that emerged from the interviews.

Interviewees confirmed that public sector organisations are under-represented in ongoing initiatives around data sharing identified by Gaia-X, IDSA's radar and Open DEI. The two exceptions at the level of European common data spaces are the Green Deal and public procurement data spaces, for which some of the interviewees provided important insights:

The role of open data portals as data providers is taken for granted in many of the data spaces (and use cases) that are being developed. However, the institutions in charge of open data portals should be more actively involved in the development of data spaces in order to have more representativeness in those developments. (P6, provides services to public administrations, Italy, male)

All interviewees confirmed that data spaces as they are today lack a fully fledged catalogue of open and closed datasets that the spaces cover. They broadly agreed that one of the initial steps in the set-up of a data space should be the development of a catalogue of datasets, as part of the data governance process, and noted that this is not the case at the moment. They mentioned a focus on technology development rather than data governance, which may explain this. In the words of one participant:

Open data portals like data.europa.eu have demonstrated the possibility of federating metadata and providing links to datasets. This type of technology is clearly useful for many data spaces that do not have additional requirements for the collection of the catalogue of datasets, so institutions like data.europa.eu should make an effort to position their open source technology in as many data spaces as possible. (P3, develops architectures and technology for spaces, Germany, male)

With no catalogues of datasets in place, there are no clear plans to include specific open datasets either. However, in some cases, there is a high-level understanding of the categories of datasets needed (e.g. meteorology, traffic and infrastructures).

None of the respondents planned to contribute data to data.europa.eu. They mentioned, again, the Green Deal data space and the public procurement data space as spaces to which they might contribute in the future.

Metadata schema for data spaces are still underspecified, although the Data Catalog Vocabulary application profile for data portals in Europe is generally considered a good option as it has shown its

value in the federation of open data portals. However, most interviewees believe the Data Catalog Vocabulary application profile for data portals in Europe will require extensions to meet data spaces requirements (level of detail, aspects related to the quality of data, geospatial or temporal resolutions, etc.). Some of the respondents were aware of ongoing work on the information model proposed in the International Data Spaces Reference Architecture Model, but did not participate in or follow the work in great detail.

Some participants, among whom there were identity and vocabulary providers, also noted the role of public sector organisations in establishing common standards for data interoperability:

Public administrations (e.g. those behind data.europa.eu) may act in some occasions as neutral organisations that can provide support for some of the roles identified in the main architectures. For instance, they may have a relevant role as vocabulary providers, including the participation in the development of data standards and models, or even as identity providers or as part of the data governance managers. (P12, develops vocabularies for the supply chain and logistics sector, Netherlands, male)

4. Conclusions and next steps

For this first of two reports, we analysed key initiatives relating to data spaces. Some of them are directly related to ongoing policy at EU level and some are happening locally. The analysis included official documents relating to the European strategy for data, as well as online resources and position papers from three industry initiatives: IDSA, Gaia-X and Open DEI. Tellingly, there is no similar initiative representing the public or third sector, despite several core common data spaces targeted by ongoing funding calls that require the buy-in of these stakeholders (focusing on skills, cultural heritage, the media, the Green Deal, etc.). Nevertheless, given the sheer number of use cases and implementations available, this analysis was helpful to get a sense of the state of the art and common trends. We were also able to recruit a diverse set of data space stakeholders for semi-structured interviews to contextualise our analysis.

The aim of this research is to understand how data.europa.eu should position itself in the context of data spaces – and perhaps more broadly how open government data portals and stakeholders should do so. The work was planned for the summer of 2020, after the publication of the European strategy for data, with the expectation that by the time of this study in Q1 2022, we would have access to several operational data spaces and be able to drawing on complete reference architectures and implementations from IDSA and Gaia-X. Unfortunately, progress on all these fronts was slower than planned, which meant that our analysis could take into account only use cases, ongoing development work and data space roadmaps. In addition, there were delays in establishing the network of national hubs for Gaia-X in countries other than Germany and France, which further biased our findings.

The follow-up study will be conducted once some (European common) data spaces become available and work on reference resources by the IDSA and Gaia-X is complete. This will allow us to come up with more specific recommendations, informed by characteristics of actual data spaces in operation. Nevertheless, this preliminary analysis suggests that more needs to be done to ensure that the open

data community is represented and considered in data space developments, both in terms of content (e.g. data.europa.eu contains datasets from the public sector that may be relevant in most vertical sectors) and with regard to technology infrastructure (as the analysis has demonstrated how effective data federation can be done). Future activities may include organising workshops with relevant stakeholders, conducting additional studies assessing the compatibility of reference architectures and implementations with established (federated) open data publishing and use technologies, and establishing community initiatives equivalent to IDSA and Gaia-X to set up data spaces with a pronounced public sector component, for example in the area of cultural heritage or skills.

References

- European Commission (2021a), *Towards a European strategy on business-to-government data sharing for the public interest: Final report prepared by the High-Level Expert Group on business-to-government data sharing*, Directorate-General for Communications Networks, Content and Technology, Publications Office of the European Union, Luxembourg (<https://doi.org/10.2759/406717>).
- European Commission (2021b), *Annex to the Commission implementing decision on the financing of the digital Europe programme and the adoption of the multiannual work programme for 2021–2022*.
- European Commission (2022), Commission staff working document on common European data spaces, SWD(2022) 45 final (<https://digital-strategy.ec.europa.eu/en/library/staff-working-document-data-spaces>).
- European Parliament and the Council of the EU (2019), Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information, OJ L 172, 26.6.2019, p. 56.
- Gaia-X (2021a), ‘Gaia-X domain agriculture’, *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-agriculture.pdf>)
- Gaia-X (2021b), ‘Gaia-X domain energy’, *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-energy.pdf>)
- Gaia-X (2021c), ‘Gaia-X domain finance’, *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-finance.pdf>)
- Gaia-X (2021d), ‘Gaia-X domain geoinformation’, *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-geoinformation.pdf>)
- Gaia-X (2021e), ‘Gaia-X domain health’, *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-health.pdf>)

- Gaia-X (2021f), 'Gaia-X domain industry 4.0/SME', *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-industry40.pdf>)
- Gaia-X (2021g), 'Gaia-X domain mobility', *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-mobility.pdf>)
- Gaia-X (2021h), 'Gaia-X domain public sector', *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-public.pdf>)
- Gaia-X (2021i), 'Gaia-X domain smart city / smart region', *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-scsr.pdf>)
- Gaia-X (2021j), 'Gaia-X domain smart living', *Position Paper*, version 1.0. (<https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/211116-pp-smartliving.pdf>)
- Nagel, L. and Lycklama, D. (2021), 'Design principles for data spaces', *Position Paper*, version 1.0, Zenodo (<https://doi.org/10.5281/zenodo.5244997>).
- Otto, B., Steinbuß, S., Teuscher, A. and Lohmann, S. (2019), *Reference Architecture Model*, version 3.0, International Data Spaces Association (<https://internationaldataspaces.org/wp-content/uploads/IDS-Reference-Architecture-Model-3.0-2019.pdf>).

Annex 1. Interview protocol

This annex provides the interview protocol that was used for the semi-structured interviews that were carried out as part of this work. As in any semi-structured interview, the questions that are presented here mainly act as a guide for the conversation with the interviewee.

1. Are you involved in the development of any emergent or well-established data space? If yes, in which domain or group of domains?
2. Are you involved in the set-up of any of the European common data spaces? If yes, in which one? Are you submitting or have you submitted a request for funding under any of the digital Europe or horizon Europe programme calls?
3. Do you or the organisation that you represent belong to any of the organisations that are active in the development of frameworks and architectures for data spaces (IDSA, Gaia-X, etc.)?
4. For each of the data spaces that you are involved in, can you tell me (no need for specific names, the answers can be similar to ‘a relevant company in the automotive sector’):
 - 4.1. the private organisations that are involved in it?
 - 4.2. the public organisations that are involved in it?
 - 4.3. any other type of organisation or individual that is involved in it?
5. Do you already have an initial catalogue of datasets identified for your data space?
 - 5.1. How many of these datasets are from public administrations?
 - 5.1.1. If there are public datasets, are the public administrations that act as data providers or data intermediaries aware of the fact that these datasets will be used in the data space?
 - 5.1.2. Have you thought of using data.europa.eu or any other open data portal as a source of data?
 - 5.1.3. Will the data space contribute any data to data.europa.eu or any other open data portal?
 - 5.2. How many of these datasets are from private institutions?
 - 5.3. Are there any other relevant datasets that will be used?
6. Have you decided on the metadata schemas that will be used to describe (and federate) datasets? Something like the Data Catalog Vocabulary or the international data spaces information model?
7. Do you know of other similar data spaces in the domain of your data space that we should look at?
8. Do you have any recommendations for data.europa.eu on how to make sure that their datasets are used in the data space?

Annex 2. Open data usage in data space-related initiatives

This annex provides details on open data usage in the data spaces that were selected during the desk research. The table shows each initiative (be it a use case, data space or project) from the three selected information sources; its name and URL; if it involves the use of any type of open data; whether, if it does use open data, the open data source is available in data.europa.eu; and, finally, if the open data providers are also included in some form as stakeholders in the initiative, with an indication of which public administrations are involved in that case.

The initiatives that have been reviewed are in the following sectors, derived from the sectors/categories identified in the three selected information sources (Gaia-X, IDSA and Open DEI): agriculture/agri-food (9), automotive (4), energy (21), finance (3), geoinformation (5), health (35), manufacturing and industry 4.0 (27), mobility (10), public sector (9), smart living and smart cities (10), and supply chain and logistics (8). The table also contains some initiatives that are marked as 'other' (8) on the IDSA's radar, but may have well been included in any of the previous categories.

Source	Use case / data space / project name and URL	Uses open data?	In data.europa.eu?	Open data providers involved
Agriculture/agri-food				
Gaia-X	Agri-Gaia (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/agri-gaia.html)	No	No	None
Gaia-X	Agdatahub – Consent and data exchange in agriculture (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-agriculture-data-exchange-in-agriculture.html)	No	No	None
Gaia-X	AgriML – Machine Learning for Agriculture in South Tyrol: automatic crop type recognition with intelligent satellite imagery (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/agriML-automatic-crop-type-recognition-with-intelligent-satellite-imagery.html)	Yes (Earth observation data)	No	None
Gaia-X	Soil-X (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/81-soil-x/use-case.html)	Yes (Earth observation data)	Yes	None
Open DEI	Demeter (https://h2020-demeter.eu/)	No	No	None

Open DEI	Agricultural Interoperability and Analysis System (ATLAS) (https://www.atlas-h2020.eu/)	No	No	None
Open DEI	agROBOfood (https://agrobofood.eu/project/)	No	No	None
Open DEI	Internet of Food and Farm (IOF) (https://www.iof2020.eu/)	No	No	None
Open DEI	SmartAgriHubs (https://smartagrihubs.eu/)	No	No	None
Automotive				
IDSA's radar	Collaborative warranty and quality management (https://internationaldataspaces.org/usecases/sap-fraunhofer/)	No	No	None
IDSA's radar	Catena-X (https://catena-x.net/en/)	No	No	None
IDSA's radar	Supply chain manager (https://internationaldataspaces.org/usecases/supply-chain-manager-achieving-transparency-in-automotive-supply-chains/)	No	No	None
IDSA's radar	Light commercial vehicles	No	No	None
Energy				
IDSA's radar	EDF vehicle charging	No	No	None
IDSA's radar	EDF wind and solar assets modelling	No	No	None
IDSA's radar	Basque Energy Cluster	No	No	None
IDSA's radar	Energy Data Space (EnDaSpace) (https://www.iee.fraunhofer.de/de/projekte/suche/2021/EnDaSpace.html)	No	No	None
Gaia-X	Infrastructure data for new business models (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/infrastructure-data-for-new-business-models.html)	Yes	No	None

Gaia-X	Edge data centres (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/edge-data-centres.html)	No	No	None
Gaia-X	Aggregator services for energy communities (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/aggregator-services-for-energy-communities.html)	No	No	None
Gaia-X	Municipal open data for business models in the energy industry (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/municipal-open-data-for-business-models-in-the-energy-industry.html)	Yes	No	None
Gaia-X	Redispatch 3.0 (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/redispatch-30.html)	No	No	None
Gaia-X	Secure and agile cloud edge infrastructures (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/energieanlagen.html)	No	No	None
Gaia-X	Optimisation of the services and marketing of decentral renewable energy generators (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/dezentrale-energieerzeuger.html)	No	No	None
Gaia-X	Smart, privacy-preserving coordination of energy supply and demand (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/decentralized-energy-trading-infrastructure-and-industrial-residential-energy-agents.html)	No	No	None
Gaia-X	System for automated certification of renewable energy and management of certificates (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/system-for-automated-certification-of-renewable-energy-and-management-of-certificates.html)	No	No	None
Open DEI	Interoperable Solutions Connecting Smart Homes, Buildings and Grids (InterConnect) (https://interconnectproject.eu/consortium/)	No	No	None

Open DEI	Digital Platform and Analytics Tools for Energy (PLATOON) (https://platoon-project.eu/)	No	No	Municipality of Rome
Open DEI	INTERRFACE (http://www.interrface.eu/)	No	No	None
Open DEI	SYNERGY (https://www.synergyh2020.eu/)	No	No	None
Open DEI	CoordiNet (https://coordinet-project.eu/)	No	No	Málaga, Uppsala
Open DEI	Platform for Operation of Distribution Networks (Platone) (https://www.platone-h2020.eu/)	No	No	None
Open DEI	BD4OPEM (https://bd4opem.eu/)	No	No	None
Open DEI	OneNet (https://onenet-project.eu/)	No	No	Institute for the Diversification and Saving of Energy
Finance				
Gaia-X	Financial Big Data Cluster (FBDC) (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/financial-big-data-cluster-fbdc.html)	Yes	No	Deutsche Börse; Deutsche Bundesbank; Hessian Ministry of Economics, Energy, Transport and Housing
Gaia-X	Sustainable finance (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/sustainable-finance.html)	No	No	None
Gaia-X	Pay-per-use supply chain finance (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/pay-per-use-supply-chain-finance.html)	No	No	None
Geoinformation				

Gaia-X	Space4Cities (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/space4cities.html)	Yes	Yes	None
Gaia-X	Smart infrastructure management (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-infrastructure-management.html)	Yes	No	None
Gaia-X	The digital twin as a basis for 3D planning and citizen participation (smart urban planning) (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/3d-planning-platform.html)	Yes	No	None
Gaia-X	Earth observation data analysis in a trustworthy cloud environment (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/earth-observation-data-analysis-in-a-trustworthy-cloud-environment.html)	Yes	No	None
Gaia-X	Automatic generation and update of 3D surfaces and objects using artificial intelligence (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/automatic-generation-and-update-of-3d-surfaces.html)	Yes	No	None
Health				
IDSA's Radar	HEALTH-X dataLOFT (categorised as 'other' in the IDSA's Radar)	No	No	None
IDSA Radar	NL AI Coalition – Oncology Research (categorised as 'other' in the IDSA's radar)	No	No	None
Gaia-X	AIQNET – Medical Data Ecosystem (previously KIKS) (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/aiqnet.html)	No	No	None
Gaia-X	Berlin Health Data Space – AI to beat acute kidney failure (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/berlin-health-data-space.html)	No	No	None
Gaia-X	Smart Health Connect (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-health-connect.html)	No	No	None

Gaia-X	Research Platform Genomics (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/research-platform-genomics.html)	No	No	None
Gaia-X	Future care platform (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/future-care-platform.html)	No	No	None
Gaia-X	Surgical platform for AI-based risk identification (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/surgical-platform-for-ai-based-risk-identification.html)	No	No	None
Gaia-X	Medical Crisis Management and Research Platform 'UNITY' (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/medical-crisis-management-and-research-platform-unity.html)	No	No	None
Gaia-X	Patient Empowered, Privacy Secured (PEPS) (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/patient-empowered-privacy-secured.html)	No	No	None
Gaia-X	Framework of medical records in Europe (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/framework-of-medical-records-in-europe.html)	No	No	None
Gaia-X	Improve chronic heart failure patient management (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/improve-chronic-heart-failure-patient-management.html)	No	No	None
Gaia-X	CarePay (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/carepay.html)	No	No	None
Gaia-X	Image sharing for medical professionals and the citizen (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/image-sharing-for-medical-professionals-and-the-citizen.html)	No	No	None
Gaia-X	EMPAIA marker quantification (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/empaia-marker-quantification.html)	No	No	None

Gaia-X	COVID-19 dashboard and hub (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/covid-19-dashboard-und-hub.html)	Yes	Yes	None
Gaia-X	KAMeri – Cognition-based workplace safety for human–machine interaction (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/kameri-cognition-based-workplace-safety-for-human-machine-interaction.html)	No	No	None
Gaia-X	Recupera REHA (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/recupera-reha.html)	No	No	None
Gaia-X	The digital twin (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/the-digital-twin.html)	No	No	None
Gaia-X	Differential diagnosis (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/differential-diagnosis.html)	No	No	None
Gaia-X	Smart diabetes management (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-diabetes-management.html)	No	No	None
Gaia-X	End-to-end cell and gene therapy orchestration (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/end-to-end-cell-and-gene-therapy-orchestration.html)	No	No	None
Gaia-X	Digital end-to-end data map in translational research and the medical industry (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/digital-end-to-end-data-map-in-translational-research-and-the-medical-industry.html)	No	No	None
Gaia-X	Data spaces for the statutory health insurance companies for data analysis (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/data-spaces-for-the-statutory-health-insurance-companies-for-data-analysis.html)	No	No	None

Open DEI	InteropEHRate (https://www.interopehrate.eu/)	No	No	None
Open DEI	Smart4Health (https://smart4health.eu/)	No	No	Madeira
Open DEI	Activage (http://www.activageproject.eu)	No	No	Parma, Galicia, Leeds
Open DEI	Pharaon (https://www.pharaon.eu/)	No	No	Andalusia, Diputación de Jaén, Slovenian public health service
Open DEI	Smart Big Data Platform to Offer Evidence-based Personalised Support for Healthy and Independent Living at Home (SMART-BEAR) (https://www.smart-bear.eu/)	No	No	Region of Peloponnese
Open DEI	GATEKEEPER (https://www.gatekeeper-project.eu/)	No	No	Several public health services from six countries
Open DEI	Smart and Healthy Ageing through People Engaging in Supportive Systems (SHAPES) (https://shapes2020.eu/)	No	No	None
Open DEI	ADLIFE (https://adlifeproject.com/)	No	No	None
Open DEI	FAITH (https://www.h2020-faith.eu/)	No	No	None
Open DEI	AICCELERATE (https://aiccelerate.eu/)	No	No	None
Open DEI	AI powered, Decentralised Production for Advanced Therapies in the Hospital (AIDPATH) (https://www.sciencrow.com/c/6499?title=AIDPATH)	No	No	None
Open DEI	Hospital Smart development based on AI (HOSMARTAI) (https://www.hosmartai.eu/)	No	No	Region of Madrid
Open DEI	TeNDER (affective based integrated care for better Quality of Life) (https://www.tender-health.eu/)	No	No	Region of Madrid

Industry 4.0/manufacturing				
IDSA's radar	Logistics and product life cycle management	No	No	None
IDSA's radar	Smart factories	No	No	None
IDSA's radar	Plastic domain data space – market 4.0	No	No	None
IDSA's radar	Smart Factory Web (https://internationaldataspaces.org/usecases/smart-factory-web/)	No	No	None
IDSA's radar	NTT Testbed on Data Governance and Sovereignty Across Countries and Companies (https://internationaldataspaces.org/usecases/ntt-siemens-switzerland-innovation-park-biel-bienne/)	No	No	None
IDSA's radar	Metal domain data space – market 4.0 (https://internationaldataspaces.org/usecases/tecnalia-2/)	No	No	None
IDSA's radar	Boost 4.0 – European industrial data space (https://boost40.eu/)	No	No	None
Gaia-X	Collaborative condition monitoring (https://www.bmw.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/collaborative-condition-monitoring.html)	No	No	None
Gaia-X	Smart manufacturing (https://www.bmw.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-manufacturing.html)	No	No	None
Gaia-X	Supply chain collaboration in a connected industry (https://www.bmw.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/supply-chain-collaboration-in-a-connected-industry.html)	No	No	None
Gaia-X	Shared Production: Cross-Factory and Cross-Company Production as a Showcase; Smart factory KL Vision 2025 – ‘Production Level 4’ (https://www.bmw.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/shared-production.html)	No	No	None
Gaia-X	Industrial internet of things platform with out-of-the-box manufacturing execution systems applications (https://www.bmw.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/industrial-internet-of-things-platform.html)	No	No	None

	World/GAIA-X-Use-Cases/Ilot-platform-with-out-of-the-box-mes-applications.html)			
Gaia-X	Predictive maintenance (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/predict-maschines-pdm.html)	No	No	None
Gaia-X	An ecosystem For artificial intelligence (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/ai-marketplace-the-ecosystem-for-artificial-intelligence-in-product-development.html)	No	No	None
Gaia-X	Collaboration platform for the international development of aircraft and space vehicles (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/dasc-lab.html)	No	No	None
Gaia-X	Data interoperability and data sovereignty for food production (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/fast.html)	No	No	None
Gaia-X	Improving the user experience and developing innovative forms of user experience (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-experience-smart-creation.html)	No	No	None
Gaia-X	A digitally interconnected production ecosystem for data-driven and sustainable value creation (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/87-euprogigant-european-production-giganet/use-case.html)	No	No	None
Gaia-X	Integration of data along the life cycle of production machines (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/integration-of-data-along-the-life-cycle-of-production-machines.html)	No	No	None
Gaia-X	Enabling full transparency in the supply chain (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/enabling-full-transparency-in-the-supply-chain.html)	No	No	None
Open DEI	Qu4lity (https://qu4lity-project.eu/)	No	No	None

Open DEI	Zero Defects Manufacturing Platform (ZDMP) (https://www.zdmp.eu/)	No	No	None
Open DEI	European Factory Platform (https://www.efpf.org/)	No	No	None
Open DEI	Connected Factories (https://www.connectedfactories.eu/)	No	No	None
Open DEI	KYKLOS 4.0 (https://kyklos40project.eu/)	No	No	None
Open DEI	DigiPrime (https://www.digiprime.eu/)	No	No	None
Open DEI	Smart Human-Oriented Platform to Connected Factories (SHOP4CF) (https://shop4cf.eu/)	No	No	None
Mobility				
IDSA's radar	Rail data space	No	No	None
IDSA's radar	Kiel mobility digital twin	Yes	No	City of Kiel
IDSA's radar	RealLab Hamburg (https://reallab-hamburg.de/en/)	Yes	No	Hamburg
IDSA's radar	Mobility Data Space (https://mobility-dataspace.eu/ and https://www.mobility-data-space.de/en.html) – a data space and two use cases.	Yes	No	North Rhine-Westphalia, Rhine-Neckar Metropolitan Region
IDSA's radar	Mobilithek (formerly Mobility Data Marketplace (MDM)) (https://www.mdm-portal.de/)	Yes	No	Federal Ministry of Transport and Digital Infrastructure
Gaia-X	Mobility – data interoperability and data sovereignty (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/mobility-data-interoperability-and-data-sovereignty.html)	Yes	No	None, although it is acknowledged that they will have to be involved

Gaia-X	Digital parking management – seamless parking (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/digital-parking-management-seamless-parking.html)	No	No	None
Gaia-X	Testbed Lower Saxony (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/the-testbed-lower-saxony-is-ready-for-gaia-x.html)	No	No	None
Gaia-X	Smart mobility innovation along the travel chain (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-mobility-innovation.html)	Yes	No	None, although it is acknowledged that they will have to be involved
Gaia-X	AI-based solution for optimising the energy efficiency and consumption of electric vehicles (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/77-gaia-x-decentralized-in-vehicle-mlaas-to-ev-energy-efficiency/use-case.html)	No	No	None
Public sector				
Gaia-X	Digital public administration – chatbot (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/digital-public-administration-chatbot.html)	No	No	None
Gaia-X	Using the intelligent chatbot to reduce help desk tickets (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/chatbot-for-reducing-tickets.html)	No	No	None
Gaia-X	High performance and quantum computing as a service (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/high-performance-and-quantum-computing-as-a-service.html)	No	No	None
Gaia-X	Quality Infrastructure ‘Digital’ (QI-Digital) (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/quality-infrastructure-digital-qi-digital.html)	No	No	None

Gaia-X	Phoenix – the open source workplace for the public sector (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/75-phoenix-the-open-source-workplace-for-the-public-sector/use-case.html)	No	No	None
Gaia-X	Predictive maintenance for the road infrastructure in South Tyrol (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/predictive-maintenance-for-the-road-infrastructure-in-south-tyrol.html)	Yes	No	Autonomous Province of Bolzano
Gaia-X	Innovative EU-wide sovereign 'Qit' person control system with checks on residence permits (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/qit-identity-checks.html)	No	No	None
Gaia-X	Opening data silos in administration for usage in data science and machine learning (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/data-science-and-machine-learning-hub.html)	No	No	None
Gaia-X	A digital coordination platform for the open source community (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/a-digital-coordination-platform-for-the-open-source-community.html)	No	No	None
Smart living / smart cities				
IDSA's radar	MyDataForCities	Yes	No	Helsinki, Open and Agile Smart Cities
IDSA's radar	City Dataspace	Yes	No	Wuppertal, Solingen, Remscheid
IDSA's radar	Trusted data sharing in smart cities (https://internationaldataspaces.org/usecases/vastuu/)	Yes	No	None
IDSA's radar	Smart parking	Yes	No	None
Gaia-X	Cloud-based data platform for smart communities (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-	Yes	No	Hamburg, Darmstadt,

	World/GAIA-X-Use-Cases/66-smart-city-data-platform/use-case.html)			Wolfsburg, Ulm, Paderborn, Rhine-Neckar Metropolitan Region
Gaia-X	Smart living (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-living.html)	No	No	None
Gaia-X	Energy efficiency (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-living-energy-efficiency.html)	No	No	None
Gaia-X	Smart living ambient assisted living (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-living-aal.html)	No	No	None
Gaia-X	Smart living security (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/smart-living-security.html)	No	No	None
Gaia-X	Automated reading of gas, water and electricity consumption levels for age-appropriate living (https://www.bmwi.de/Redaktion/EN/Artikel/Digital-World/GAIA-X-Use-Cases/86-smart-metering-age-appropriate-living/use-case.html)	No	No	None
Supply chain and logistics				
IDSA's radar	Silicon Economy (https://www.iml.fraunhofer.de/en/silicon-economy.html)	No	No	None
IDSA's radar	Development and valorisation of a Dutch Data Spaces for Logistics (DASLOGIS) (https://www.dinalog.nl/project/daslogis-development-and-valorization-of-a-dutch-data-space-for-logistics/)	No	No	None
IDSA's radar	ONCITE – German Edge Cloud (https://internationaldataspaces.org/usecases/german-edge-cloud/)	No	No	None
IDSA's radar	Horizontal supply chain collaboration	No	No	None

IDSA's radar	Industrial additive manufacturing services (https://internationaldataspaces.org/usecases/ibm-thyssenkrupp-fraunhofer/)	No	No	None
IDSA's radar	AI Sovereignty (AI.SOV)	No	No	None
IDSA's radar	ECI Gatewise	No	No	None
IDSA's radar	Smart Connected Supplier Network – market 4.0 (https://smart-connected-supplier-network.gitbook.io/processmanual/)	No	No	None
Other				
IDSA's radar	MERLOT	No	No	None
IDSA's radar	Privacy-Aware, intelligent and Resilient Crisis Management (PAIRS) (https://www.pairs-projekt.de/en/home/)	No	No	None
IDSA's radar	DataPorts	No	No	None
IDSA's radar	Data Sharing Coalition – green loans (https://datasharingcoalition.eu/use-cases/sharing-energy-information-with-mortgage-providers-to-include-in-mortgage-applications/)	No	No	None
IDSA's radar	Maritime data space (https://www.sintef.no/projectweb/maritime-data-space-mds/)	No	No	None
IDSA's radar	Defence data space (https://www.tno.nl/nl/over-tno/nieuws/2021/9/fedice-laait-defensie-en-haar-partners-eenvoudig-beheersbaar-en-veilig-digitaal-informatie-delen/)	No	No	None (although a public administration is involved)
IDSA's radar	Trusted space for aeronautics	No	No	None
IDSA's radar	MARKET4.0 Marketplace	No	No	None