

DATA SPACE 4.0

A European Common Digital Manufacturing Infrastructure and Data Space
Pathway for Connected Factories 4.0 Data Value Chain Governance

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Authors	Christian Krug (VDI)
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COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	CEA
VDI TECHNOLOGIEZENTRUM GMBH	VDI TZI
BRAINPORT INDUSTRIES COOPERATIE UA	BPI
INDUSTRIE 4.0 OSTERREICH – DIE PLATTFORM FUR INTELLIGENTE PRODUKTION	PIA
CHALMERS TEKNISKA HOGSKOLA AB	CHALMERS
INTERNATIONAL DATA SPACES EV	IDSA
ENGINEERING - INGEGNERIA INFORMATICA SPA	ENG
UNPARALLEL INNOVATION LDA	UNPARALLEL
SOFTWARE QUALITY SYSTEMS SA	SQS
FIWARE FOUNDATION EV	FIWARE
IDC ITALIA SRL	IDC ITALIA
SIEMENS AKTIENGESELLSCHAFT	SIE



Executive Summary

This report represents the status of D2.1 in January 2023: The structure and the content of the online survey to be contributed by experts and stakeholders of NI is aligned in the project consortium. To achieve the deliverable by April 2023 the survey will be started end of January 2023 and will be evaluated in March 2023.

Keywords: Requirement elicitation, online Survey, rating of requirements for manufacturing data spaces

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Abbreviations and Acronyms

Acronym	Meaning
CA	Consortium Agreement
CPPS	Cyber-Physical Production System
DoA	Description of Action
EC	European Commission
GA	General Assembly
IPR	Intellectual Property Regulations
KPI	Key Performance Indicator
REI	Responsible Exploitation & Innovation Board
RRI	Responsible Research & Innovation
TCC	Technical Coordination Committee
WP	Work Package



1 Background and Objective of D2.1

WP 2 focusses on the Co-design of a highly replicable methodology for set-up, deployment, and operation of manufacturing data spaces. Therefore, the consortium strives to define hierarchical and non-hierarchical reference application scenarios and capture the needs from Industry 4.0 data value ecosystems and use cases. Thus, to facilitate the co-design of data governance, legal infrastructure and service models for future dynamic assets management, predictive maintenance, and agile supply chain data spaces.

Against this background the objective of D2.1 is to estimate the requirements on the hierarchical and non-hierarchical predictive maintenance and agile value network data spaces via a Pan-EU Hierarchical Data Spaces Interoperability and Data Federation Requirement Elicitation.

2 Process to achieve D2.1

To achieve D2.1 we are processing following steps.

1. First discussion and collection of requirements while Digital Transformation Summit on Madeira, October 26, 2022 ✓
2. Introduction and Discussion of Outcomes while Kick-Off while 1st General Assembly, Milan, 17 November 2022 ✓
3. Preparation of survey to rate the so far collected requirements and to collect further ones from the members of NI and further Initiatives, December 13, 2022 ✓
4. Set up of survey and provide to NI and further Initiatives, Mid of January, 2023
5. Start of survey, End of January
6. Evaluation of survey and preparation of report, April 2023

Details of the already completed steps:

@1 At Kick-off approximately 60 Person have contributed and provided the “raw data” for the following steps. Contributors were asked after a short introduction to provide their requirements on manufacturing data spaces separated into technical, business, and legal requirements by an online tool via their smart phones. The outcome was impressive: 61 requirements were mentioned. These requirements were clustered to 8 initial clusters.



@2 While 1st General Assembly the outcomes of the kick-off were introduced and discussed with the project partners. The clustering of the requirements and the next steps were refined.

@3 The project partners had invited experts of NI, associated NI, and related projects to participate to the workshop. Overall, 35 persons have contributed. The workshop was focused to fix the content and concept of the survey to collect the requirements for data spaces from those involved in the national initiatives and working groups as part of an online survey. The outcome of the workshop is the aligned description of clusters of requirements (see 3 Clusters of requirements) and the of the structure of the survey (see Appendix)

3 Clusters of requirements

Outcome of the 3rd step (see step list above) is the aligned description of requirement clusters. Those will be the basis for the online survey.

3.1 General Requirements

- Simple, secure, cost-effective connectivity for data space participants
- Use of standard technologies and concepts, use of cross-industry federated infrastructures if necessary
- Clear, compatible regulations/general terms and conditions at the legal level for data space participants. A technical platform on its own is not enough.
- Clear, compatible economic options for data space participants
- The data space itself must be provided and operated in a way that is legally binding and creates trust among participants

3.2 Specific Requirements

At the kick-off while the Digital Transformation Summit in Madeira (October 26, 2022), the audience was asked to indicate their requirements for Data Spaces via an electronic survey tool. The survey was divided into technical, business, and legal requirements. In the following section, the collected input is aggregated from one-word requirements to statements.



3.2.1 Technical requirements

3.2.1.1 User friendliness

From the user's perspective, a data space provides a trusted environment for multilateral collaboration between companies, e.g., from the integration of data sources, through storage and data access management, to data analysis and value-added services based on data analysis, considering the three design aspects. User friendliness means against this background Usability of any kind, including accessibility and adaptability.

3.2.1.2 Interoperability

The interoperability of all stakeholders is necessary for the shaping of complex, decentralized ecosystems. A high level of interoperability – to which all the partners commit and contribute equally – is required to ensure networking across companies and sectors. Standards and integration are needed for this, as a uniform regulatory framework and decentralized systems. The use of interoperable data formats ensures that data can be used across different providing and application contexts. This effort must be done international against the background of required qualities and capacities.

3.2.1.3 Autonomy

Autonomy is the freedom to take independent decisions and to interact in conditions of fair competition – from a chosen business model to an individual's decision to make a purchase. Security requires an open digital infrastructure for everyone, data protection, IT and information security and technology-neutral research, development, and innovation. To ensure data sovereignty, the data generator must be responsible for determining access to and use of the data generated as well as use of data has to follow clear rules agreed among all partners involved. Data security must be top priority: Security by design and state-of-the-art security lifecycle management ensure that data access, processing, storage, and evaluation meet the needed security standards.

3.2.1.4 Sustainability

Economic, environmental, and social sustainability is a fundamental pillar in our societal values. Firstly, these considerations feed into Industry 4.0, and secondly, Industry 4.0



promotes substantial progress on sustainability. Key aspects of sustainability in the ecosystems of the future are decent work and education, mitigating climate change, the circular economy and social inclusion beside monitoring and reducing the Product Carbon footprint e.g., by energy optimization.

3.2.2 Business requirements

All business activities must be driven by clear economic considerations such as increasing efficiency, optimizing across company boundaries, reducing carbon emissions, or tapping into new business areas. Economic success is measured by corresponding KPIs. Economic interoperability is only present if there is the same formulation of goals, alignment of KPIs in the processes for creating goods and services (networked via ERP systems), compatibility of the support processes and an aligned pricing model/revenue sharing model among the participants of the DVC.

Therefore, the development of the business model in a DVC must be hand in hand between the business partners to ensure that the KPIs are not in conflict. Therefore, at first an agreement on the management level regarding the common objectives of the DVC must be in place (objectives of the involved partners can be different but must be not in conflict with the others). Based on that this alignment, the processes for creating goods and services, and support processes can be installed coherently.

3.2.2.1 Costs

While requirement elicitation in the kick-off a distinction was made between two main types of costs: operating costs for the functional tasks of the operator of the data space and the partners involved, and operating costs for the qualitative tasks of all those involved, e.g., for security of data exchange. The main requirements are transparent, low costs and concepts those are supporting scalability of costs. Beside the pricing models the solution space of the addressed topics refers more to technical requirements. Therefore, the mentioned topics will be shifted to technical requirements as qualitative attribute of concepts and implementations. Only transparent costs and pricing models will be kept as business attributes.



3.2.2.2 Data

As DVCs are all about data-based business models, Data were the second most mentioned category for business requirements while requirement elicitation in the kick-off. But the solution spaces of the addressed topics refer more to technical or legal requirements. Therefore, the mentioned topics will be sorted to technical and legal requirements.

3.2.3 Legal requirements

The European Commission wishes to counteract the uncertainty caused by not resolved legal issues, at least within the European Union (EU), with many legislative acts as part of the European Data Strategy. The cross-sectoral use of data in business and the public sector is to be specifically regulated and promoted. Examples of such legislation include the Data Act (a bill to promote data access and exchange), the Data Governance Act (which aims to promote the availability of data for use), and the Digital Markets Act and Digital Services Act (which regulates online platforms). Although these legislative acts are likely to be controversial in the short term, they can contribute to the desired legal certainty in the medium term. However, any Data Space has fully to comply to the regulations, those are relevant for the involved parties (national regulations, European regulations etc.). All must comply to the highest requirements of all involved parties.

Beside that freedom of contract enables the operator of the data space and the involved parties to agree on common terms and conditions, including aspects like liability and intellectual property. If trade secrets or intellectual property can be derived from data, these are subject to the corresponding property rights.

4 Concept of the survey

The survey will be structured into 3 sections:

- Introduction and contributor information
- rating and input
- conclusion.

In the introduction and contributor information section the background and the objectives of the survey will be introduced to set the scene for the contributor. The contributor has the



options to take part anonymous or by submitting his contact data, e.g., to be informed about the outcomes of the survey and the progress of the project at all. In any case some general information about the contributor as sectorial information etc. will be asked, even if the anonymous contribution was selected.

The rating and input section will be separated in three subjects for each topic:

- Rating of collected requirements
- Providing of further requirements
- Providing of known Examples

Even if the focus of the survey lies on the rating of the collected requirements on a Likert-Scale from 1 to 6, the opportunity to obtain further requirements and of known examples for good implementation of the requirements will be used by corresponding subsections.

If the contributors have passed the before described sections a summary of his contribution will be displayed and the option to edit will be given. After that the option to stay in contact with the project via different channels will be provided.



Appendix A – Structure of Survey

The parts of the survey will be introduced by the aligned description of clusters of requirements (see section 3).

Entrance Page

- Background of the survey
- Objective of EU-Data Sp4ce project/ Glossary
- Originator of survey
- Objective of the survey
- Estimated Time to fill survey
- Benefits for the participant
- GDPR Disclaimer
- Description of target group/ needed level of knowledge, experience/ Parts of survey// Skip Parts
- Explanation of the role of Use Cases and examples for the contribution// General requirements and Use Case/ example-specific requirements.
- Concept of the survey
 - Rating of collected requirements
 - Providing known Examples
 - Providing further requirements

Contributor Information

- Anonymous contribution is possible, Checkboxes for sectorial information (manufacturing sectors, digital sector, platform operator) etc.
- If the contributor likes, he can provide his contact data (name, mail-address, organization etc.). Checkboxes for sectorial information (manufacturing sectors, digital sector, platform operator) etc.
- Request, if the contribution to the survey is against the background of a specific Use Case or Data Space or Data Platform. If yes: Request to the details of the Use Case etc.



(short description (max. 500 words), links, publications etc.), role in the use case (observer/ active role)

Survey Part 1, General requirements// Use Case independent

How do you rate the importance of the following general requirements on a scale from 1 (not important) to 6 (very important)?

	1	2	3	4	5	6
Simple connectivity for data space participants						
Secure connectivity for data space participants						
Cost-effective connectivity for data space participants						
Use of standard technologies and concepts						
Use of cross-industry federated infrastructures if necessary						
Clear, compatible regulations/general terms and conditions at the legal level for data space participants. A technical platform on its own is not enough.						
Clear, compatible economic options for data space participants						
The data space itself must be provided and operated in a way that is legally binding and creates trust among participants						



Survey Part 2, Technical requirements

How do you rate the importance of the following technical requirements on a scale from 1 (not important) to 6 (very important)?

	1	2	3	4	5	6
Importance of User friendliness at all						
Accessibility						
Easy to understand for everybody						
Easy Adaptability						
Provide end user support						
Support end user involvement						
Onboarding of end users and providers						
Offboarding/ No Lock-in						
<i>Your Input</i>						

Do you have further suggestions for requirements in the category user friendliness?

Requirement	Short description of requirement (max. 200 letters)	Rating					
		1	2	3	4	5	6
tbd							

Do you know best practices that consider the before rated aspects?

Topic	Industrial Sector	Short description of best practices (max. 500 letters)	Further Information (Link, Publications etc.)
Accessibility			



Easy to understand for everybody			
Easy Adaptability			
Provide end user support			
Support end user involvement			
Onboarding of end users and providers			
Offboarding/ No Lock-in			

Interoperability

	1	2	3	4	5	6
Importance of Interoperability at all						
Outside Europe interoperability						
Worldwide adoption						
Alignment with adjacent sectors						
Scalability of concepts						
Use of standardized digital representation of an asset						
Onboarding of end users and providers						
Offboarding/ No Lock-in						
Legacy/ Brown Field						
Life-cycle of data – up-to date data - data liability						
Plug-in of multiple equipment from different vendors						
Long term storage of data// If a company goes bankrupt etc.						



Do you have further suggestions for requirements in the category interoperability?

Requirement	Short description of requirement (max. 200 letters)	Rating					
		1	2	3	4	5	6
tbd							

Do you know best practices that consider the before rated aspects?

Requirement	Short description of best practice (max. 500 letters)	Further Information (Link, Publications etc.)
Outside Europe interoperability		
Worldwide adoption		
Alignment with close sectors		
Use of a standardized digital representation of an asset		
Onboarding of end users and providers		
Offboarding/ No Lock-in		
Legacy/ Brown Field		
Life-cycle of data – up-to date data - data liability		
Plug-in of multiple equipment from different vendors		
Long term storage of data// If a company goes bankrupt etc.		



Autonomy

	1	2	3	4	5	6
Importance of Autonomy at all						
Cybersecurity & Security						
Integrity						
Availability						
Confidentiality						
Resilience						
Reliability, business continuity						
Diversity of operators of data spaces						
No single point of failure						
Location of servers and services						
Vulnerability of data						
Data confidentiality						
Data privacy						
Data storage						
Data security						
Data withdrawing						
Trust						
State of the art security measures and processes						

Do you have further suggestions for requirements in the category autonomy?



Requirement	Short description of requirement (max. 200 letters)	Rating					
		1	2	3	4	5	6
tbd							

Do you know best practices that consider the before rated aspects?

Requirement	Industrial Sector	Short description of best practice (max. 500 letters)	Further Information (Link, Publications etc.)
Cybersecurity & Security			
Availability			
Integrity			
Confidentiality			
Resilience			
Reliability, business continuity			
Replicability			
Diversity of operators of data spaces			
No single point of failure			
Location of servers and services			
Vulnerability of data			
Data confidentiality			
Data privacy			
Data storage			



Data security			
Data withdrawing			
Trust			
State of the art security measures and processes			

Sustainability

	1	2	3	4	5	6
Importance of Sustainability at all						
Support of a Data Space to realize following Use Cases/ Scenarios about sustainability						
Monitoring Product Carbon footprint						
Energy optimization						
Production in value chains, cross company value creation						
Distributed Manufacturing, Manufacturing as a Service						
Remanufacturing						
Recycling						
Reuse						
Computing Infrastructure// Edge AI						
Requirements on Data Spaces on Sustainability						
Social Sustainability (Application Scenario and requirement for Data Spaces in manufacturing)						
Economical Sustainability						



Green Computing							
Low Energy consumption							
EFRA – Further requirements							

Do you have further suggestions for requirements in the category Sustainability?

Requirement	Short description of requirement (max. 200 letters)	Rating					
		1	2	3	4	5	6
tbd							

Do you know best practices that consider the before rated aspects?

Requirement	Short description of best practice (max. 500 letters)	Further Information (Link, Publications etc.)
Support of a Data Space to realize following Use Cases/ Scenarios about sustainability		
Monitoring Product Carbon footprint		
Energy optimization		
Production in value chains, cross company value creation		
Distributed Manufacturing, Manufacturing as a Service		
Remanufacturing		
Recycling		
Reuse		
Computing Infrastructure// Edge AI		
Requirements on Data Spaces on Sustainability		
Social Sustainability (Application Scenario and requirement for Data Spaces in manufacturing)		



Economical Sustainability		
Green Computing		
Low Energy consumption		
EFRA – Further requirements		

Costs

	1	2	3	4	5	6
Importance of Costs at all						
Technical concepts those are supporting scalability of costs						
Functional Tasks						
Cost of hosting						
Link between Costs and Performance						
Maintenance and support costs						
Cost for end users						
Qualitative Tasks						
Cost and performance of cybersecurity						
Cost of data quality						
Cost of Privacy						
Cost for compliance assessment (bronco, silver, gold ready)						

Do you have further suggestions for requirements in the category costs?

Requirement	Short description of requirement (max. 200 letters)	Rating					
tbd		1	2	3	4	5	6



Do you know best practices that consider the before rated aspects?

Requirement	Short description of best practice (max. 500 letters)	Further Information (Link, Publications etc.)
Technical concepts those are supporting scalability of costs		
Functional Tasks		
Cost of hosting		
Link between Costs and Performance		
Maintenance and support costs		
Cost for end users		
Qualitative Tasks		
Cost and performance of cybersecurity		
Cost of data quality		
Cost of Privacy		
Cost for compliance assessment (bronco, silver, gold ready)		



Survey Part 3, Business requirements

Business requirements	1	2	3	4	5	6
Importance of Business requirements at all						
Alignment of objectives in the DVC among the partners						
Definition of value sharing mechanism						
Development of processes for creating goods and services, and support processes based on the alignment of objectives						
Common operating and monitoring of processes for creating goods and services, and support processes in the DVC						
Transparent Costs and pricing models						
Transparent billing						
Clearness of value proposition						

Do you have further suggestions for requirements in the category business requirements?

Requirement	Short description of requirement (max. 200 letters)	Rating					
tbd		1	2	3	4	5	6

Do you know best practices that consider the before rated aspects?

Requirement	Short description of best practice (max. 500 letters)	Further Information (Link, Publications, Tools etc.)



Alignment of objectives in the DVC among the partners		
Definition of value sharing mechanism		
Development of processes for creating goods and services, and support processes based on the alignment of objectives		
Common operating and monitoring of processes for creating goods and services, and support processes in the DVC		
Transparent Costs and pricing models		
Transparent billing		
Clearness of value proposition		



Survey Part 4, Legal requirements

How do you rate the importance of the following legal requirements on a scale from 1 (not important) to 6 (very important)?

	1	2	3	4	5	6
Importance of legal requirements at all						
Support merging of different national/ international/ European regulations						
Location of servers and services						
Political independence						
Treat data spaces as critical infrastructures (including the specific regulation e.g., in Germany)						
Agreement on Governance in DVC						
Agreement on Ensure Compliance						
Agreement on Data usage policies						
Agreement on Data ownership						
Agreement on Intellectual property data						
Agreement on Liability (e.g., for Data loss or theft)						

Do you have further suggestions for requirements in the category legal requirements?

Requirement	Short description of requirement (max. 200 letters)	Rating					
		1	2	3	4	5	6
tbd							



Do you know best practices that consider the before rated aspects?

Requirement	Short description of best practice (max. 500 letters)	Further Information (Link, Publications, Tools etc.)
Support merging of different national/ international/ European regulations		
Location of servers and services		
Political independence		
Treat data spaces as critical infrastructures (including the specific regulation e.g., in Germany)		
Agreement on Governance in DVC		
Agreement on Ensure Compliance		
Agreement on Data usage policies		
Agreement on Data ownership		
Agreement on Intellectual property data		
Agreement on Liability (e.g., for Data loss or theft)		



Summary of contribution

- The contributor gets a summary of his contribution and can update it if necessary (if technical possible)
- Note of thanks
- Click box
 - Further Information
 - Engage with the community
 - CSA
 - Outcomes of survey
 - Etc.

