Data Ownership Studies through Field Examples:

(1)Exchange of Work Progress Data in Made-to-order Manufacturing
(2) Judging the quality of high-speed precision press work
(3) Carbon traceability starting from castings

Advanced Study Group
on Data Sovereignty (ASG-22)
IVI

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1. Introduction: About this document

This document presents the discussions and deliberations of the Data Sovereignty ASG, Advanced Study Group, regarding data ownership and description in specific examples.

The importance of data utilization in manufacturing is widely recognized, and government measures such as Connected Industries are being promoted, but the lack of accumulation of data contracting practices has been identified as an issue.
In response, IVI organized the Data Ownership Committee in 2017 and began activities aimed at protecting the rights of shop floor data (IVI named it “deep data”) in the IoT era. This committee was reorganized into the Data Ownership ASG in 2018, which later became the Data Sovereignty ASG in 2021 to develop and continue its activities.

In order to realize higher value in connected manufacturing in the IoT era, it is important to be able to negotiate, judge, and realize ownership of deep data appropriately according to the business environment of each company. This document is the result of discussions and examinations conducted by the parties concerned, and is expected to contribute to the expansion of recognition of data ownership, activation of discussions, and better realization of data ownership.

1. Introduction: About this document

To promote the utilization of *deep* data while protecting the rights of deep data, IVI has conducted a hearing survey on the current status and issues of data ownership and solutions for data transfers between companies, and has published it as a white paper※.

※ IVI Data Ownership ASG “current status and issues of data ownership and solutions for”; Sept. 2019
https://iv-i.org/downloads/whitepaper_asg/ (in Japanese only)

In addition to the above efforts, examples of data ownership studies in specific cases are considered to be helpful for implementation by those in charge of the field. Therefore, this document presents the contents discussed in the Data Sovereignty ASG, together with its description.

We hope that this document will be used as a reference for promoting understanding of the concept of data ownership in the field, sharing understanding with legal and intellectual property departments and information-related personnel, and considering and negotiating data ownership and its implementation in data trading platforms when companies actually decide to exchange data in the field. We hope you will find this document useful. Please note that this document is a summary of the discussions at the Data Sovereignty ASG and we are not responsible for any actions taken by users using this document.

2. Exchange of Work Progress Data in Made-to-order Manufacturing

This section describes the results of the following two IVI's smart manufacturing business scenario working group projects:

- ✓ 6E02 "How to Connect for Mass Customization" and
- ✓ 7E03 "Affordable data collaboration for small and medium-sized manufacturing companies".

Reference:
IVI Open Symposium 2021 -Spring-
https://iv-i.org/en/2021/02/28/english-announcement-of-ivi-open-symposium-2021-spring/

IVI Open Symposium 2022 -Spring-
https://iv-i.org/en/2022/02/23/english-information-on-ivi-open-symposium-2022-spring/

2.1 Target Situation

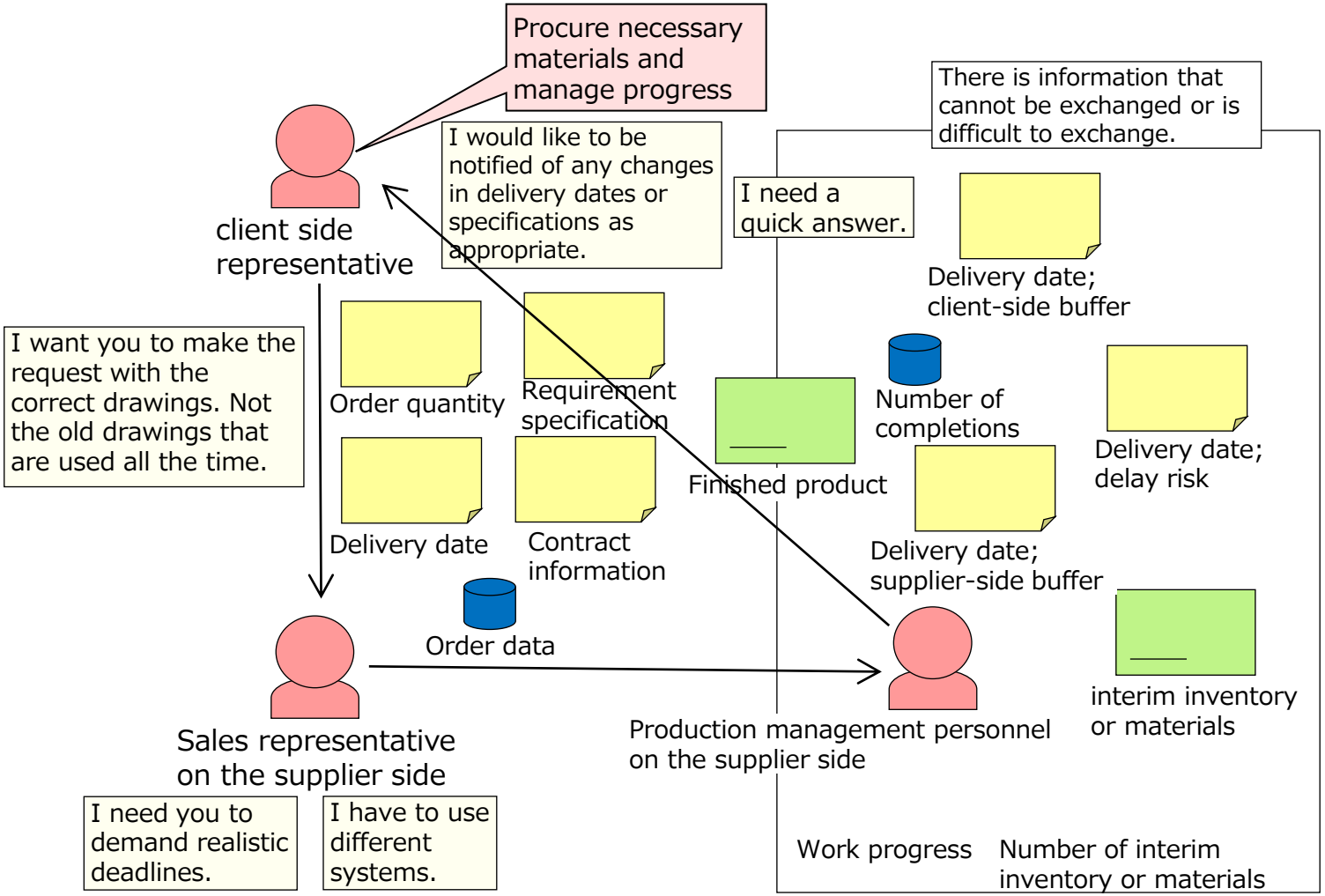
Target Sites :

- ✓The target companies are Manufacturer A, a make-to-order manufacturing company, and its component suppliers.
  - ✓The supply chain is multi-tiered.
  - ✓In some cases, Manufacturer A provides free-issue components / assemblies to its component supplier.
- ✓The manufactured product is a custom product with a delivery time of more than one year.
  - ✓Forecasts are made with standard lead times, but there are no precise estimates at the beginning.
  - ✓Once a plan is established, each company makes adjustments to refine the plan.
- ✓It is not simply a matter of making products as quickly as possible (Just-In-Time:JIT may be preferred to overcome storage space issues).
- ✓The situation may change during the production process due to changes in delivery dates from final customer, tight supply of materials, and so on.

2.1 Current Issue

✓ Manufacturing progress information between companies and factories is not obtained in a timely manner with good accuracy.

Chart of exchange; As-Is



2.2 Exchange Data to overcome issues

Purpose of data exchange:

✓Delivery date confirmation, i.e. which parts are to be shipped, when and how many, in a timely and accurate manner. Supplier wants to know which parts are to be wanted, when and how many, in a timely and accurate manner.

✓Adjust production priorities.

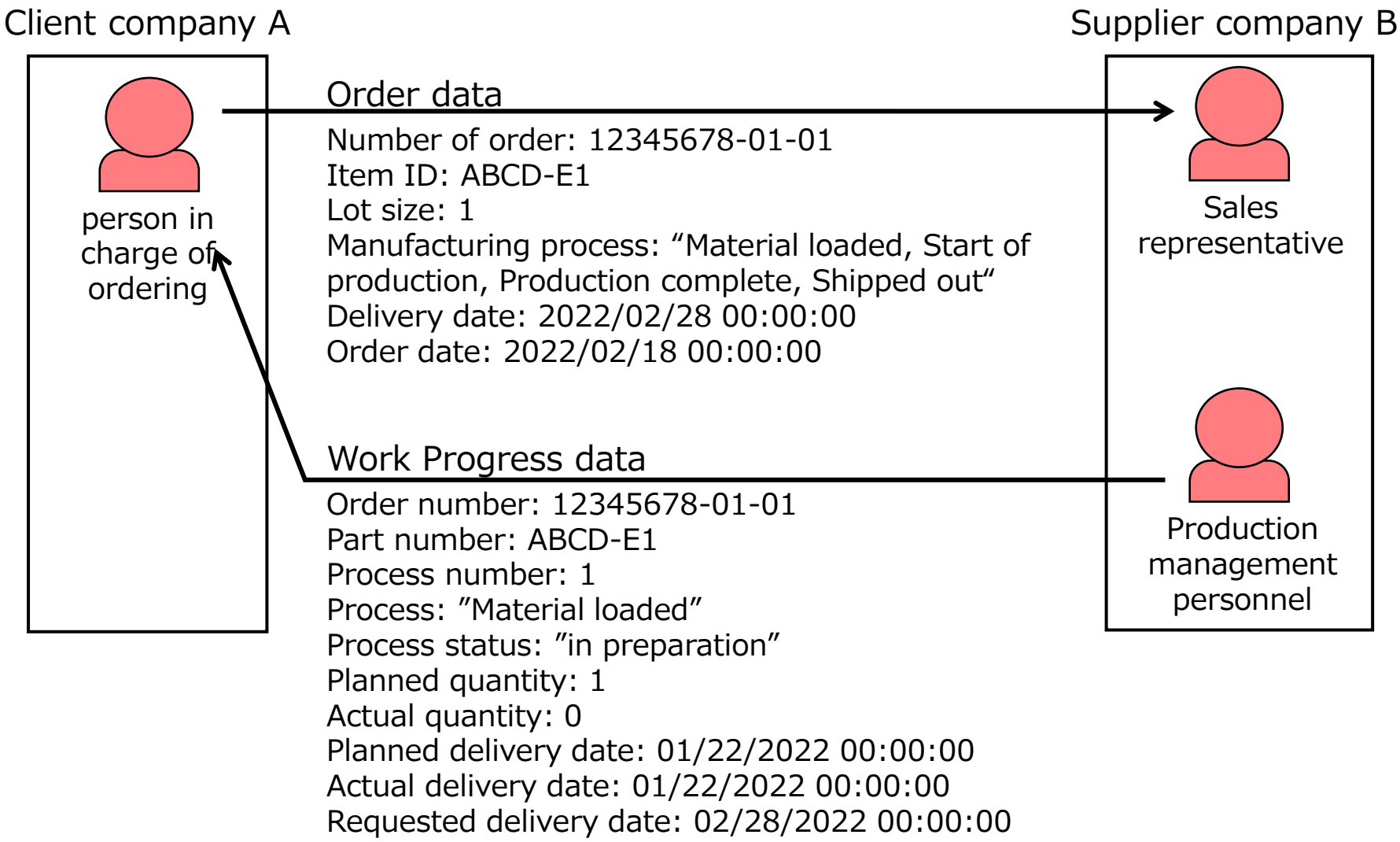
✓Facilitate JIT supply of finished products, parts/materials and free-issued parts.

Data to be exchanged:

✓Requirements, progress data and inventory data

- ✓Consider exchanging data between two companies for simplification.

2.2 Examples of data to be exchanged

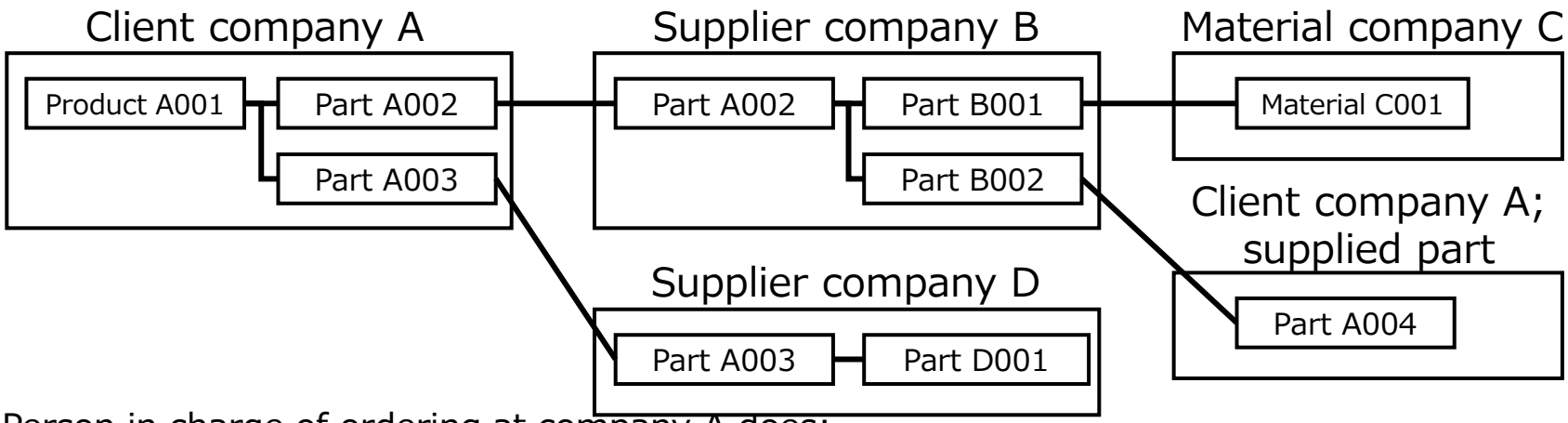


2.3 Considering data ownership

1. The data shall be referenced only by the two companies that transfer the data (i.e., the received data shall not be provided to any other company). Since there are advantages or disadvantages in narrowing or widening the reference range, this study assumes a narrower case in order to reduce concerns* such as use for other purposes in data sharing.
   - If the scope of reference is narrow, the company's data will be referenced only by those with whom it has a direct order-receipt relationship, thereby reducing the risk that the company's order status or production capacity will be guessed.
   - If the reference range is wide, it is easier to infer the cause of progress delays and to adjust production plans.
2. Immediate transmission of updated data shall not be committed.
3. The scope data exchange shall be determined by the two companies that exchange data.

* IVI data ownership ASG “Data Ownership Status, Challenges and Solutions “, Sept. 2019
https://iv-i.org/downloads/whitepaper_asg/

2.3 Considering data ownership



Person in charge of ordering at company A does:

- enter order information of part A002 and A003
- receive and refer to the order progress of parts A002 and A003 from Company B and Company D, respectively.

For example, if the process "material arrival" for part A002 is not completed beyond the scheduled time, we can guess that "material arrival for part A002 is not in progress“; we can not guess whether the arrival of parts B001 or B002 is in progress.

Sales representative and production management personnel at company B does:

- refer to the order information for part A002.
- enter the order progress for part A002.

If Company A changes its delivery request for A002 due to a change in the delivery date of product A001 or a delay in the progress of part A003, Company B can also adjust its priority for A002 production.

It is not possible to refer to the order progress of Company D; it is impossible to even know that Company A has placed orders with Company D. The reverse is also true.

3. Judging the quality of high-speed precision press work

This section describes the results of the following three IVI's smart manufacturing business scenario working group projects:

- ✓ 6E03-2 "Defect Detection of High Speed Press Machine by AE Sensor",
- ✓ 7B02 "Implementing Sensors and Image AI for Predictive Maintenance", and
- ✓ 7E01 "Inter-company collaboration through AI data distribution platform".

Reference:
IVI Open Symposium 2021 -Spring-
https://iv-i.org/en/2021/02/28/english-announcement-of-ivi-open-symposium-2021-spring/

IVI Open Symposium 2022 -Spring-
https://iv-i.org/en/2022/02/23/english-information-on-ivi-open-symposium-2022-spring/

3.1 Target Situation

■Target Sites :

- ✓The target companies are Company A, a manufacturer of high-speed precision press work, and Company B, an AI vendor.
  - ✓Company A also manufactures its own molds and has excellent expertise in precision machining.
  - ✓Company A conducts off-line visual inspections.
  - ✓Large quantities of defective products may be generated, for example, in the event of a mold malfunction.
- ✓By installing sensors on presses and using AI to perform online good/fail judgment, the company A aims to curb the number of defective products generated.
- ✓The permission of the ordering company can be obtained to send (non-image) sensor data outside the company (to automate the good/fail judgment).
- ✓In the future, company A aims to provide the molds and the AI to neighboring companies in the same industry, so that they can jointly accept large-scale orders.

3.1 Target Situation

■ **Current Issues:**

✓Large quantities of defective products may be produced.

✓Since sensor data is acquired at high speed and in large volumes, it is not easy to provide it to Company B.

✓When providing sensor data to Company B, it is not easy to make them comply with the agreement, such as the authority to use the data.

✓When receiving the AI model from Company B, it is not easy to prove compliance with the agreement, such as authority to use.

■ **Our goals:**

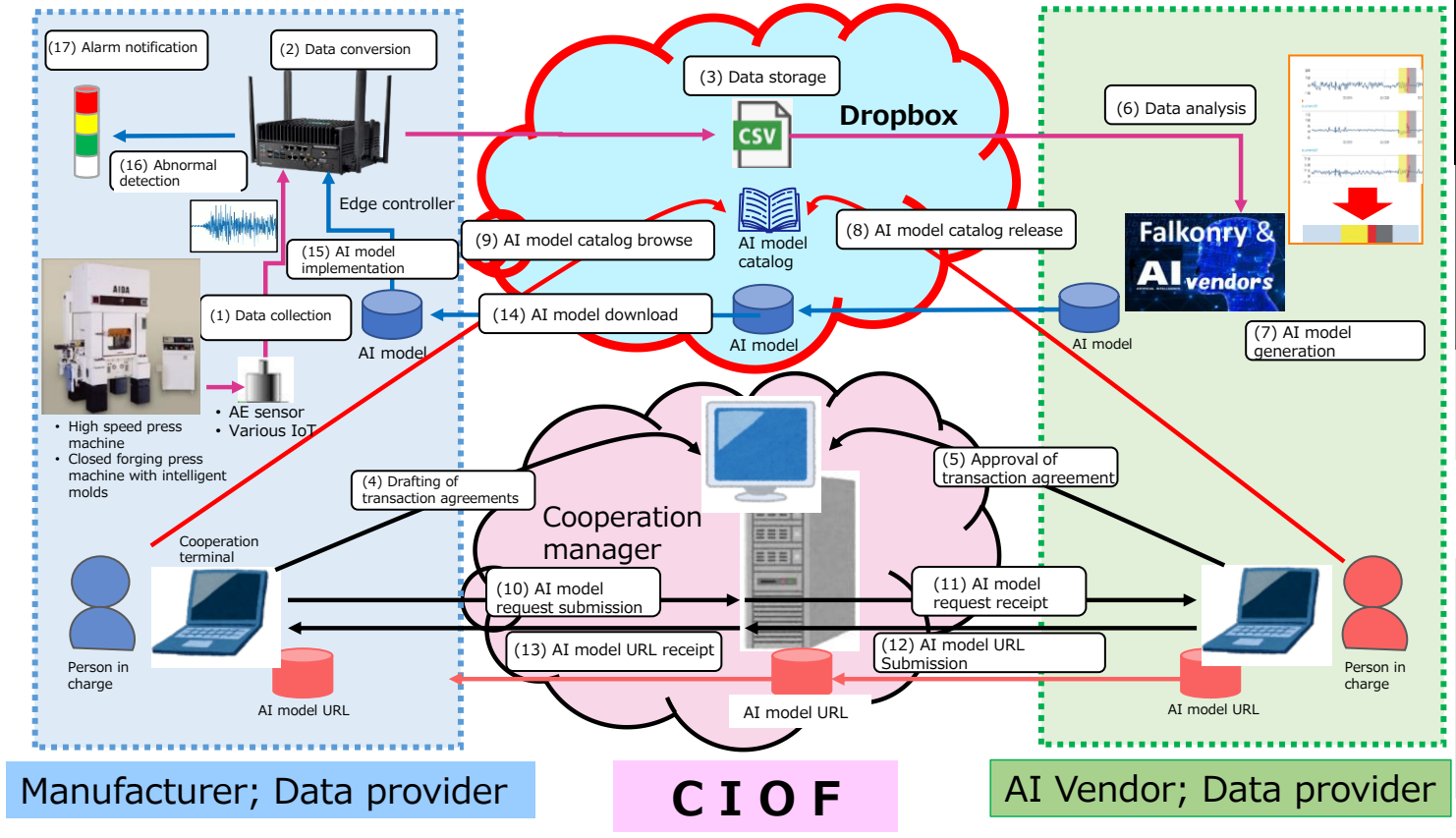
As shown on the next page, we aim to develop an AI model using the following procedure and embed it in an edge controller to enable online good/fail judgment.

➢As shown in (1) through (5), Company A provides sensor data to Company B for AI model development.

➢Company B will provide AI model development, speed and accuracy values to Company A as shown in (6)-(9).

➢As shown in (10)-(17), the AI model is provided by Company B to Company A and incorporated into the edge controller.

3.1 Target Situation



(1) Data collection
(2) Data conversion
(3) Data storage
(4) Drafting of transaction agreements

(5) Approval of transaction agreement
(6) Data analysis
(7) AI model generation
(8) AI model catalog release

(9) AI model catalog browse
(10) AI model request submission

(11) AI model request receipt
(12) AI model URL submission

(13) AI model URL receipt
(14) AI model download
(15) AI model implementation
(16) Abnormal detection
(17) Alarm notification

3.2 Data to be exchanged

- ✓Data stored in step (3) is stored in storage in the cloud in advance.
- ✓It will be made accessible by company B; the access URL is sent to company B, after an agreement on AI model development is made between Company A and Company B as an agreement in the transaction contract.
- ✓It includes information on the type of sensor, in addition to the time-series values for each sensor,
- ✓During the development of the AI model, Company B will also ask Company A questions about the data and check for data defects.

- ✓The AI model catalog provided in (8) includes the accuracy achieved with the above data and the time required to make a decision.
- ✓AI model development may be iterative, with an AI model catalog created for each version.

3.3 Considering data ownership

Data provided by Company A to Company B will be used only for AI model development, and will be discarded after development is complete, including cleansing data.
If the AI model catalog provided by Company B to Company A is copyrighted, the copyright belongs to Company B.
If Company B makes an invention in the development of an AI model, e.g., a cleansing device, the rights to the invention belong to Company B.
If Company B invents an invention in the development of an AI model, for example, if it invents a method of data cleansing, the right to the invention belongs to Company B.
Company B will provide Company A with the developed AI model and its catalog, but not the cleansed data.

Company A does not reverse engineer AI models.

4. Carbon traceability starting from castings

This section describes the results of the following IVI's smart manufacturing business scenario working group project:

✓ 7E02 "Monetization model for inter-company data distribution".

Reference:
IVI Open Symposium 2022 -Spring-
https://iv-i.org/en/2022/02/23/english-information-on-ivi-open-symposium-2022-spring/

4.1 Target Situation

■ **Target Sites :**

✓The target companies are foundries of metalworking components suppliers and finished product manufacturers.

  ✓In the casting process, sand is kneaded to make a frame and molten iron is poured into it.

  ✓IoT data, such as power consumption of equipment, as well as work performance and production information, are available.

✓The service provider's CO2 emissions calculation function can be utilized.

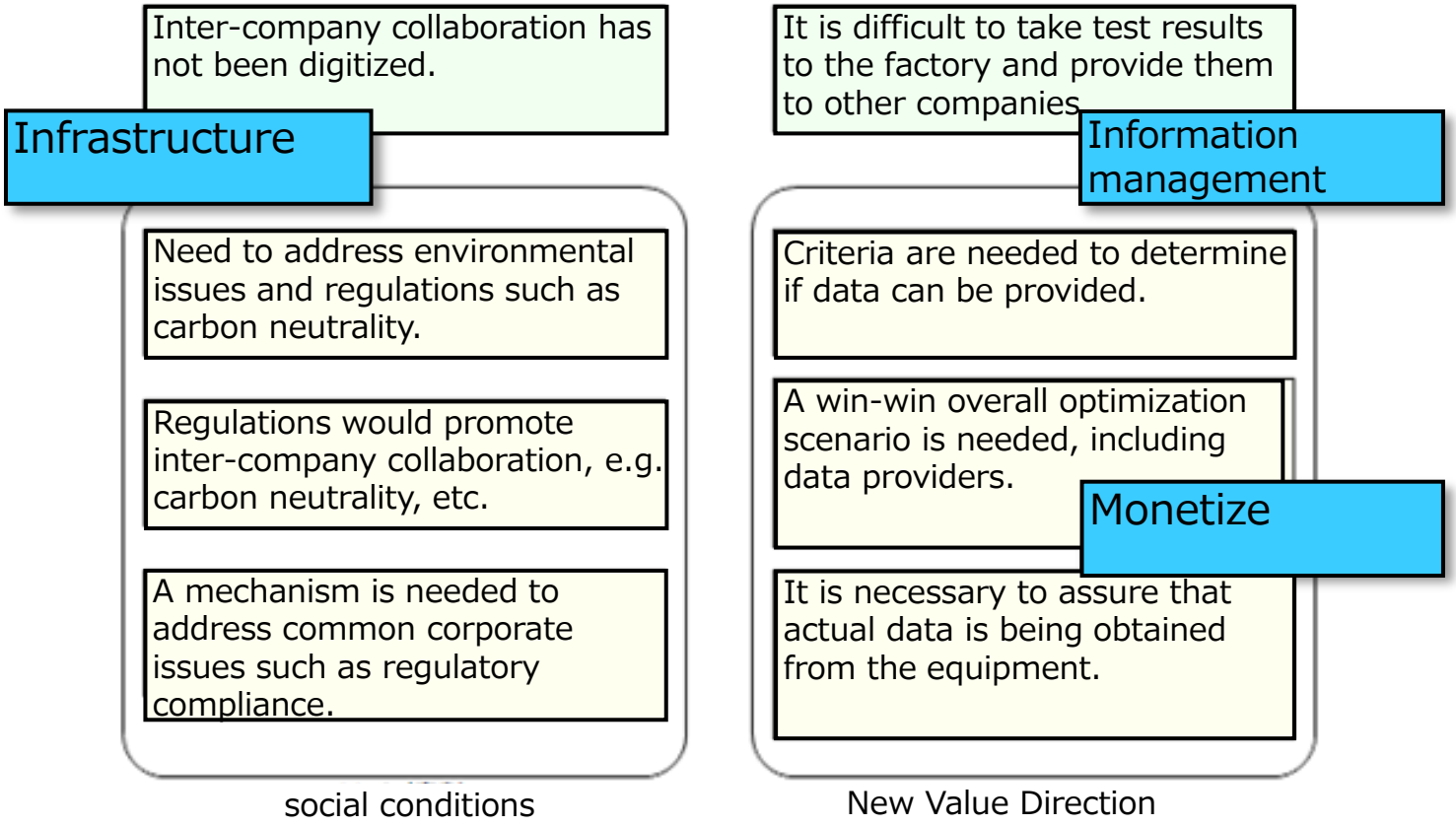
✓The goal is for suppliers to be able to calculate and share the manufacturing carbon footprint of products, CFP, by component with the finished products manufacturer.

✓In the future, the company will work on data valorization, such as supply chain CFP optimization simulations.

4.1 Target Situation

■Current Issues:

✓It is difficult to calculate and share manufacturing CFP by component with finished products manufacturers.



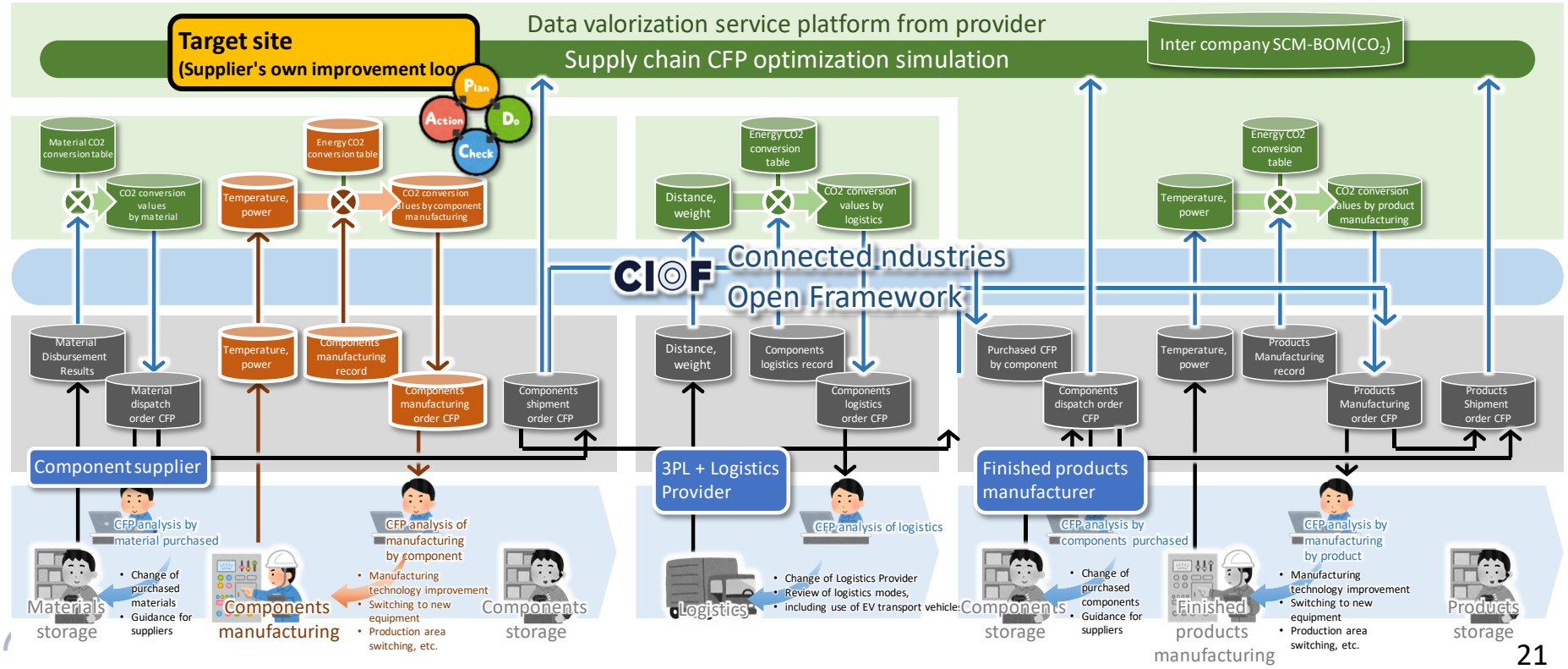
4.1 Target Situation

■ **Our immediate goals :**

Suppliers will be able to calculate manufacturing CFP at component suppliers and to be able to turn the improvement loop.

■ **Our future goals :**

Combining the CO2 calculation function and data distribution through CIOF, manufacturers and suppliers will realize the great social value of preventing global warming through their own improvement loops toward carbon neutrality and the coordination of the entire supply chain.

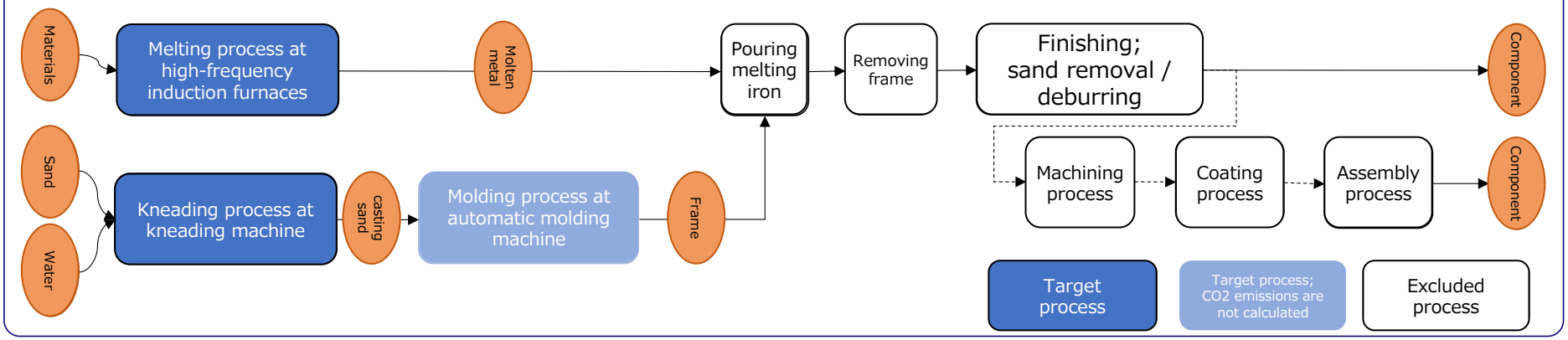


4.1 Target Situation

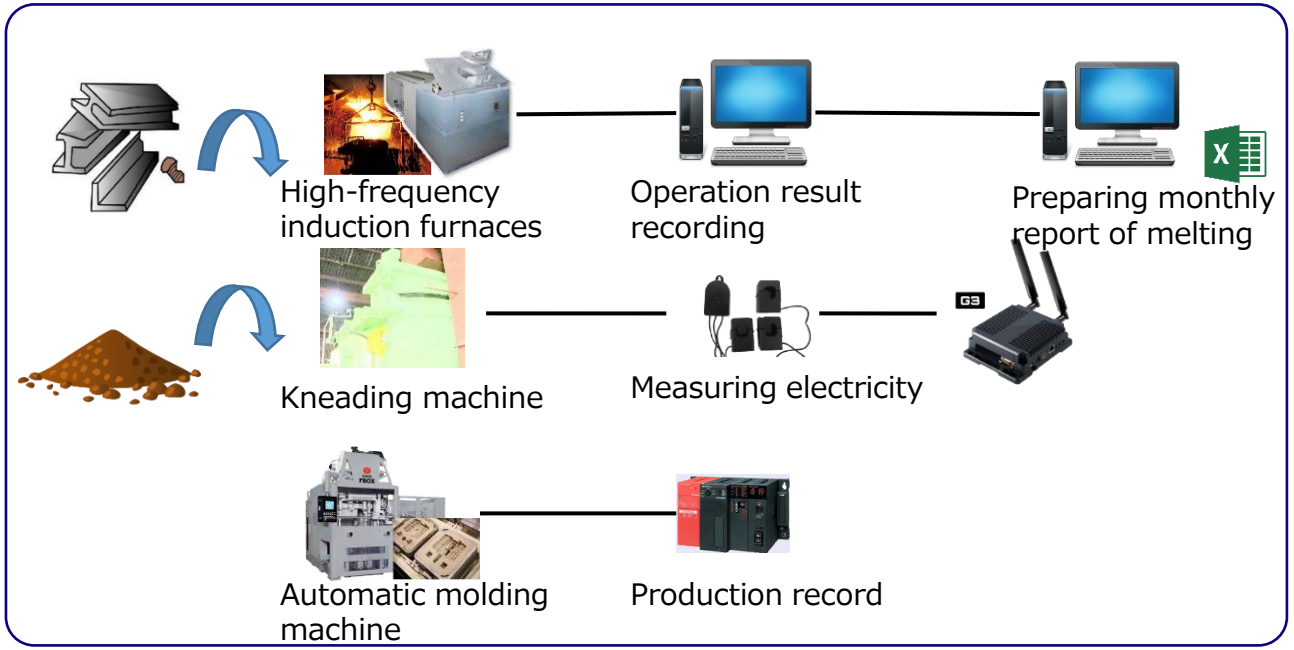
■Target process :

The target process is shown in the figure below.

Target process



4.2 Data to be exchanged



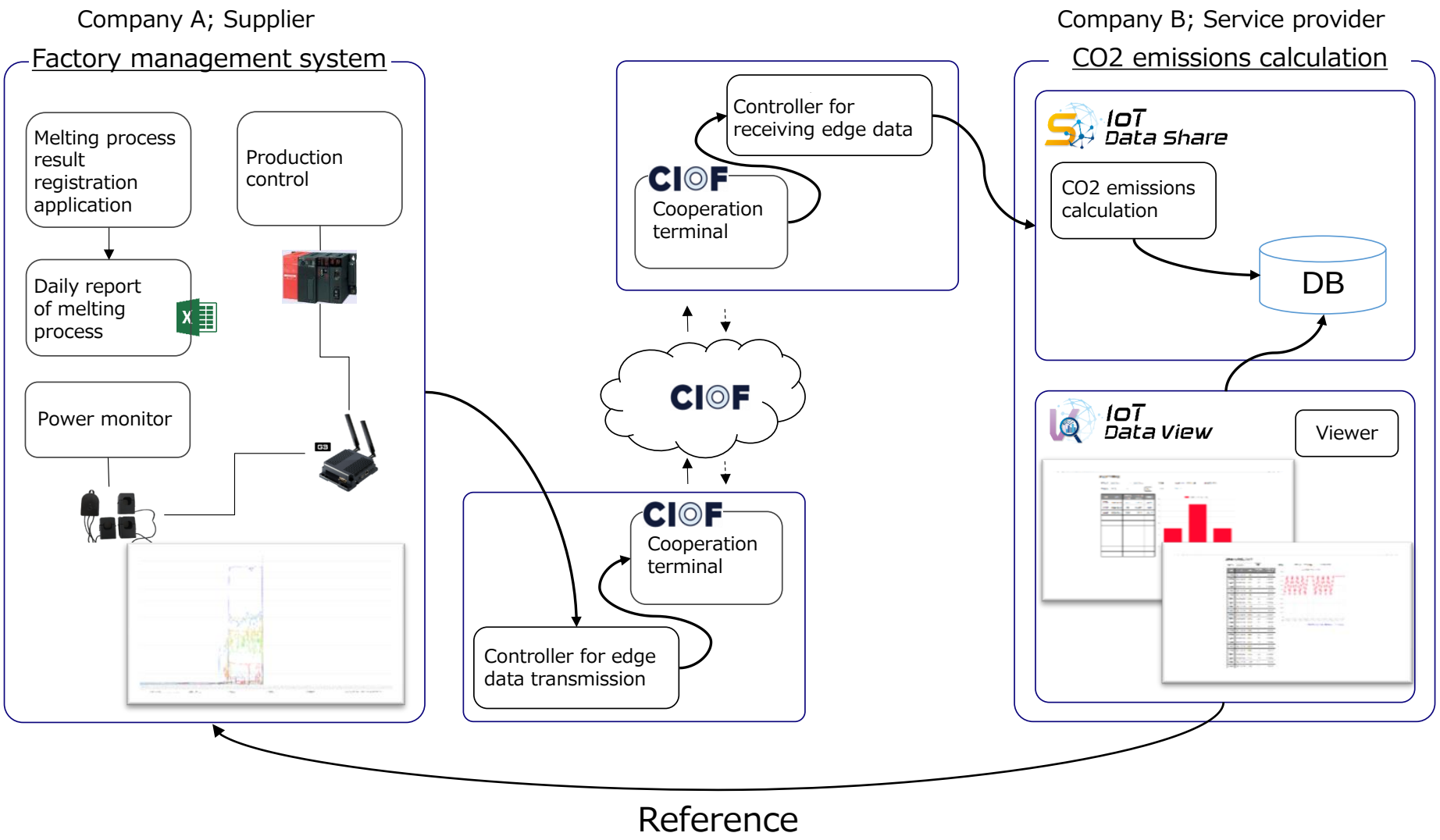
(1) Melting process result recording
(2) Power consumption at kneading process
(3) Manufacturing record

→ CIOF →

IoT Data Share
(4) Conversion to CO2 emissions
(6) Reporting

IoT Data View
(5) Visualization of CO2 emissions

4.2 Data to be exchanged



4.3 Considering data ownership

Supplier A shares (1) melting process result recording, (2) power consumption at kneading process, and (3) automatic molding machine production record with service provider B.
Regarding high-frequency induction furnaces and kneading machines, Company A also share with Company B number, (0) information about power supply, other specification information and the electricity used in the factory, e.g., whether it is renewable electricity or not.

Service provider B's CO2 emissions calculation function performs a proportional calculation based on (1) melting process result recording to determine the power used per component manufacturing order, uses (3) automatic molding machine production record to prorate (2) power consumption at kneading process for each components manufacturing order, and then calculates CFP for each component manufacturing order using a energy CO2 conversion table to calculate CO2 emissions from energy consumption such as electricity and gas.
Suppose that these proration calculation programs and conversion tables were not provided by Company A or custom developed based on individual requirements, but were originally developed and owned by Company B.

The CFP for each components manufacturing order is stored on the system managed by Company B, and Company A refers to it through a viewer program on a Web browser. Company A can also download the CFP data.
Using this CFP, Company A turns an improvement loop to reduce CO2 emissions.

4.3 Considering data ownership

From the data provided by supplier A to service provider B, it is theoretically possible to calculate and infer capacity information, operation information, progress information, defect rate information, manufacturing management methods, and design information, in addition to CO2 emissions, which is the original purpose. Company A may be averse to sharing performance and design information outside the company, which may lead to customer information, or it may be necessary to place restrictions on the region where the server is located even if it is stored on the cloud.

On the other hand, depending on the scale of Company A, it may be difficult for Company A to develop, implement, and maintain CO2 emissions conversion tables and calculation programs on its own, and to prove the validity of the calculation results.
Therefore, in the following, we discuss data ownership in the case where all primary data necessary to calculate CO2 emissions are shared from Company A to Company B, and where the scope of data utilization at each of Company A and Company B is set to be simple.

Suppose that the CFP for reporting to Company C, the finished product manufacturer, is sent to Company C at the time of delivery of components, by Company A's instruction, separately specifying the user, purpose of use, etc. within Company C. In other words, it is not assumed that the CFP is automatically shared from Company B to Company C at any time at the time of CFP calculation.

4.3 Considering data ownership

■The case where all primary data necessary to calculate CO2 emissions are shared from Company A to Company B, and where the scope of data utilization at each of Company A and Company B is set to be simple.

Information (0) are stored not only while Company A is using Company B's system, but also for a certain period of time after Company A has finished using the system, in case the need arises to verify the calculation process.
Information (1), (2), and (3) are stored in Company B's system for a certain period of time after the CFP for each part or each manufacturing order is calculated, in case a need arises to verify the calculation process. Intermediate data used in the process of calculation is also handled in the same way.
Information (0), (1), (2), (3), CFP for each part and manufacturing order, as well as their derivatives, are contractually specified for the region where the server storing them is located.
The CFP for each part or manufacturing order, as well as its derived data, is stored on Company B's system and is used only to respond to requests for display and downloading to Company A.
If intellectual property of a better calculation and display method arises, the intellectual property rights, i.e., patents, copyrights of programs, etc., are retained by Company B. Based on these rights, Company B may provide the CFP calculation function to other customers other than Company A.

Company A can freely use the CFP for each component or manufacturing order shared from Company B to Company A, i.e., viewer display results and downloaded contents. However, Company A will not reverse engineer the proration program or conversion table.

5. Acknowledgements

We would like to express our sincere appreciation to the members of the smart manufacturing scenario WG. The smart manufacturing scenario are the subject of our study for the preparation of this documents.

Judging the quality of high-speed precision press work

- ✓ WG 6E02 " How to Connect for Mass Customization " and
- ✓ WG 7E03 " Affordable data collaboration for small and medium-sized manufacturing companies ".

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Data ownership and its description in specific examples

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