MaterialsCommons

Heyrovský Institute

MaterialsCommons for Europe

Connecting data, tools and communities in a European federated digital infrastructure

Presented by Marek Cebecauer (Heyrovsky Institute CAS)

Adapted from Gerhard Goldbeck (EMMC), Peter Gumbsch (Fraunhofer IWM)

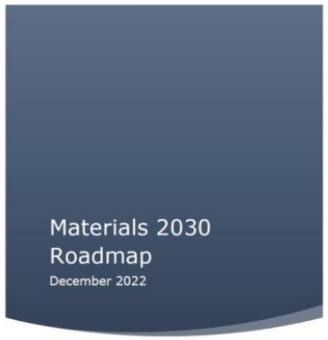
Cluster 4 – Digitalisation, industry, space and European partnerships. Information Day: 11-Nov-2026, Technology Centre, Prague, Czech Republic

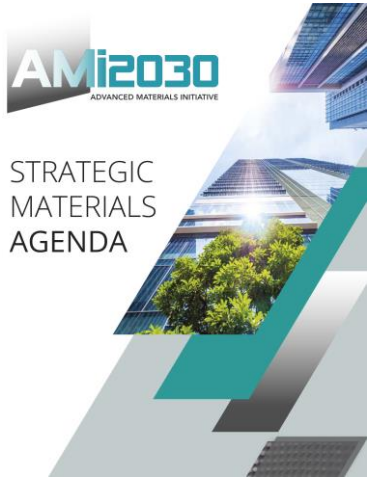
MaterialsCommons Timeline

Where does vision come from?

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Preliminary Considerations and Concept Development	MaterialsCommons Proposal Submission	Invitation to Grant Preparation	Project Implementation	MaterialsCommons "Foundation"
Since the early 2020s	September 23rd, 2025	January 5th, 2026	June 2026 to June 2030	Further development of the infrastructure Beyond the end of project

Czech and Europe‘s Materials Data Landscape

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Digitalisation Initiatives

Data

NOMAD (2014)

Materials Cloud (2017)

FAIRmat / NFDI (2020)

OPTIMADE (2020/21)

Czech Open Science II: DANTE^{c} (CZ 2025)

Workflows & Automation

AiiDA (2014)

Galaxy Europe (2018)

Plattform MaterialDigital (2019)

CAPeX (2023)

DDR Platform (CZ 2023)

Dataspaces

International Data Space Association (2016)

Gaia-X (2019)

Catena-X (2021)

Manufacturing-X (2022)

EOSC Federation (2025)

Shared Semantics

DCAT-AP (2013)

AAS - Asset Administration Shell (2015/2016)

EMMO (2019)

PMDCo (2021)

DANTE^{core} (CZ 2025)

Excellent building blocks, but not connected

Our Vision for MaterialsCommons

Overcoming fragmentation and building a long-term vision

- A federated digital infrastructure covering the whole life cycle
- Data reside in local, public, or restricted repositories, supported by storage and compute infrastructures on site.
- Meaning of data is transported along with the data
- Digital framework and AI tools support complex workflow
- Data can be exchanged securely in a distributed manner to form data alliances, but without compromising property rights
- Industry-driven use cases validate applicability and performance



MaterialsCommons Technical domains

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Overview



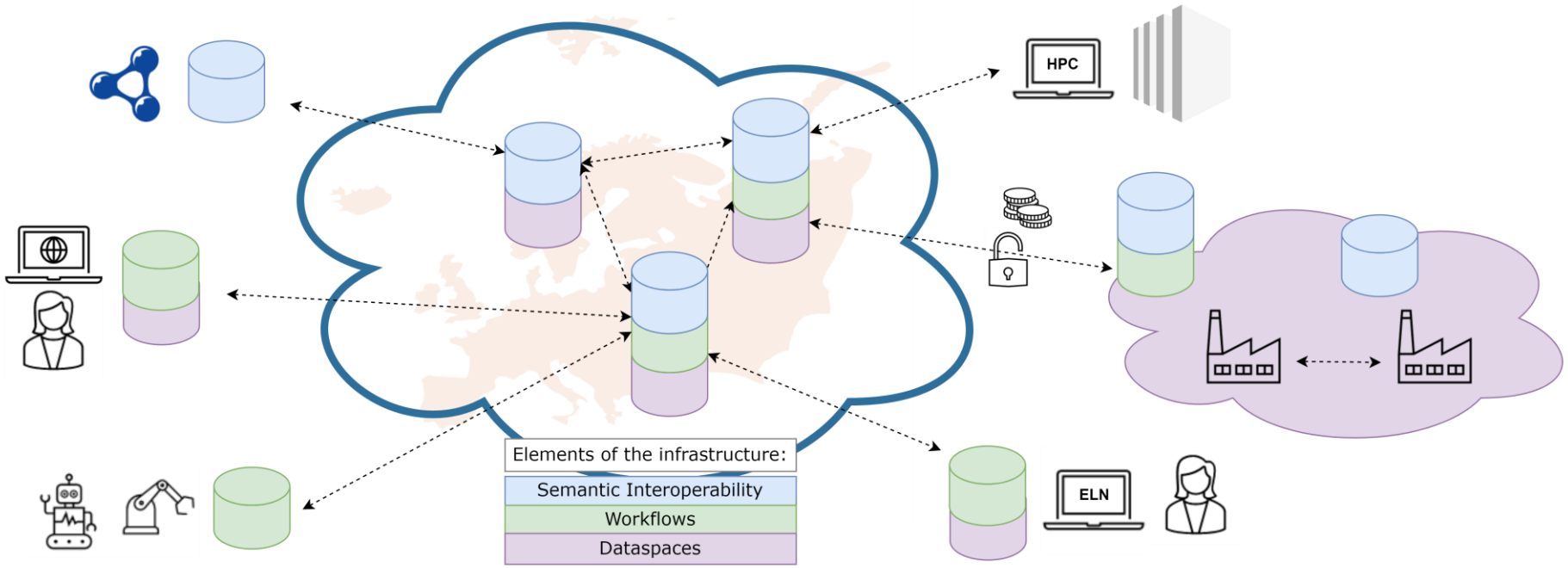
A digital research infrastructure for all materials research stakeholders in Europe

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Federated and DQ ➡ monitoring data quality and respecting data sovereignty aspects

Inclusive ➡ **open to all relevant activities, important role of national hubs and projects (DANTE[c] in Czech R.)**

Sustainable ➡ building the governance, ensuring the availability of MaterialsCommons to all stakeholders in Europe



Strategically selected use cases

To cover a wide range of industrial requirements

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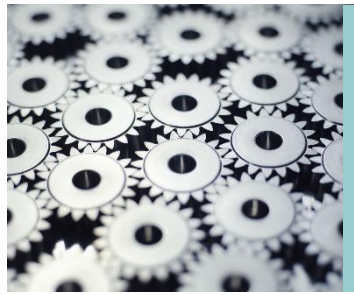
UC 1
Co-optimization of Battery Materials and Cells in a Distributed Self-Driving Lab



UC 2
Community Adoption of Multimodal Characterization Workflows for Battery Materials



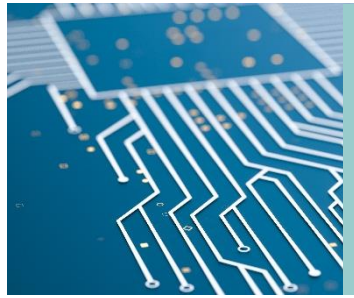
UC 3
Accelerated Lab to Line Design for Bainitic Steels



UC 4
Intelligent Steel Value Chains with Robust IP Safeguards



UC 5
Quality assurance along the additive manufacturing process chain



UC 6
Materials Acceleration Platform (MAP) for functional materials integration in microelectronic devices to achieve faster LAB to FAB innovations

Accelerated Lab to Line Design for Bainitic Steels

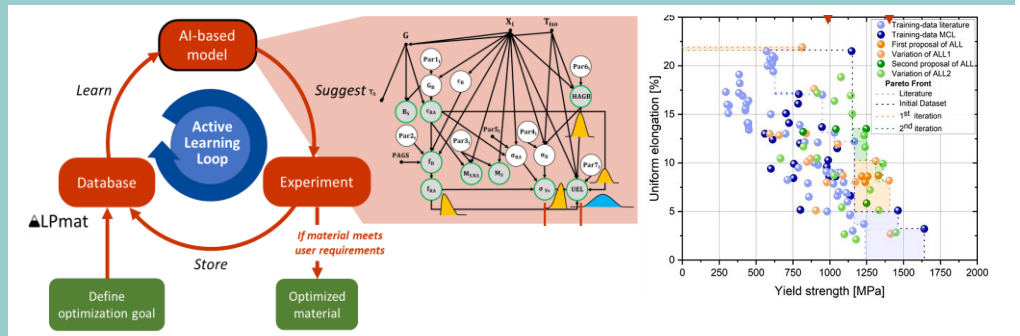
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Use Case 3

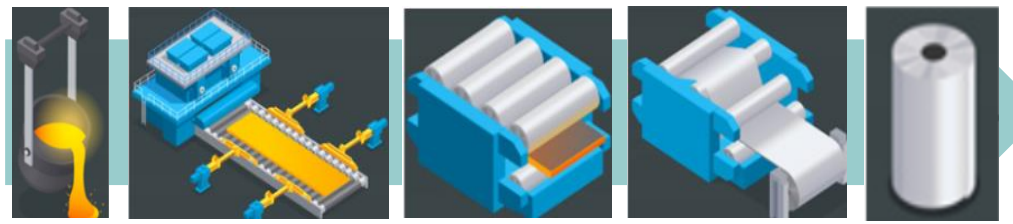
Materials optimization tailored towards application-relevant properties

- **Today**, material properties are optimized for representative properties. Not towards defined needs in application.
- Aligning materials and process optimization in lab with customer needs prevents dead ends for research early on, *e.g. When increasing corrosion resistance, also allow for a defined thermal treatment window for manufacturing*
- Fragmentation of research at different TRLs and missing interoperability of tools hinder efficient lab-to-line design.
- ***Our Vision:*** **Accelerated design** of materials in MAPs **driven by customer needs** and enabled by interoperable workflows for simulation and characterization.

Accelerated materials design for green steels



Advanced assessment and design of steel processing



Link to Use-Case 4

Example outcome: CO_2 footprint reduction

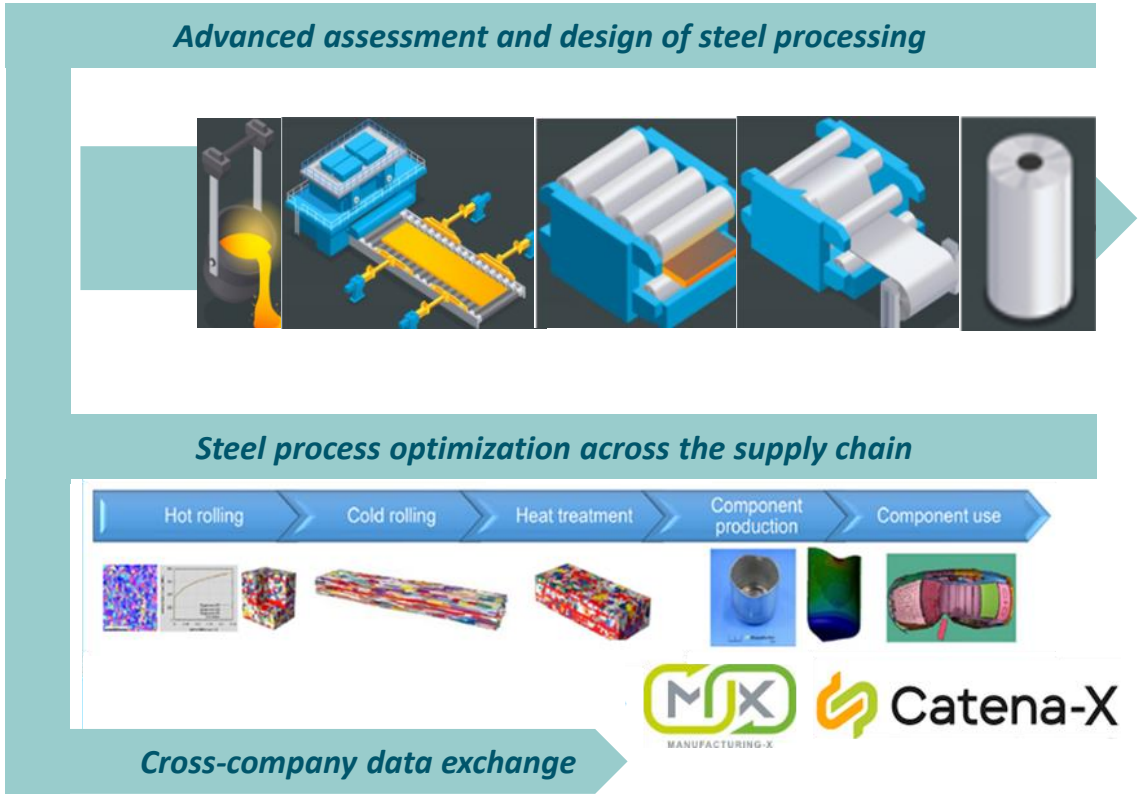
Intelligent Steel Value Chains with Robust IP Safeguards

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Use-Case 4

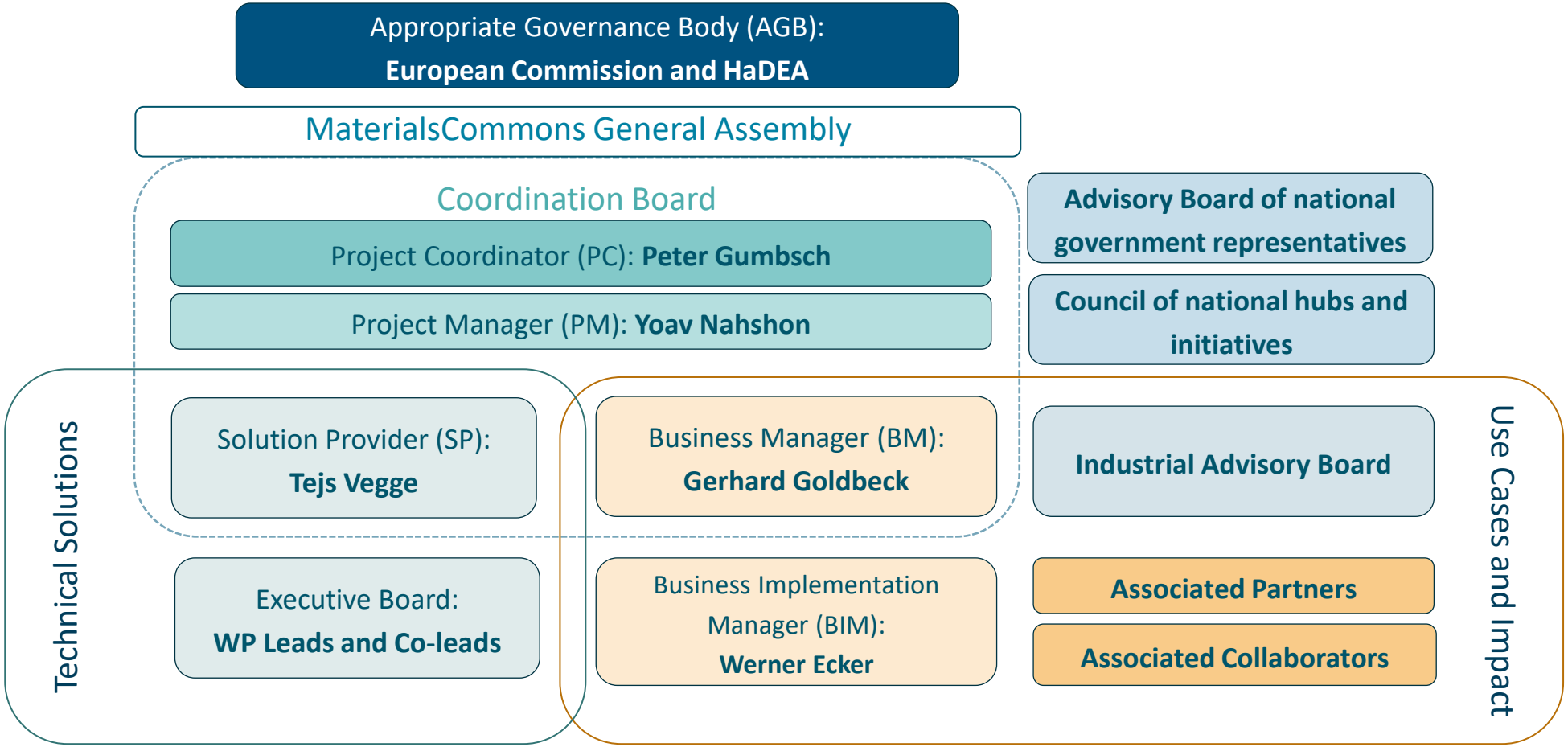
Unlocking cross-boundary materials optimization with full IP and data control

- **Today**, production processes are optimized within single companies. Not across the full supply chain
- A holistic cross-company optimization enables targeted material properties at lower cost and energy consumption
- Yet IPR and data ownership concerns hinder data exchange between organizations
- ***Our Vision:*** **Automated, IP-secure data exchange** across organizational boundaries enables federated learning, unlocking **holistic optimization** of the entire steel value chain

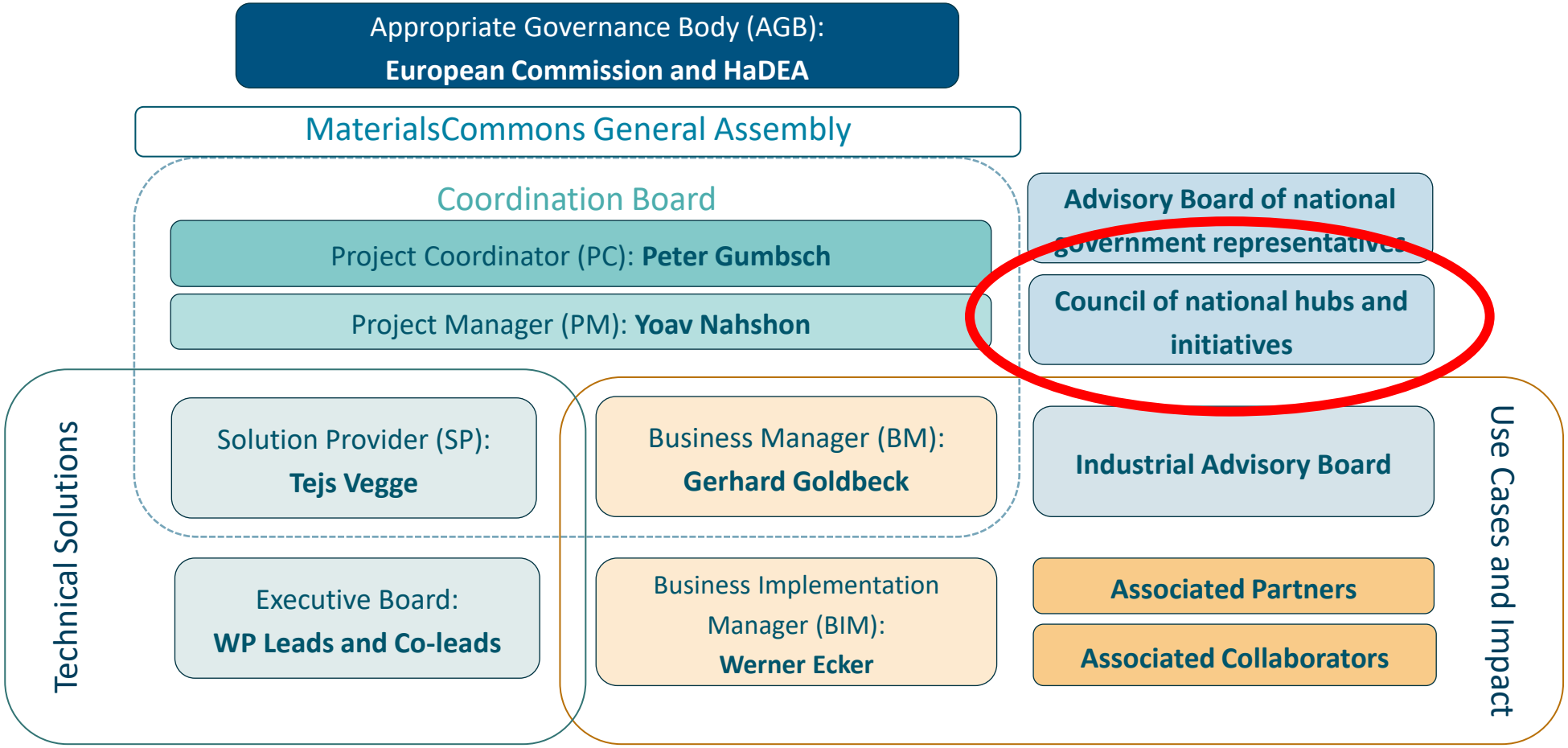


Example outcome: cost and time reduction

MaterialsCommons Governance



MaterialsCommons Governance



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26 Partners

21 Associated Partners

SIEMENS · BOSCH · SALZGITTER MANNESMANN FORSCHUNG · CSIC · 7P9 · KIST · I-FEVS · ArcelorMittal · voestalpine · Battronics · PHASETREE · Applus IMA · Applus laboratories · SCHAEFFLER · Infineon · Helmholtz-Zentrum hereon · CEMEA · nanomakers · AUSTEN

Associated Collaborators

fem · Prima Additive by Sodick · ESRF · matnex · APERON intelligence · soitec · TEC-Eurolab · IMA Innovative Materials Arena · AI · gM. · ICN2 · Excelencia Severo Ochoa · University of Toronto · Acceleration Consortium · INPRODAT



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