In collaboration with
Boston Consulting Group

Sharing Data to Achieve Decarbonization of Value Chains:

BRIEFING PAPER

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The challenge to setting an accurate emissions baseline

Global production sectors are responsible for one-fifth of carbon emissions and 54% of the world's energy sources consumption,[1] leading more manufacturing companies to position decarbonization (and energy efficiency) at the centre of their priority agendas. The connection between climate action and business performance is also becoming more relevant, making sustainability and resilience key drivers for competitive advantage. In fact, in a recent Boston Consulting Group (BCG) survey, 80% of study participants reported that their company plans to transition to carbon-neutral operations. Nearly one-third (31%) plan to become carbon neutral by 2025, and approximately 60% plan to achieve this goal by 2030.[2]

However, in order to progress in the decarbonization agenda, manufacturers are realizing that they need to go beyond carbon-neutral operations within companies' boundaries and involve stakeholders from their value chains and business ecosystems to tackle the largest contributors to the total emissions. The Carbon Disclosure Project estimates that upstream emissions outweigh internal emissions by a factor of 11.4.[3]

In the decarbonization journey of supply chains, the first step is to gain an understanding of a product carbon footprint (PCF). The importance of establishing an emissions baseline is reinforced by the growing consciousness among society, and demand from consumers, investors and governments for the correct labelling of a PCF.

Within this context, the challenge for many manufacturers is the accurate reporting of not only the internal emissions related to a given product, but also the external supply chain emissions. These emissions may be estimated using emission factors and aggregated data from lifecycle databases and other sources whenever the required data is not available. To understand their main emission drivers, many companies, however, want a more detailed understanding of their emissions – accounting for parameters such as differences in geography, fuel sources and process variations – in all areas where PCF can be measured based on real data. This granularity and correctness of data will allow firms to precisely track the impact of improvement and reduction measures from cradle-to-gate.

Sharing data with customers and obtaining data from suppliers is therefore becoming crucial to establish a granular and accurate emissions baseline. Exchanging data successfully requires overcoming both technical and trust-based barriers, as discussed in the white paper Share to Gain: Unlocking Data Value in Manufacturing.[4]

This briefing paper shares the learnings and success factors from an incubated pilot collaboration among members of the World Economic Forum's Advanced Manufacturing and Value Chains community to exchange carbon dioxide-equivalent data trustfully and securely along supply networks in order to obtain complete PCFs.

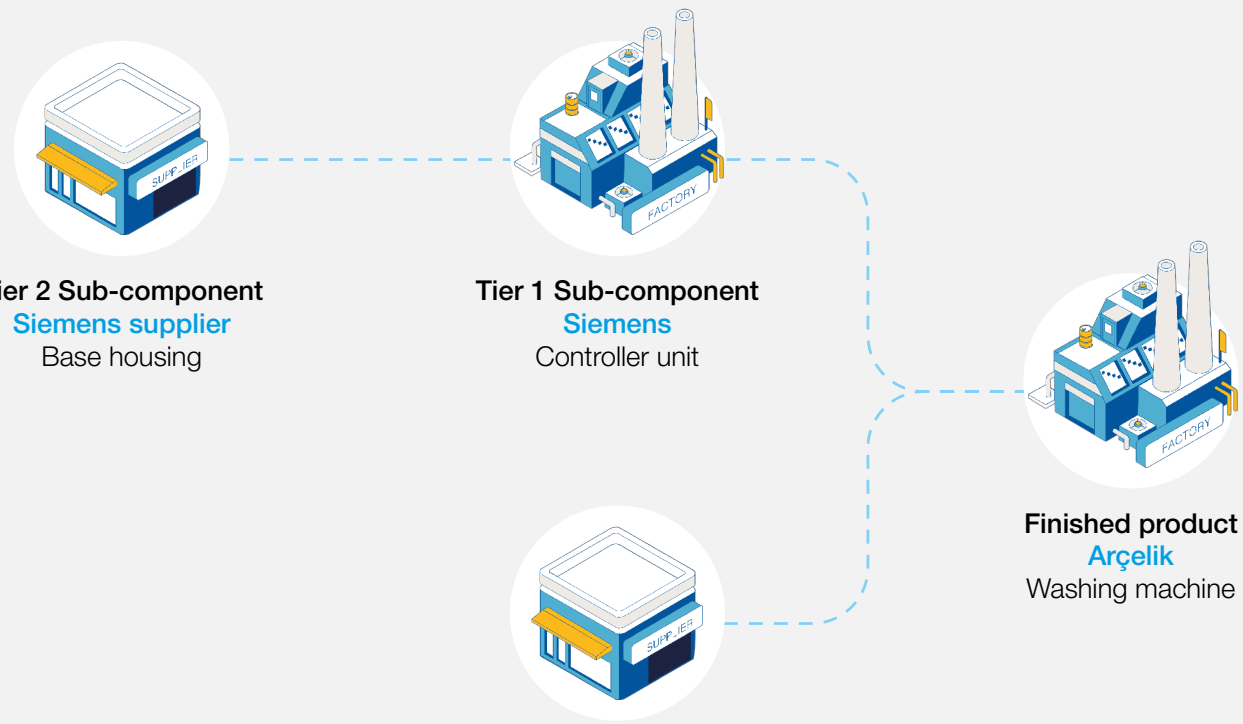
Trustful and secure PCF data-sharing: the pilot explained

To explore ways to overcome barriers associated with data exchange, senior executives from the Advanced Manufacturing and Value Chains community have engaged in the "Unlocking value in manufacturing through data sharing" initiative.

Within this initiative, organizations such as Arçelik, BCG, Dow, EPFL, GreenPlat, Rockwell Automation, SAP and Siemens joined forces to incubate and develop an open blueprint and technical solution for trustfully and securely exchanging PCF data along manufacturing and supply networks. Such data sharing is essential for manufacturers to establish a baseline of carbon emissions and the resulting visibility provides the foundation for initiatives to decarbonize production operations.

In a first pilot implementation, Arçelik, Siemens and Dow set up a simulated supply network for an Arçelik washing machine with a controller from Siemens and resins from Dow to exchange PCF data across parties (see Figure 1).

FIGURE 1 **A simulated supply network to demonstrate the data-sharing mechanism**



Source: Authors

One of the key incentives that triggered this data collaboration was the shared understanding among members of the working group that carbon footprint transparency is for the greater good and brings value to all stakeholders regardless of their supply chain role. The success of this partnership was further enabled by a clear common strategy centred on purpose-driven data sharing to ensure trust as well as a diverse set of skills and capabilities to drive this work forward – from industrial leaders and technology experts, to members of academia.

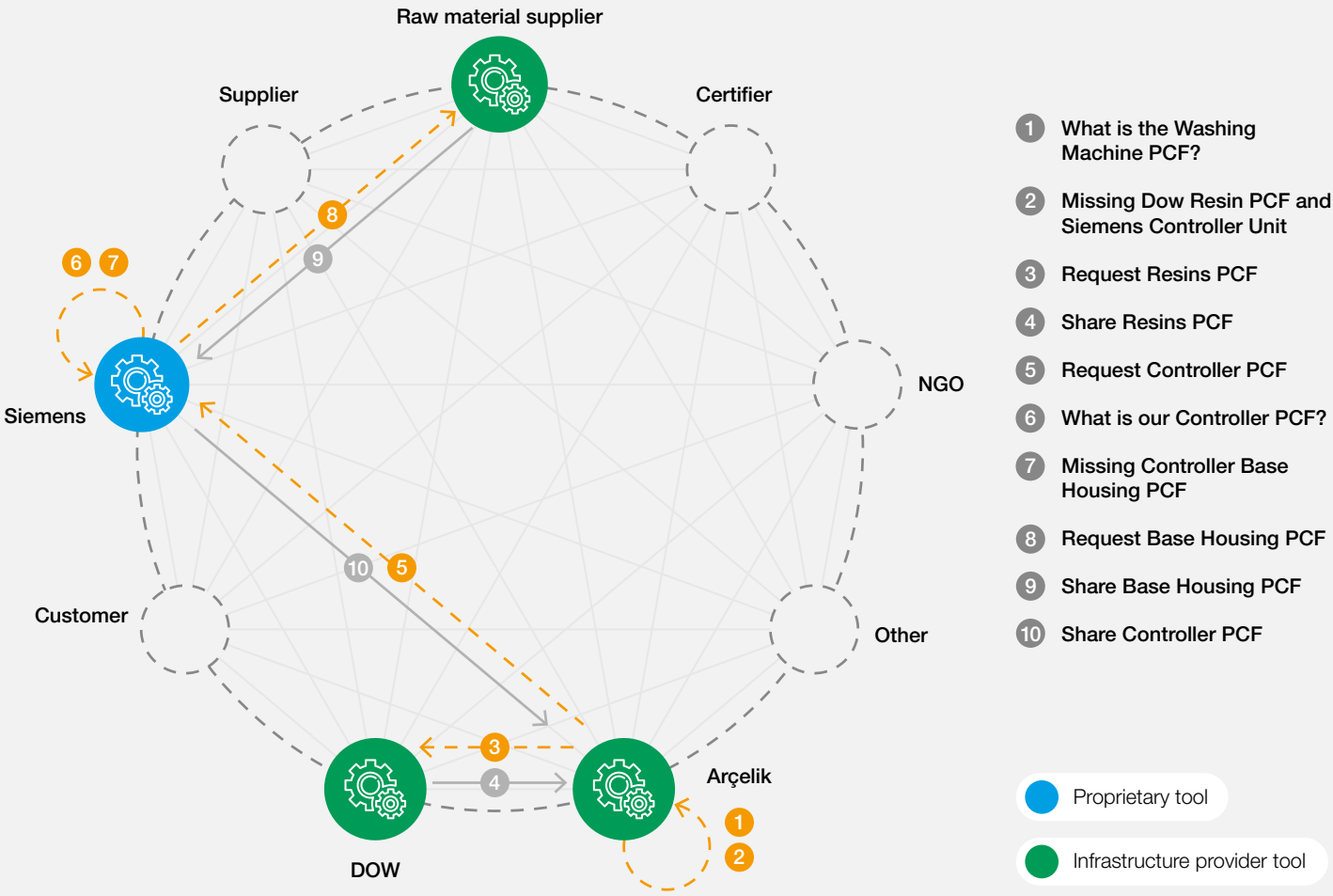
Bringing these foundational elements to practice, the working group developed a blueprint for the exchange of PCF data along manufacturing and supply networks. Once developed, the technical solution led by GreenPlat and Siemens, featured three main design characteristics:

- **A distributed architecture with peer-to-peer data exchange.** The group used crypto technology-based trust mechanisms to provide verifiable data along multi-tier supply chains while keeping supply chains confidential. Data is shared on a request-basis and only visible to the requesting party.
- **A decentral storage and aggregation of PCF data.** This to ensure compliance with local regulations for each country data is stored in, also known as data sovereignty.
- **A common interface and data model for interoperability.** The group developed an open-source ontology for PCF reporting and used a semantic data model to create a common standard for the seamless exchange of PCF data between different systems and databases.

The trusted technology-based solution offers three core functionalities to help supply chain actors obtain an accurate account of their external emissions (see Figure 2):

1. Requesting a PCF from another company, such as a supplier
2. Entering PCF data and sharing it with the requestor
3. Aggregating supply chain PCF data to calculate the finished product's carbon footprint

FIGURE 2 **A scalable, decentralized architecture to ensure data sovereignty and trusted-data sharing**



Source: Authors

The system design also offers additional functionalities, such as auditing and certification of PCF data, tracking of carbon-dioxide compensation, and enabling the involvement of legislators and non-governmental organizations (NGOs) to promote correct data reporting and labelling. The trustworthy supply chain exchange mechanism (see Box 1) is worth highlighting in itself: many blockchain projects have shown that the ecosystem design and roles involved are critical, with technology being only the first step to providing an immutable storage mechanism.

BOX 1 Trustworthy supply chain exchange (TSX) for product carbon footprints

Trustworthy supply chain exchange (TSX) is a method for exchange of certified product-level information in supply chains. TSX addresses requirements on transparency, confidentiality and data control when sharing information across the supply chain.

A selected certifier – typically an organization with knowledge of the manufacturer's production process and the carbon emission measurement method – can confirm the authenticity of the data and ultimately provide PCF certificates in the form of digitally signed verifiable credentials towards the company sharing the data. Each organization sharing data in the ecosystem ("certificate holder") can present these certificates to its customer for verification using public digital keys.

The multi-stage application of PCF certificates allows a customer to verify the end-to-end and aggregated product carbon footprint in a trustworthy manner while keeping confidential details such as the identity of the suppliers, components and materials hidden. Each data owner also stays in control of carbon emission data and decides with which business partner data should be shared.

The opportunity to decarbonize value chains

The blueprint and technical tools for the exchange of PCF developed among organizations within the community demonstrate that with an aligned strategy and objective, data can be shared in a trustworthy and secure way. In the case of this pilot collaboration, the participating companies are charting the course for a data-driven journey towards the decarbonization of value chains.

The sharing of carbon dioxide-equivalent data allows manufacturers to compute their carbon footprint and establish an accurate emissions baseline that accounts for not only internal emissions, but also upstream supply chain ones. This helps supply chain actors get a holistic understanding of the major contributors. Ultimately, working with their business ecosystem, they can make informed decisions towards setting the right targets to reduce their footprint for more sustainable value chains, better customer experiences and alignment with legislations.

The sharing of data among supply chain partners has proven to be essential to establish a baseline of carbon emissions as the resulting visibility provides a solid foundation for initiatives to decarbonize production operations. The World Economic Forum's Platform for Shaping the Future of Advanced Manufacturing and Value Chains and community around this effort seek to share back outcomes from this demonstration project. Building on these learnings and leveraging the Manufacturing Data Excellence Framework[5] (see Box 2), the Platform will also continue working with key organizations across industries to incubate new partnerships such as this one, to unlock the value from data collaborations and analytics in manufacturing, driving productivity, enhancing customer experiences, and ensuring a positive impact on society and the environment.

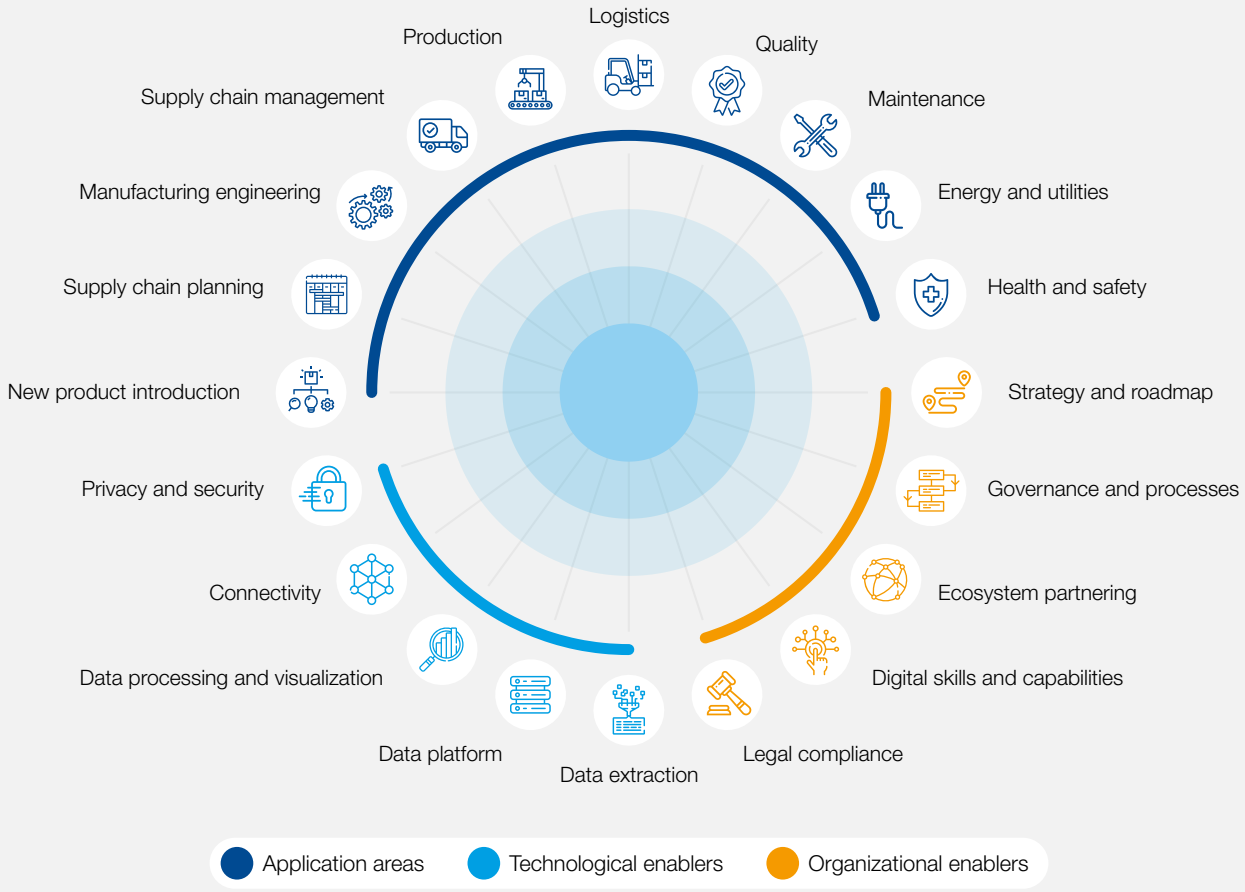
BOX 2 Manufacturing Data Excellence Framework

The framework shown in Figure 3 was co-developed by the Unlocking Value in Manufacturing through Data Sharing initiative community. It covers the key opportunities and success factors for manufacturing data excellence, breaking them down into 20 dimensions covering three pillars: application areas, technological enablers and organizational enablers.

The process of moving towards manufacturing data excellence starts with an organization understanding its current level of data maturity. The framework is designed to provide these insights, enabling manufacturers to self-assess their strengths and development areas, relative to their peers. This helps them devise a path forward, planning the change strategy and the launch of new initiatives. Ultimately, the framework gives an opportunity for companies to collaborate beyond their explicit boundaries by defining a common target for data excellence and incubating new partnerships that can turn mutual pain points into tangible solution.

More details about the Manufacturing Data Excellence Framework can be found in the white paper The Data-Driven Journey towards Manufacturing Excellence.[6]

FIGURE 3 Manufacturing Data Excellence Framework



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Endnotes

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6. Ibid.