PLM Road Map™ & PDT EMEA 2026

AI in PLM: A Disruptive Opportunity and Challenge

Turning AI disruption into enterprise value:
Strategic insights for the PLM professional

4-5 November 2026

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Why circular economy in manufacturing?

How to implement circular economy better through PLM and AI?

Tom Sakao

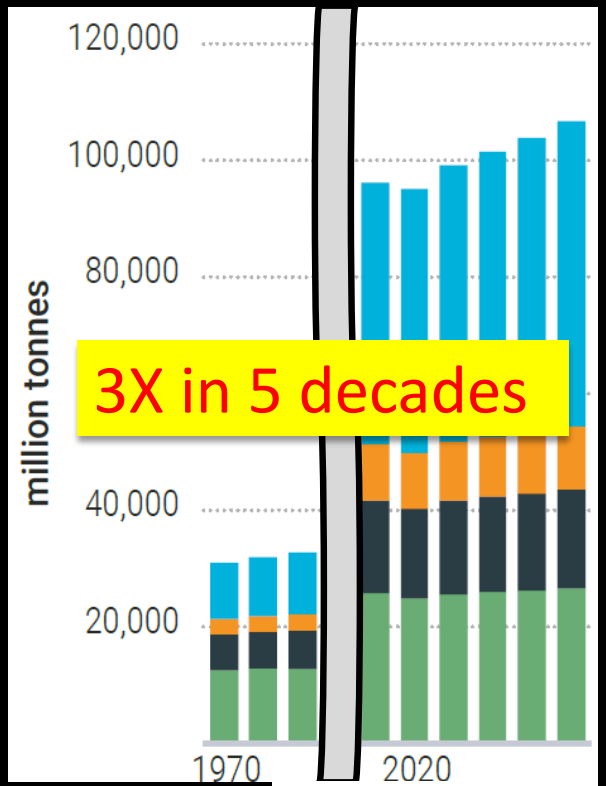
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Our industry partners (examples)



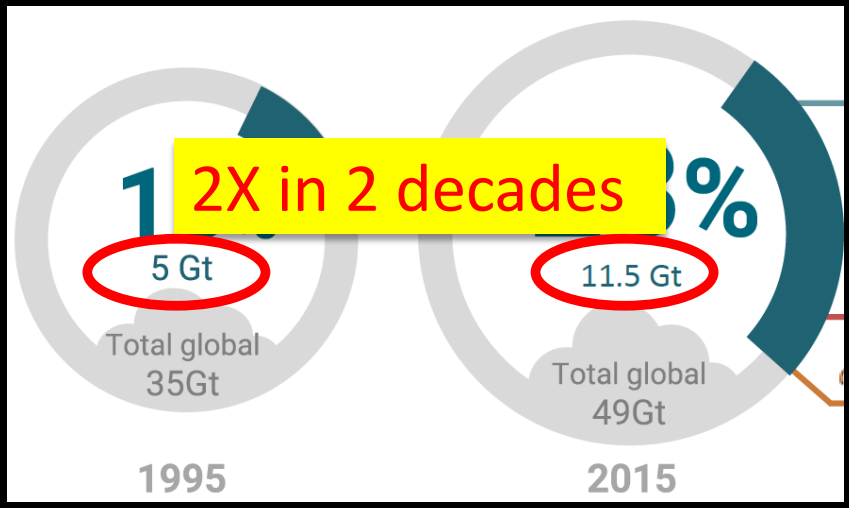
Resource use in global trends

Material **extraction**



Source: (UNEP-IRP 2024)

CO2 eq. emission by material production

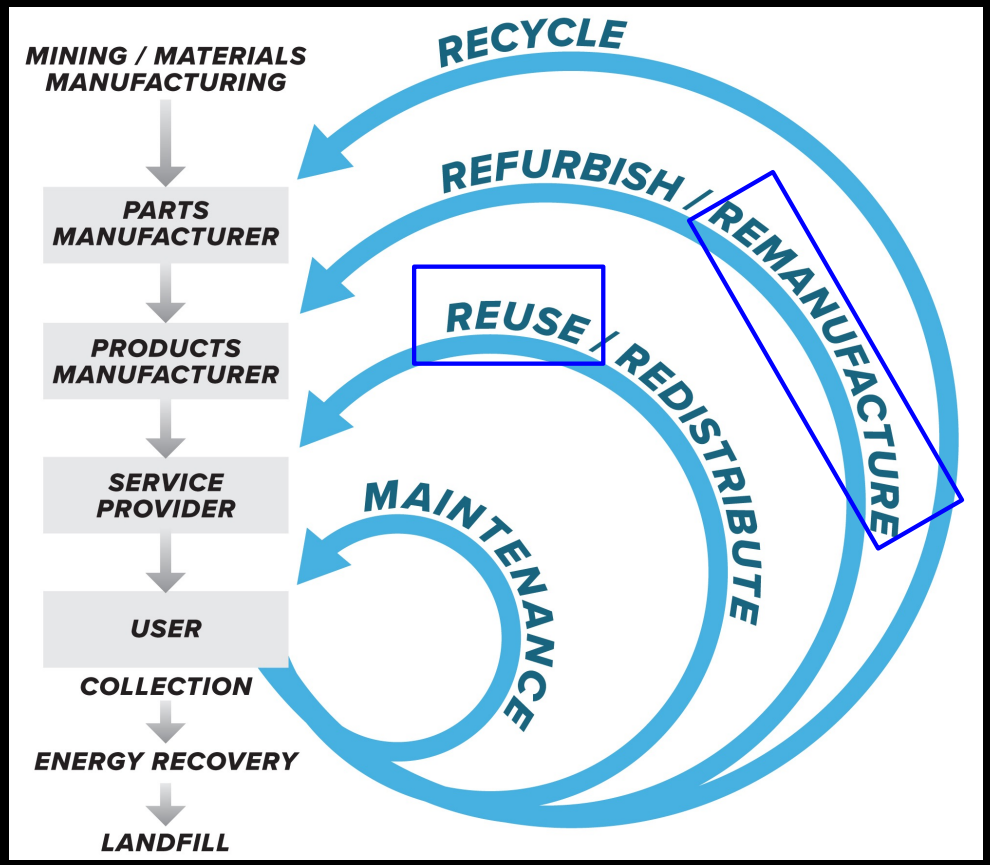


Source: (UNEP-IRP 2000)

Circularity in societies: dropped from 2021 to 2023: 9 to 8 to 7%

Source: (Circle Economy 2023)

A circular economy (CE)



Source: Ellen MacArthur Foundation 2013

Remanufacturing: e.g., 80-90% Environmental burden reduction

(E.g., Tolio et al., CIRP Annals, 2018)



Source: Tolio et al. 2018

Environmental and economic contributions of a CE offering

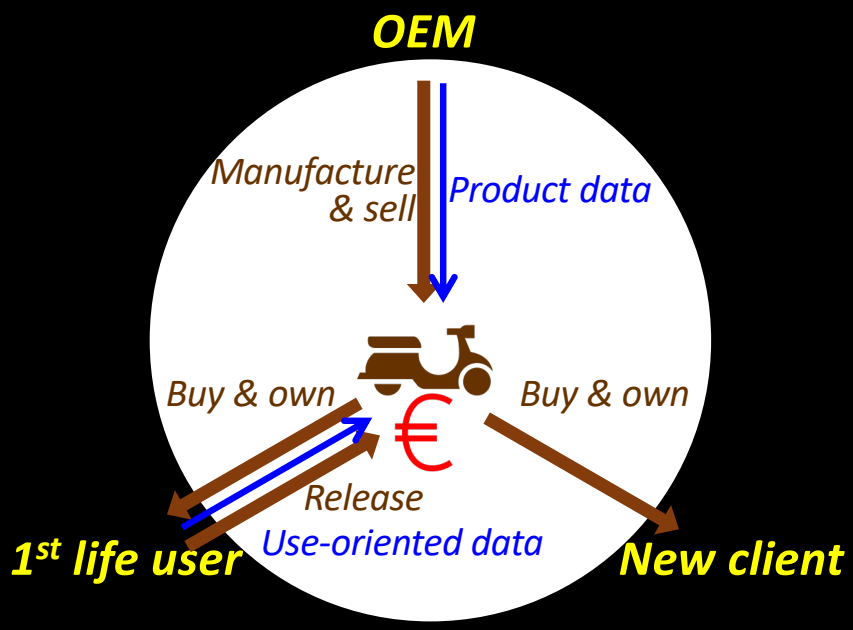


Event tent Beach flag

- **BAU**: product one-off sales
- **CE**: refurbishment using product frames 10 times (**Product-as-as-Service**)

Included in ISO/TR 59031:2026
Circular economy — Performance-based approach — Analysis of case studies

Circular-value-as-a-service (CVaaS)



Legend
→ : Information flow (**need-to-know basis**)
➡ : Product, component, and material flow
€ : Economic value
EoU: end-of-use

Aim:
- Exploit the remaining useful life of products
- Create & capture value of an EoU product

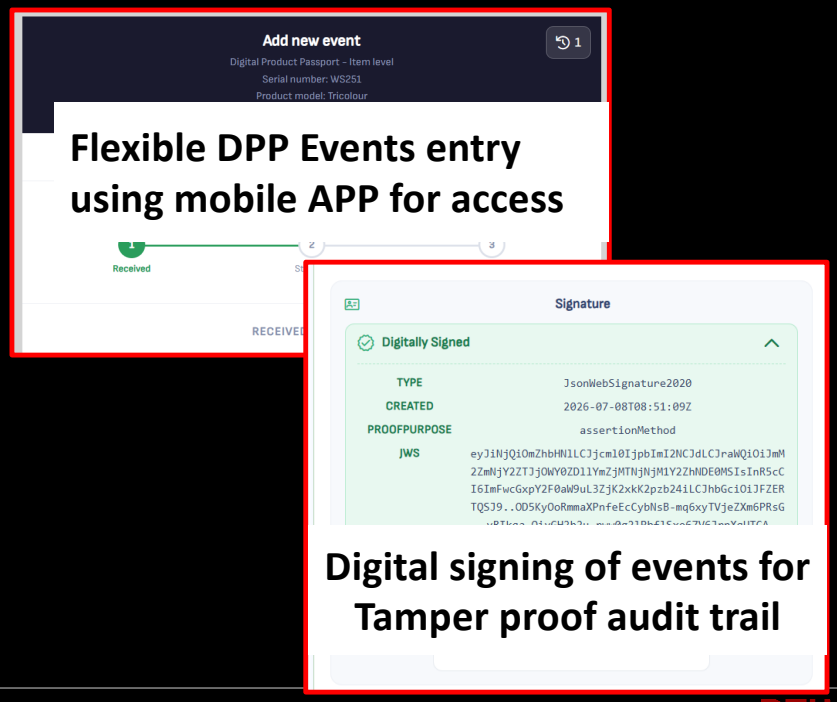
What's needed:
- To **show** EoU (end-of-use) products (e.g. marketplace/platform with governance)
- To **inform about** the economic value of an EoU product (using e.g. DPP)
- To rapidly **calculate** the economic value (in a standardized way)

How OEMs monetize the circular value
- By receiving a **share** of the resale value
- By offering CVaaS contract with **buy-back**
- :

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Infrastructure: DPP (Digital Product Passport)

Existing DPP solution developed by ekodenge group
With Dynamic events management



Baseline (existing) - TRL 8 solution

- JTC24 EN DPP standards based DPPs
- Item level event management
- Differentiated access via Mobile Wallets

Novel features – advancement from TRL 4

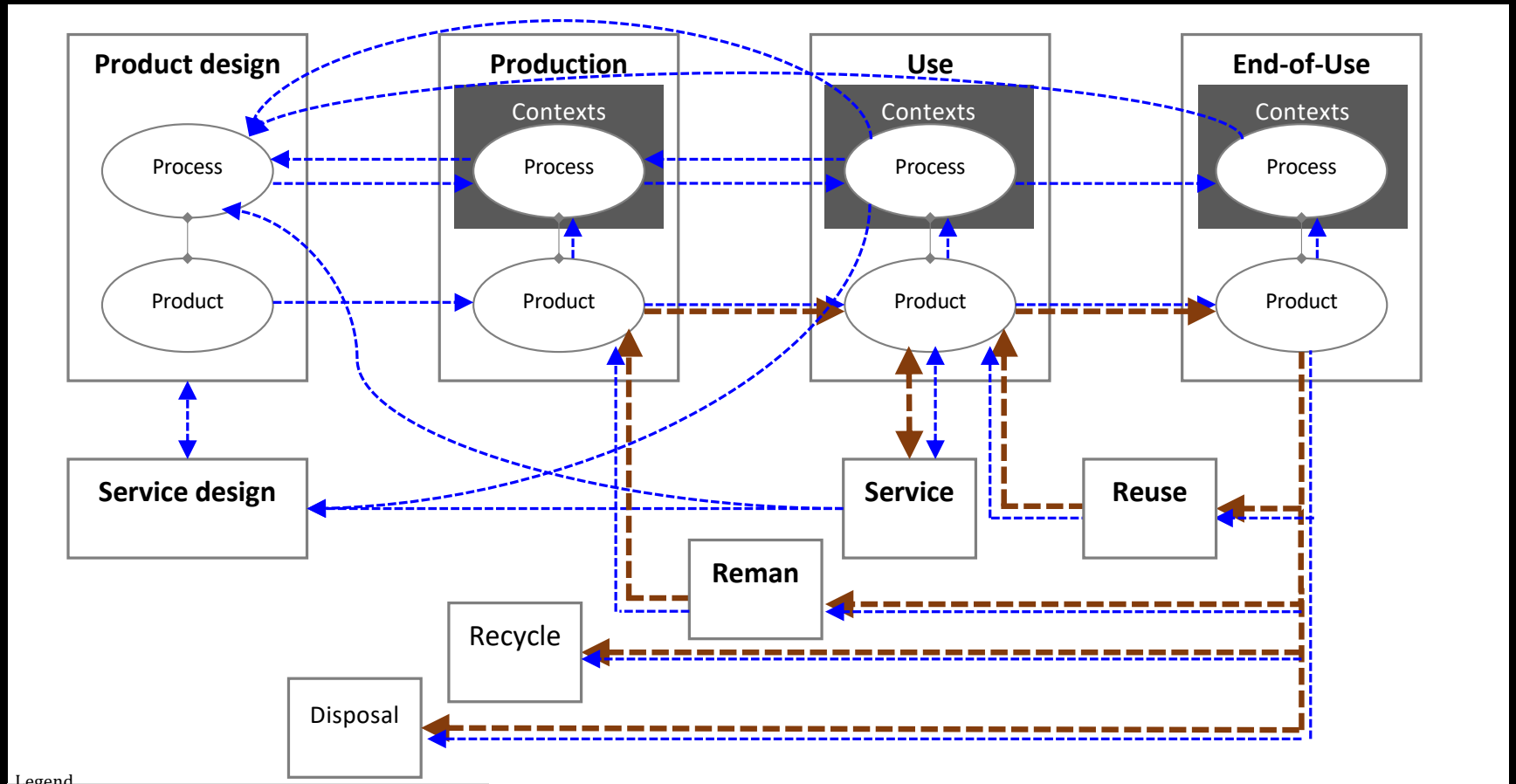
- Maintenance data / logs --> Quality state
- End of Use Assessment --> Quality grade
- Quality grade + Economic parameters --> Economic value estimate

Monetization – DPP Ecosystem marketplace

- Manufacturer "Fleet visibility" for CVaaS contracts
- DPP integration with event visibility
- B2B visibility between the OEM & new clients
- Buy-back execution at end-of-use offering point

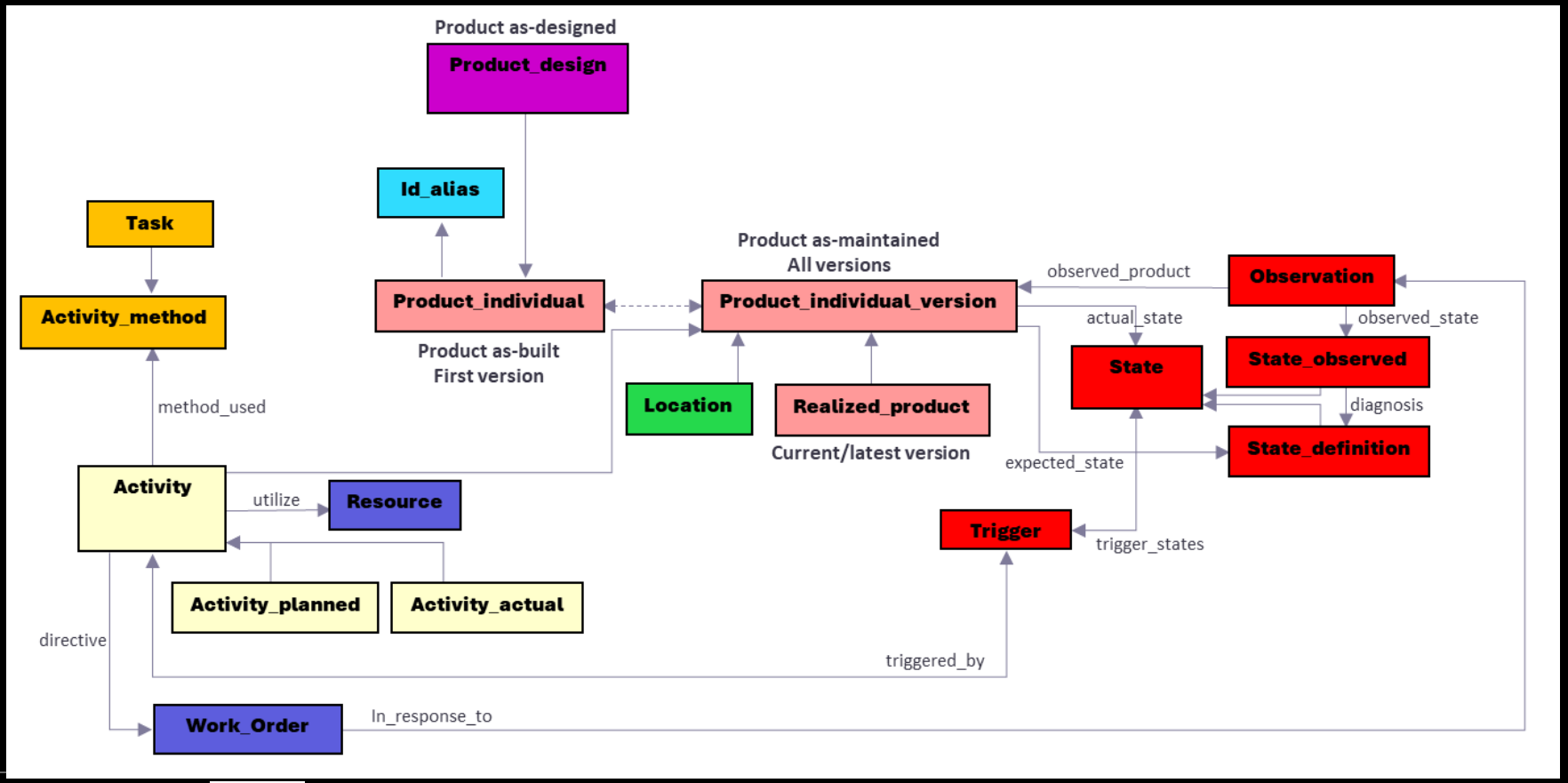
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Data flows needed for product & component flows

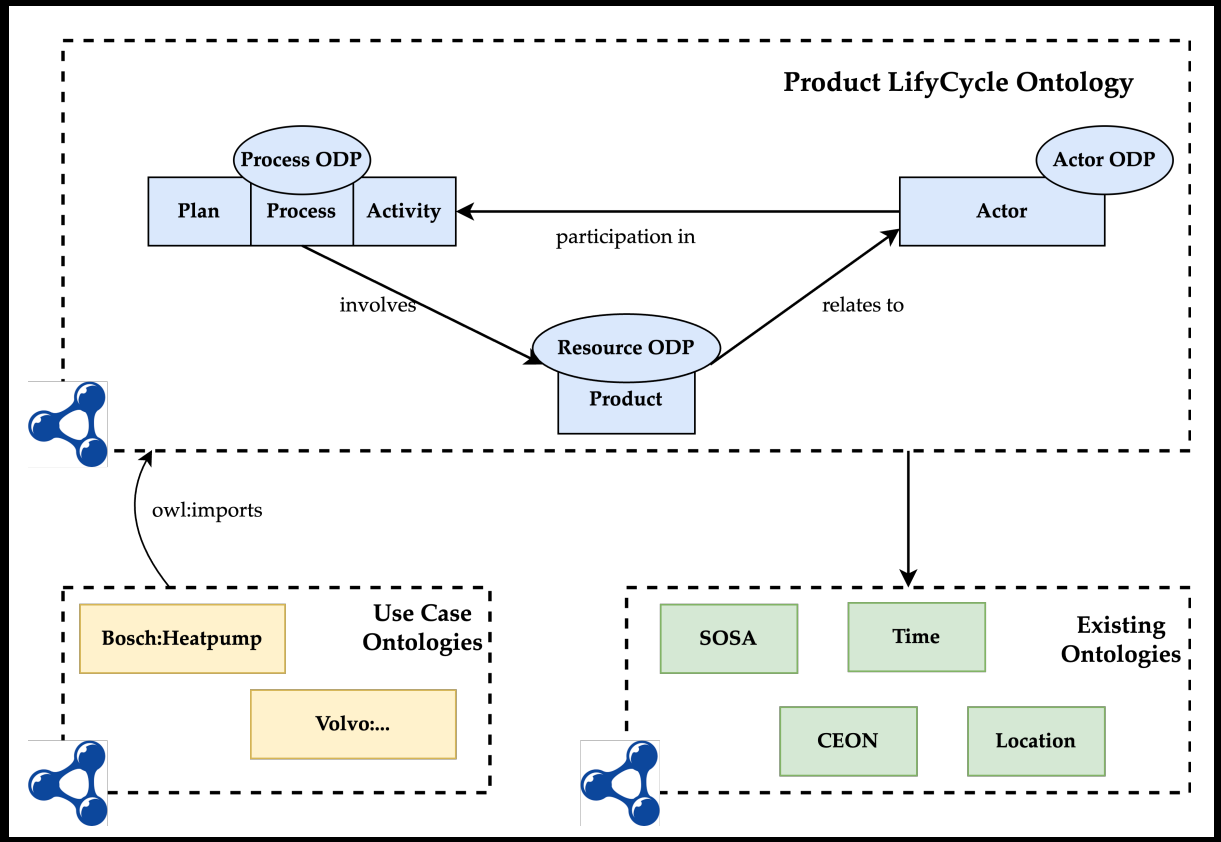


Source: Adjusted from (Sakao, Nordholm, 2021)

Conceptual data model based on ISO 10303 PLCS standards



Ontologies for accessing various data sources



: a single ontology representing a specific topic

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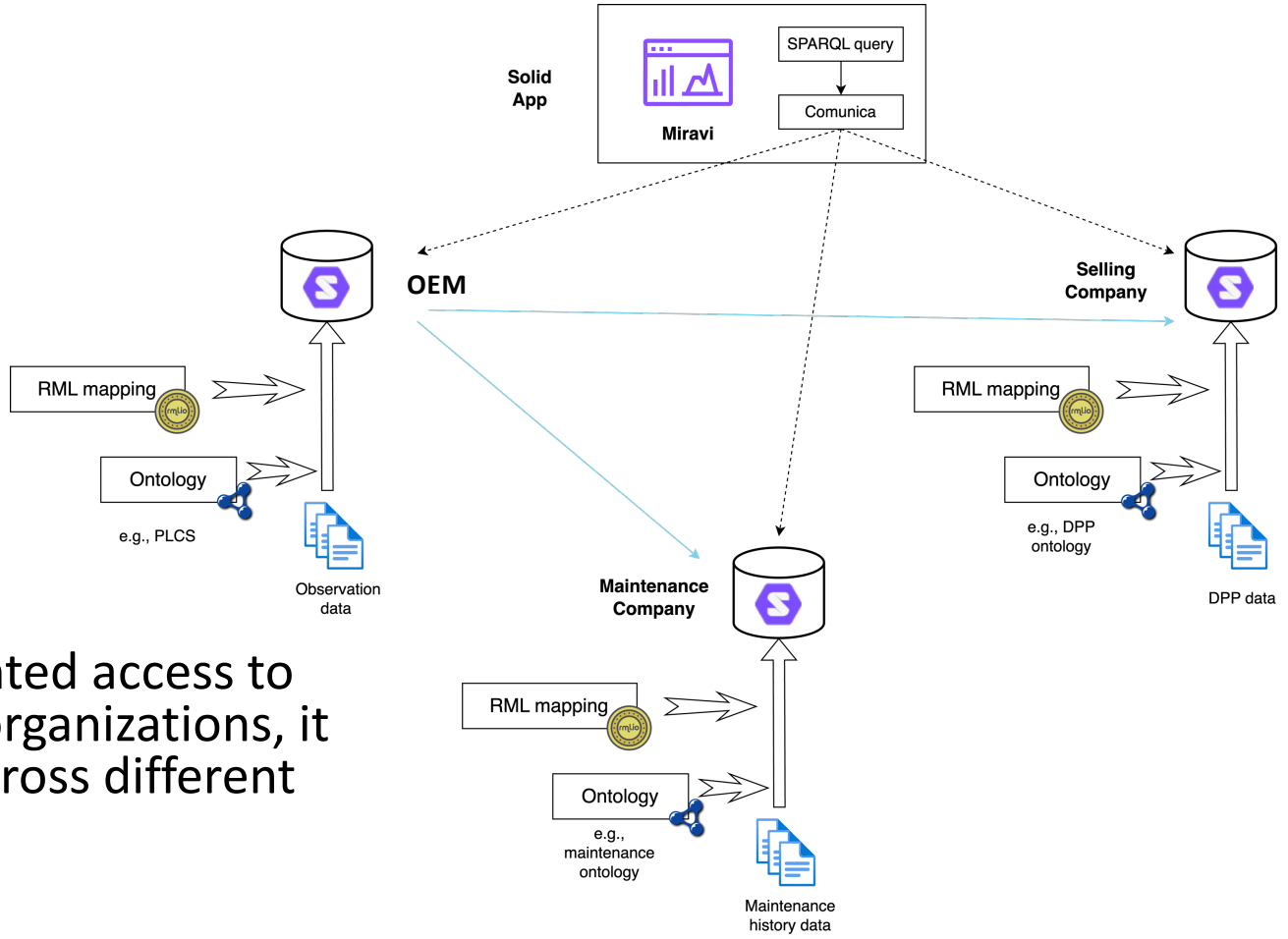
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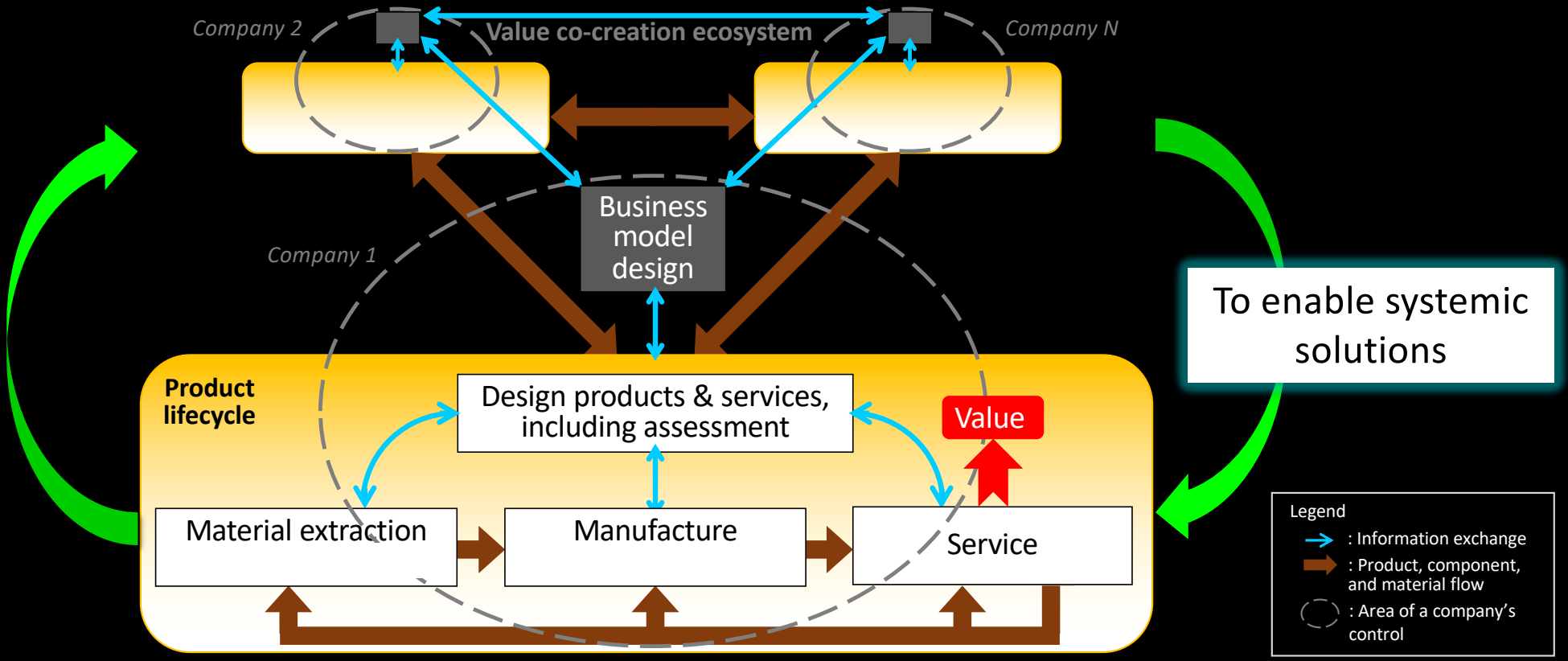
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Data access using Open Circularity Platform



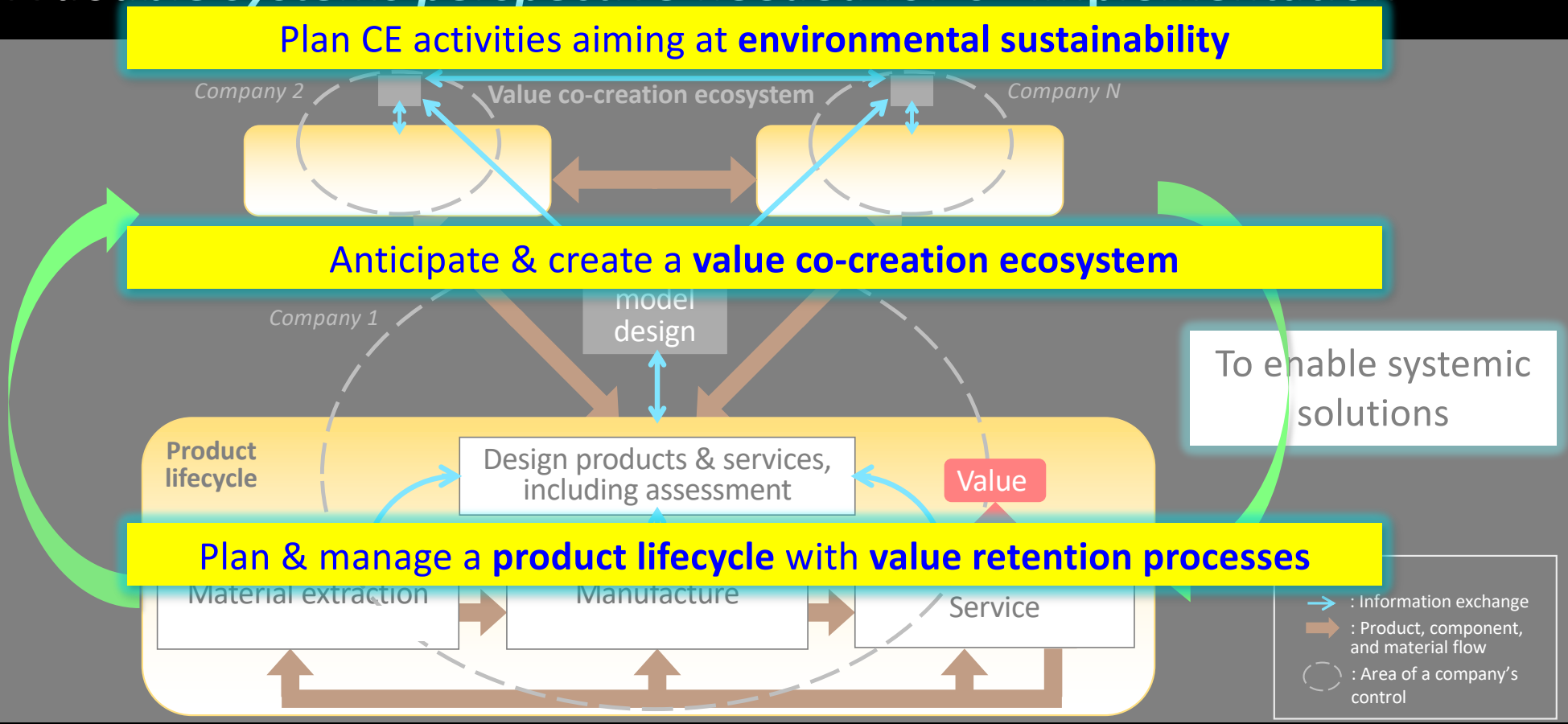
If the OEM is granted access to data from other organizations, it can query data across different data sources.

A *double systems perspective* needed for CE implementation



(Sakao et al., Implementing Circular Economy Activities in Manufacturing for Environmental Sustainability, CIRP Annals, 2024)

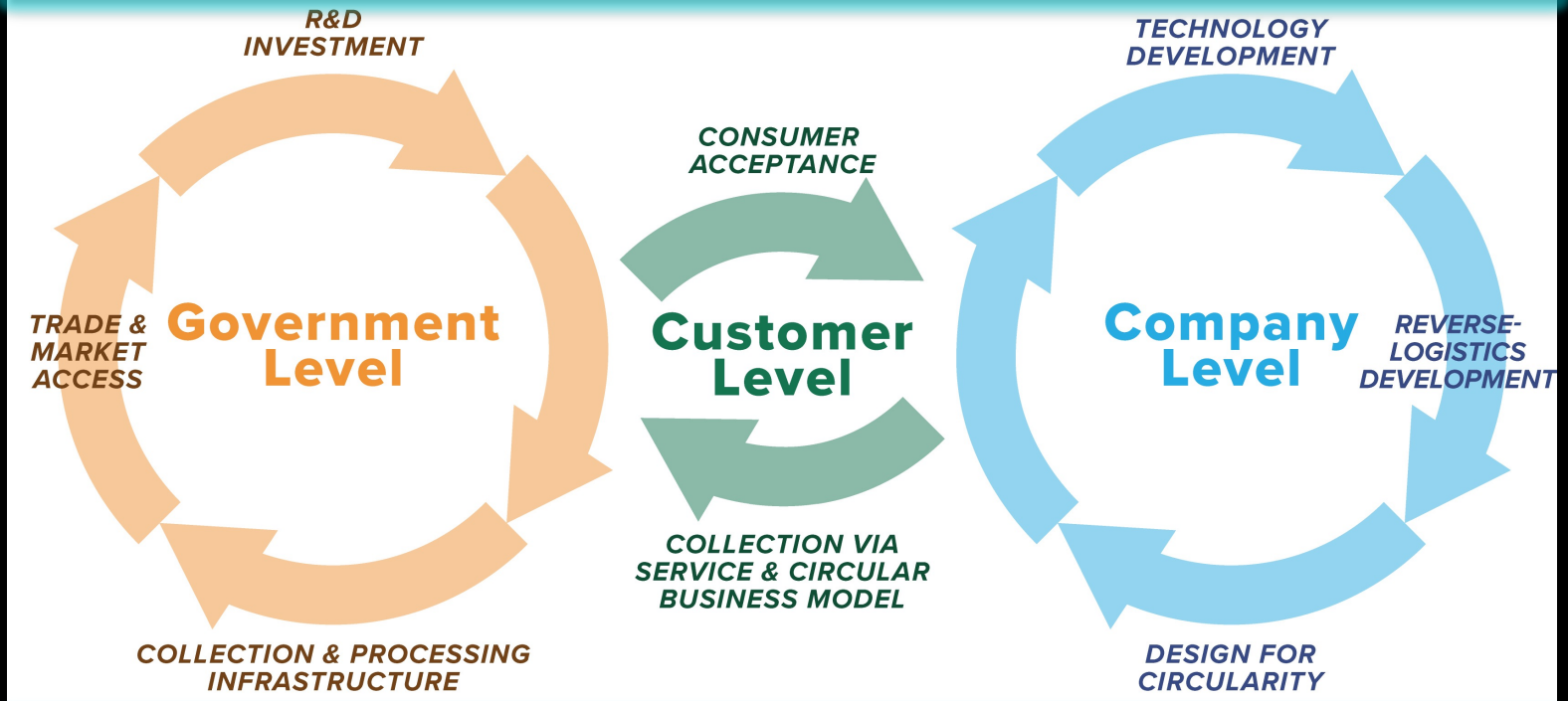
A *double systems perspective* needed for CE implementation



(Sakao et al., Implementing Circular Economy Activities in Manufacturing for Environmental Sustainability, CIRP Annals, 2024)

Activities needed for transformation

Determine & implement **top management CE strategies**



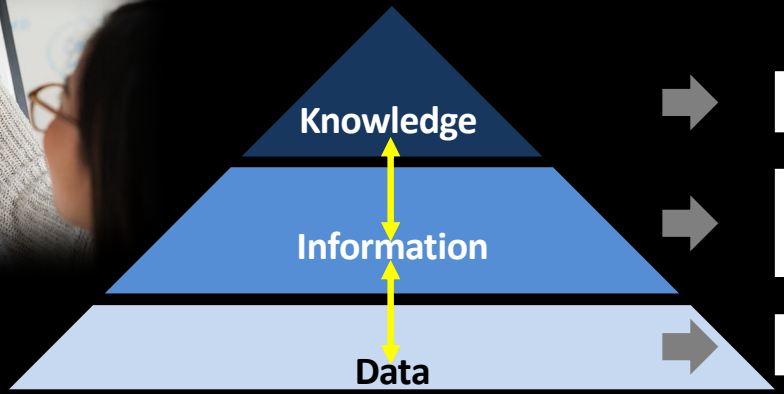
Plan & manage **transformation of the organization**.

(Sakao et al., Implementing Circular Economy Activities in Manufacturing for Environmental Sustainability, CIRP Annals, 2024)

Systemic approach needed for CE transformation

Activities enabling a CE:
Requiring more complex **cognitive** skills
(Burger et al. 2019)





University research will contribute to:

- **Upskilling facilities**
- **Guidance for information-driven design**
- **Infrastructure**

(Sakao et al., CIRP Annals, 2024)

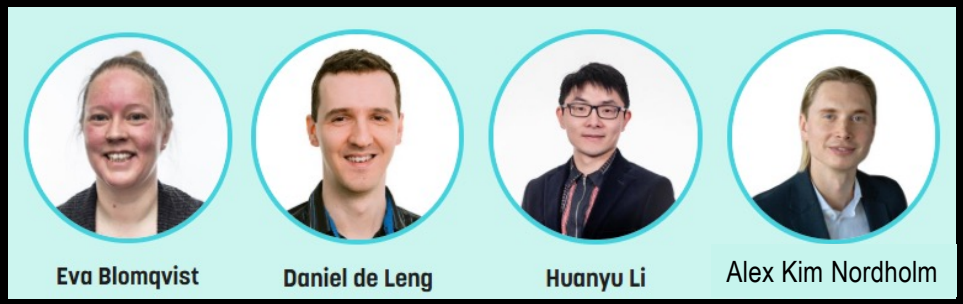
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Want to know more?

Tomohiko Sakao



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