POSITION PAPER

Shaping European Data Spaces for Smart Manufacturing

Proposing a pan-European sectorial Alliance to develop a common European Data Space for the Manufacturing Industry

We, the trilateral cooperation[1], with representatives from France, Germany, and Italy, together with representatives from the Netherlands, call on the European Commission, European governments, data sharing initiatives, and related associations to elevate data sharing in the manufacturing industry on top of the technological strategy agendas: national initiatives must be reinforced and coordinated to collaboratively develop a shared vision and implementation plan to build pan-European data spaces in manufacturing. Without urgent actions paving a pathway towards common data sharing practices, we put Europe's manufacturing industry's competitiveness at risk and might lose data sovereignty in the era of data-driven economies.

Challenges for the European Manufacturing Industry

The global shift towards a data-driven economy has also found its way into the manufacturing domain: in recent years, the usage of data has been significantly rising in importance to drive improvements in engineering, planning, commissioning, operations, and after-sale services. As this shift is mushrooming at unprecedented speed, the future role of data in the manufacturing industry, also at the intersection to its adjacent industries, has now become crystal clear to an increased number of practitioners and stakeholders. At the same time, economies in Europe are faced with drastic global challenges of major complexity that require fast and concerted action. Two exemplified incidents have recently been paralyzing Europe's economies in its foundations:

- First, Europe is forced to radically transition from a resource devouring into a sustainable society to prevent irreversible tipping of biosphere ecosystems as we know them. Scarcity and price volatility of natural resources have already triggered companies at the

[1] *The trilateral cooperation between "Alliance Industrie du Futur", "Piano Transizione Industria 4.0" (former Impresa 4.0), and "Plattform Industrie 4.0" was formed in 2017 and aims to support the digitalization processes in the European manufacturing sector. The trilateral cooperation is focused on three core topics: standardization, SME integration and testbeds, and political support.*

forefront to pivot their business operations for a greener future. Nevertheless, to accomplish a full sustainable transformation of the manufacturing industry, we still have a long path ahead of us.

- Second, vulnerability and missing robustness of Europe's global sourcing and supply chain strategies have been relentlessly disclosed in most recent times. Dramatic chip shortages due to pandemic effects have particularly affected the automotive industry by causing global revenue loss of €190bn to €290bn (as of May 2022), excluding additional operational costs for production shutdowns. Global supply chain delays are still reverberating long after the ultra-large container vessel "Ever Given" got stuck in the Suez Canal in March 2021.

Both, transition to sustainable industries and (re-)building sufficient resilience in supply chains are challenges to embark on whilst maintaining and strengthening global competitiveness with the world's economic superpowers United States (U.S.) and China. At the same time, global trends such as rising product complexity, fast increasing skilled workforce shortages, and decreasing productivity, aggravate the precarious state of European manufacturing industries even further.

The answer to cope with these challenges seems to be self-suggesting: accelerating the next evolutionary phase of the manufacturing industry's digitalization and propelling Industrie 4.0 in broad industrial day-to-day practice on European shopfloors. Key is to innovatively advance beyond pure automation in manufacturing (known as "Industrie 3.0" or third industrial revolution) and to attempt to bridge fragmented or even idle data silos in order to connect production systems, factories, and supply chains across enterprises, thus enabling new data driven business models. This needs to go hand in hand with an intrinsic paradigm shift from bilateral towards multilateral cooperation and collaborative data sharing along entire value chains to satisfy upcoming legal requirements and to exploit future business potentials.

Interoperable and Sovereign Data Spaces for the European Manufacturing Industry

In the era of data-driven economies, data-based value generation will depend on global data spaces that safeguard and guarantee data sovereignty, data interoperability, and data integrity. Data spaces enable multilateral collaborations that allow end-to-end data exchange in a fully interoperable and sovereign data-oriented ecosystem.

The architecture of data spaces is defined by examining at least three essential dimensions that must be considered comprehensively: business, legal, and technical (including security) foundations. The foundation of the data space prescribes frameworks, routines, standards, and guidelines that are agreed upon in a precompetitive manner, which can be used to initiate efficient cross-company collaboration and data sharing.

At present, numerous data spaces are emerging for manufacturing domains around the globe. For tapping into this unknown territory, economies pursue individual exploration and implementation strategies: private vendors push their solutions into the market in the U.S., whereas China runs a more centrally orchestrated approach to organize cross-company data sharing in production. Both strategies are characterized by prevailing domestic legal regulations (e.g. for data-access or data-forwarding), building the backbone of inherent domestic "cultures for data usage" that are in many facets not in line with Europe's data strategy and values. To prevent dependencies from vendors that are not underlying European legal regulations, to defy from non-European data-handling practices, and to maintain ownership of shared manufacturing data, Europe's manufacturing industry must develop a European solution for multilateral data-driven collaboration that incorporates European state-of-the-art data sharing regulations and features European values.

Status quo – Where are we today?

Development activities for manufacturing data spaces in Europe have, until today, been conducted by many different alliances, projects, networks and, in many cases, been driven in the context of national Industrie 4.0 initiatives. On a European level, first "embryonic data spaces" for various applications in the manufacturing sector are about to be established in projects such as *Boost 4.0*, *Qu4lity*, *Eur3ka*, *Productive4.0*, *Market 4.0*, *ConnectedFactories*, or *SmartFactoryEU*.

In addition, several European initiatives aim to mount the required technical infrastructure to bring data spaces into being. *Gaia-X* is the next generation of data infrastructure: an open, transparent, and secure digital ecosystem, where data and services can be made available,

collated, and shared in an environment of mutual trust. *IPCEI-CIS* creates a sovereign, highly scalable edge-cloud infrastructure in Europe that pursues the goal of creating a technical foundation that links ecosystems of data and infrastructure. The Big Data Value Association (*BDVA*) focuses on enabling the digital transformation of the economy and society through data and artificial intelligence (Trusted Industrial AI) by advancing in areas such as big data and AI technologies and services, data platforms and data spaces, Industrial AI, data-driven value creation, standardization, and skills.

Complementary, a stream of national initiatives within the trilateral cooperation and the Netherlands is already ongoing for the purpose of laying the foundation for industrial data spaces in the manufacturing sector:

Since 2005, many initiatives have been launched by the French Ministry of Industry to enhance the digital transformation of the industry, e.g. in 2005 through the TIC-PME program (€20mn), in 2020 calls for projects for digital collaborative industrial platforms and the creation of the French Gaia-X Hub, and in 2021 the creation of the "Industry of the Future Solutions sector" leveraged by the "Alliance Industrie du Futur", focusing efforts along four axes:

- organizing, federating, and promoting manufacturing solutions at the national and international level (e.g. within the Gaia-X working group), capitalizing on the results of the existing OTPaaS project, to propose and lead a sovereign platform for industrial data. The objective is to contribute to the work of structuring the platform's European exchanges of industrial data like *BoostAeroSpace* hub (> €100mn since creation), created by the European aerospace industry in 2011, interconnecting thousands of companies, essentially SMEs;

- initiating the development of new offers through structuring projects with each industrial sector;

- supporting products and services innovation to increase value, through the *ATLAS Program* (2021-2023) co-funded (> €10mn) by the industry and the French government, promoting intersectoral standardization work;

- reinforcing industry competitiveness and sovereignty.

In Germany, the government has been supporting manifold initiatives to accelerate the development of interoperable data sharing mechanisms, building up towards intersectoral and cross-sectorial data spaces since the midst of the last decade:

- The Plattform Industrie 4.0 and the International Data Space Association (*IDSA*) described a reference architecture and a formal standard to be used for creating and operating virtual data spaces for multiple industries;

- Major investments have been undertaken within public-private-partnerships to describe the technical foundations of data sharing resulting in a broad acceptance of industry-specific data models for manufacturing data spaces, as especially OPC-UA and the concept of the Asset Administration Shell (AAS);

- In initial projects such as the "Legal Testbed Industrie 4.0", "Gaia-X Federation Services", "AAS connected" or "Sovereign Cloud Stack", the basic foundations have been developed alongside three essential dimensions of manufacturing data spaces: technical, legal, and business interoperability;

- The implementation of manufacturing data spaces has successfully been ignited within the automotive sector by a dedicated funding and digital-transformation program bringing together more than 100 companies under the umbrella of Gaia-X principles – with the Catena-X consortium at the forefront of the development;

- Since its foundation in 2020, the Industrial Digital Twin Association (*IDTA*) provides main services for a successful implementation of data spaces, built on the AAS according to industry needs.

In Italy, since the year 2017, the government has promoted a plan towards the digitalization and data sharing of the entire country, regarding the manufacturing sector. Today, the "Piano Transizione 4.0" aims at diffusing knowledge and concrete actions around Industry 4.0 paradigms by subsiding investments (e.g. through tax credit) both in education

and smart and connected industrial assets. In accordance with this plan, a set of concrete actions has been conducted around the data space field. In this sense, we mention:

- the creation of several Digital Innovation Hubs and Competence Centers spread over the entire country to support Italian companies towards digitalization;
- the participation of several Italian institutions, associations and private entities to EU data space initiatives, such as *Gaia-X*, *FIWARE*, *IDSA*, and *BDVA*, aiming at fostering data sharing;
- regarding Gaia-X, the Italian Ministries of Economic Development, of Innovation and Digital Transition and of University and Research together with Confindustria, Fondazione Bruno Kesler and the National Institute of Nuclear Physics (INFN) collaborated to establish the *Gaia-X Hub Italia*;
- last, considering the involvement of Italy in the abovementioned data space initiatives, Italy contributed to the establishment of *DSBA* (Data Space Business Alliance founded by BDVA, FIWARE, Gaia-X and IDSA) intended to accelerate the data economy in Europe.

In the Netherlands, the theme of data sharing has been on the industry's strategic agenda since 2014. This has to do with the open innovation and strategic collaboration that takes place in complex, mostly high-tech value chains. From the beginning, the Netherlands pursued strategic collaboration with Germany in this regard. This has led to several initiatives in the field of data sharing:

- The Data Space "Smart Connected Supplier network" (*SCSN*), in which over 400 high-tech companies from the Netherlands and abroad are connected, based on "connect once - communicate securely with the entire chain";
- The realization of a Gaia-X Hub for industry at the Brainport Industries Campus;
- The establishment of a Dutch-German field lab *AI4DT* in which we take the next step when it comes to data sharing in industry and being able to share digital (digital twin) models with each other, and
- the active involvement in the set-up and development of Catena-X;
- In January 2020, the Data Sharing Coalition was founded. The Data Sharing Coalition is an open and growing, international initiative in which a large variety of more than 60 organizations collaborate on unlocking the value of (cross-sectoral) data sharing.

Since November 2020, the European manufacturing community and the European Commission have been in close conversations to drive the deployment of data spaces for manufacturing across Europe, revealing the needs to:

- federate currently fragmented and dispersed initiatives into a concerted effort;
- quickly extend current cross-border data space activities;
- connect data space developments and Industrie 4.0 strategies;
- agree on common pan-European foundations among all stakeholders without compromising their respective autonomy.

We, the trilateral cooperation, together with representatives from the Netherlands, reinforce those findings without "re-inventing the wheel" and emphasize the urgent need to bring together pan-European "Industrie 4.0 initiatives" for getting up to speed in the development of pan-European data spaces for the manufacturing industry to ensure global competitiveness.

What we need: an Alliance of national initiatives

In close alignment with European partners – from industry, from governments, from academia – and the European Commission, we need to advocate the broad elaboration and roll-out of common foundations for the data space throughout the European manufacturing industry.

We demand a pan-European sectorial alliance to harmonize, accelerate, and synchronize national data space initiatives for developing a common European data space for the manufacturing industry. This alliance will mark the ground by defining a common manufacturing

data space reference framework that is based on a common technical, legal, and business infrastructure. The alliance will build upon existing results and artefacts to further elaborate and specify the basic building blocks for a coherent, widely accepted operational model for the manufacturing data space based on European values and will drive the economic utilization of manufacturing data spaces by fostering dissemination and best practice sharing.

With this manifesto, we intend to make a very clear call to all data sharing initiatives in Europe to join our alliance, put data sharing on the radar of SMEs and governments to invest and ensure proper regulation. To master the common challenges of the industry's transformation, a public-private-partnership-approach is required, where political boundary setting is combined with entrepreneurial problem-solving and where investments from public and private sectors are strategically aligned. With respect to the recently published European horizontal regulation proposal (the so-called "Data Act"), where data sharing activities are promoted without making any distinction between B2C and B2B data, industry is advocating for a more sector- and problem-specific approach that does not lead to additional requirements and legal uncertainties, especially for the manufacturing industry. What industry needs is more legal certainty and trust building, as well as guaranteeing approaches to foster industrial data economy. If we do not act now, our competitiveness is in serious danger.

We, the trilateral cooperation, in close collaboration with Smart Industry from the Netherlands, with the support of European Digital Innovation Hubs (*EDIHs*) and the Test & Experimentation Facilities (TEFs), propose to boost this sectorial alliance to send a unified voice across European, national, and regional manufacturing data-driven initiatives. Under one single common governance framework for technical and business alignment, all partners will best capitalize on data directives and regulations and unlock business potentials in manufacturing products, factories, and supply chains. The alliance provides the safe environment to proceed integrated pan-European collaborations to fix manufacturing data spaces' cornerstones and jointly ensure Europe's competitiveness in the manufacturing sector.

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