DIGITALEUROPE

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Manufacturing data-sharing as driver for sustainability in Europe

Executive Summary

The potential value of manufacturing data sharing has been estimated at €83 billion just in the field of process optimisation.[1] Better leveraging machine-generated data can lead to up to 20% improvements in material resource efficiency.[2] Yet, despite emerging data partnerships, the European Commission says **80% of industrial data collected remains unused**. Commission President Ursula von der Leyen labelled this problem a ''pure waste''.[3] It is crucial to change this trend. If scaled across Europe, greater voluntary and incentivised industrial data-sharing can dramatically advance opportunities for EU climate-neutrality and innovation.

Digital twins for Industry 4.0, such as the Asset Administration Shell, can facilitate industrial data exchange among multiple parties in an ecosystem. They can offer a solution to boost the use of manufacturing data in Europe and improve efficiency, all while expanding opportunities for new services. They can also contribute to better carbon emission transparency not just at the company level, but across the entire supply chain. Multi-party data-sharing efforts, although increasing, can still be limited by a lack of trust between market actors and a coordinated approach to the uptake of voluntary international standards. Pan-European edge/cloud initiatives may alleviate these problems, as they are neutral integration platforms combining multiple existing cloud and edge infrastructures. They can foster interoperability too, by promoting existing standards for digital twin models in Industry 4.0. We recommend that the Commission and Member States:

- **Create a Multi-Country-Project for a pan-European edge/cloud initiative across Europe.** It should be spearheaded by the European Commission and open to all interested actors. It should pool funding from the national recovery and resilience plans as well as MFF funding streams like the Digital Europe Programme. It must be a key enabler to

[1] World Economic Forum, Share to Gain: Unlocking Data Value in Manufacturing, 2020

[2] McKinsey, Coronavirus: Industrial IoT in challenging times, 2020

[3] State of the Union Address by President von der Leyen at the European Parliament Plenary, 2020

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reach the EU Digital Decade target of 75% of EU companies using cloud/AI/big data by 2030.

- Embed existing digital twin models based on established communication interfaces, such as the Asset Administration Shell, into the work and outputs of the **Common European Manufacturing Data Space and the Digital Product Passport**.

The EU has long praised its global industrial leadership, but it cannot rest on its laurels. It has a duty to act with leadership and make manufacturing data essential to power the transformation of Europe's industry and ensure a cleaner environment.

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Digital twins for Industry 4.0 as manufacturing data-sharing enabler

Introduction

Established communication interfaces for the digital twin in Industry 4.0, like the Asset Administration Shell (AAS),[4] are models the EU can lead on.

A digital twin is a virtual representation of a physical product or process used to predict and optimise its performance. It can be critical to boost manufacturing data-sharing and carbon emission transparency along the value chain, which must be considered pillars for the EU's climate neutrality ambitions.

Lack of trust and clarity on benefits as existing barriers for manufacturing data-sharing

European manufacturers are sitting atop vast, unused amounts of industrial data. There are several reasons as to why the EU punches below its weight on industrial data usage.

A key barrier is the lack of trust in sharing manufacturing data with actors in the broader ecosystem. Today, most manufacturing data partnerships in Europe are limited to exchanges between the customer and the supplier only, due to fears of losing control of the use and application of their data, if shared further. These perceptions, justified or not, exert a vast impact on innovation cycles in the sector. They effectively slow down AI algorithm development by making it more difficult for companies to build large AI training datasets. Earlier attempts to scale up data exchanges *among multiple actors* have suffered from this lack of trust in the ecosystem.

Another important barrier is the lack of clear benefits for a data provider to share its manufacturing data. *The data provider must earmark upfront investments to put in place the right conditions for data-sharing. A clear understanding of the return on such investments is thus critical.* Data investments can exceed half of total IT expenditures of a mid-cap company in a non-tech sector, and can account for a full 5% of its total operating costs.[5] Manufacturing data is especially complex and

[4] In the Asset Administration Shell (AAS), the asset is the physical part, i.e. machine. The administration shell is the digital part, storing identification, operational, technical, and status information about the asset, i.e. machine, over its entire lifecycle. A more detailed definition of the AAS is in the Platform Industrie 4.0's publication here.

[5] Figures elaborated from the McKinsey article: Reducing data costs without jeopardizing growth (2020)

characterised by many specificities. It is necessary to first make the data interoperable before it can be shared with others.[6]

Why pan-European edge/cloud platforms can boost manufacturing data-sharing and emission transparency

If appropriately designed, pan-European edge/cloud initiatives can be the bedrock to help expand manufacturing data-sharing across Europe. They can help to carve out a manufacturing data governance model based on trust, mutual benefits and scalable use. This is crucial to expand data availability and allow for better algorithmic insights into machinery failure or product process tracking. Voluntary, industry-driven model contract terms could support such data-sharing efforts, but should remain voluntary and not pose restrictions nor obligations on the parties.[7]

The following aspects are required for data-sharing via pan-European edge/cloud initiatives to succeed:

- *Concrete business scenarios:* the benefits of deploying such pan-European solutions in a commercially relevant environment should be explicitly illustrated to all value chain participants. This is key to shape up supporting technical requirements at company and supply chain level. For further efficiency gains, parties can explore possible co-operation with existing cloud technologies and highlight successful projects and data collaborations in this space.
- *Neutral integration platforms (e.g. GAIA-X):* they can help to change the perception that multi-party data-sharing exposes companies to risks of sensitive production data theft. Creating vendor-neutral data infrastructures which combine multiple existing cloud and edge platforms could be particularly helpful. They should be open to all interested actors, be based on interoperable solutions and designed to enable secure data storage and sharing. To minimise IP theft risks, data-sharing use cases advanced in such platforms must put strong emphasis on data privacy classification and digital identities. These are critical considerations to

[6] Examples are the classification of products based on standardized product characteristics such as ECLASS, or the enablement of a product to comply with OPC-UA companion specifications like UMATI.

[7] Technology Industries of Finland (TIF), a DIGITALEUROPE member, has published model clauses for the sharing of industrial data. This project was launched since TIF and its members realised that deployment of data is hampered by a lack of established legal models. For more info: TIF, Model terms of the Technology industries for data sharing, 2019

ensure only defined authorised groups within the ecosystem can access and use the data in question.[8]

- *Interoperability:* common digital standards are key to create scalable manufacturing data usage and optimally use existing platforms. For example, established communication interfaces for digital twins, like the Asset Administration Shell (AAS), allow for standardised Industry 4.0 communications and data access across the entire value chain. In the right circumstances, these interfaces can even enable manufacturing data exchanges within and between business ecosystems. This is fundamental to generate ever more insightful industrial AI algorithms, as participants can merge multiple datasets from various business segments.
- *Data marketplace opportunities:* vendor-neutral platforms can act as marketplaces to trade manufacturing data. This aspect could spur the emergence of new multi-party, B2B-specific business models based on data-driven services for manufacturing sustainability or product quality. Such developments would, in turn, strengthen Europe's opportunities to nurture and grow its SME ecosystems. Importantly, any marketplace created should be seen as complementary to existing data-sharing models and continue to uphold companies' principles of contractual freedom and self-determination.

Recommendations for policymakers

- *Collaborate with urgency*: Member States and the European Commission must move fast in the creation of a Multi-Country-Project for a pan-European edge/cloud initiative. It will require pooling funding from the national recovery and resilience plans and MFF programmes like the Digital Europe Programme. This is instrumental to fulfill the ambition of the Digital Compass target of 75% of EU companies using cloud/AI/big data by 2030.
- *Place digital at the core of the EU's industrial strategy*: the European Commission should embed existing digital twin models based on established communication interfaces, such as the Asset Administration Shell, into the work and outputs of the Common European Manufacturing Data Space and the Digital Product Passport.

[8] Access to manufacturing data could be defined along the following classes: public, private and semi-public.

Annex: Examples of manufacturing data-sharing solutions

Pan-European edge/cloud initiatives can accelerate **industrial data-sharing at scale in several domains**. The three cases below illustrate concrete examples of the data availability problems that multi-party data-sharing can tackle thanks to the digital twin and a neutral integration platform. Better manufacturing performance and sustainability are the main outcomes.

Case 1 - Machinery - Predictive maintenance

Scenario

Three actors in a machinery supply chain, i.e. factory operator, machine supplier and machinery component supplier, intend to exchange data with one another to minimise production disruptions and enhance product capabilities.

Existing problem

Manufacturers have traditionally planned machinery maintenance cycles based on the age of the product. This approach leaves them exposed to unexpected faults or unpredicted failures, which can carry substantial costs. Predictive maintenance, which is about collecting and analysing operation data from the machine (i.e. vibration, temperature), can help to predict when faults occur and thus solve these production bottlenecks. Despite its value, predictive maintenance is under-developed today in manufacturing. The lack of trust in data-sharing along the value chain, or fear of IP theft, means there is scarce exchange of relevant data for predictive maintenance among multiple parties at ecosystem level. Data exchanges are therefore mainly limited to bilateral exchanges only between factory operator and machine supplier, based on contracts between the two parties. Other actors in this business ecosystem, like component suppliers, do not have access to relevant data. This explains why large data spaces for predictive maintenance are today barely available. The ecosystem as a whole misses out on opportunities for ever-more sophisticated predictive maintenance solutions to drive Green Deals goals.

Solution

Through pan-European edge/cloud initiatives, Collaborative Condition Monitoring (CCM) can help to address trust-related issues in data-sharing. CCM focuses on the collection and use of data to optimise the reliability of machines and, notably, their components in operation. In a simplified supply chain with 3 actors (factory operator, machine supplier, component supplier), it is implemented as follows:

1. The component supplier and machine supplier embed a digital twin for Industry 4.0, i.e. the Asset Administration Shell, respectively in their components and the end-use machine assembled with these components. The digital twin forwards to the neutral platform production data collected both from the components and the end-use machine. It is the component supplier and machine supplier that define who should have access to their component-generated data and machine-generated data respectively.
2. The factory operator supplements this component- and machine-generated data with other data points gathered during machine use (i.e. temperature, maintenance schedules). These data points will end up in the same neutral platform.
3. Data points collected are now all stored in a single, common, neutral platform. All three actors in the ecosystem (factory operator, machine supplier, component supplier) access these databases according to their data access rights, and use them to develop better AI predictive maintenance algorithms.

Case 2 - White Goods - Reduction of product scrap

The concept of Collaborative Condition Monitoring, rooted into data exchange among multiple parties at the same time, can be also applicable to other steps in the manufacturing process, such as process tracking.

Existing problem

In the white goods industry, critical production processes rely on flawless execution by the factory operator. Yet, regardless of the level of experience, humans are error-prone. Parts whose size does not meet the necessary criteria are scrapped and must be reworked. These errors drive up significantly production costs. They can jeorpardise entire production lines and increase resource consumption. Data-driven solutions to this problem are today too immature due to poor data availability.

Solution

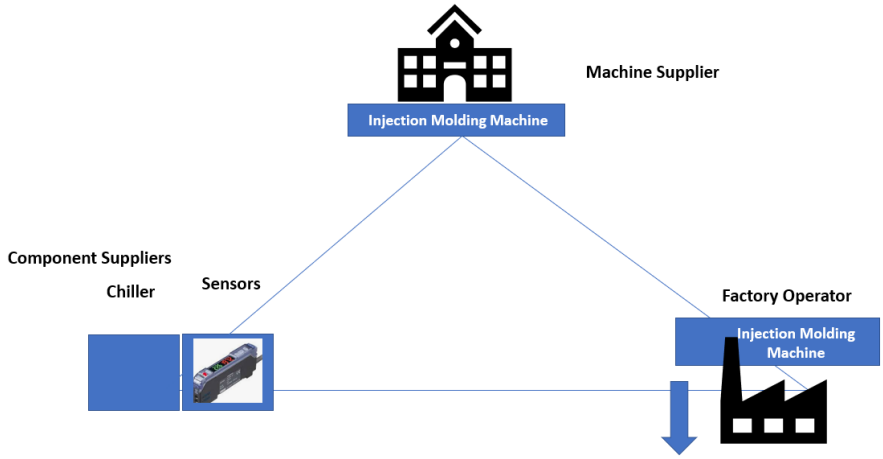
Adopting Collaborative Condition Monitoring through pan-European edge/cloud initiatives can tackle trust issues and increase data availability also in this scenario:

1. Component suppliers (i.e. chillers and sensors) and machine supplier (typically an injection molding machine) embed a digital twin for Industry 4.0, i.e. the Asset Administration Shell, in their components and machine.

The digital twin forwards component-generated and machine-generated data accumulated during production (i.e. time-based process parameters) to the neutral platform. As for Case 1, both component supplier and machine supplier define data access authorisation based on their preferences.

2. The factory operator supplements this data with other data points gathered during machine use (i.e. production data, raw material data and mold condition). Once a database is created, it then deploys the algorithm to predict quality failure and gives data-driven feedback before the human quality error occurs.

Illustration of CCM for part scrap reduction



Case 3 – Automation solutions - Emission transparency

The concept of Collaborative Condition Monitoring and the use of Asset Administration Shells are also relevant for the design of net-zero carbon emission strategies at supply chain level. They can also drive down the costs of compliance with environmental product legislation.

Existing problem

Scope 3 emissions are harder to measure than Scope 1 and 2's, as they broadly represent all indirect emissions from value chain activities. In the case of a value chain producing automation solutions, a company has visibility of just 10% of all

carbon emissions data in the ecosystem. Scarce data transparency is due to legitimate confidentiality purposes and the lack of industry-wide registries where to collect data throughout the value chain. Net-zero targets are thus difficult to reach. Boosting data visibility would smooth out the path to net-zero. It would allow companies to orchestrate decarbonisation strategies in coordination with their suppliers and the other actors in the value chain. It would also help them to reduce costs from regulatory compliance with environmental product legislation, as data could be more easily verified.

Solution

1. Suppliers embed Asset Administration Shells into their components. The latter will help to calculate metrics that will determine, in CO2 equivalents, the product carbon footprint of these components. Obtained data is stored in a confidentiality-preserving manner in a decentralised registry.
2. The manufacturer of the control cabinet accesses this Scope 3 data stored in the registry using verifiable credentials. It then integrates this data into calculations of the total carbon emission data in the supply chain.
3. Relevant data for environmental regulatory compliance is then communicated to the relevant authorities.

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