

Labs Network Industrie 4.0 e.V.

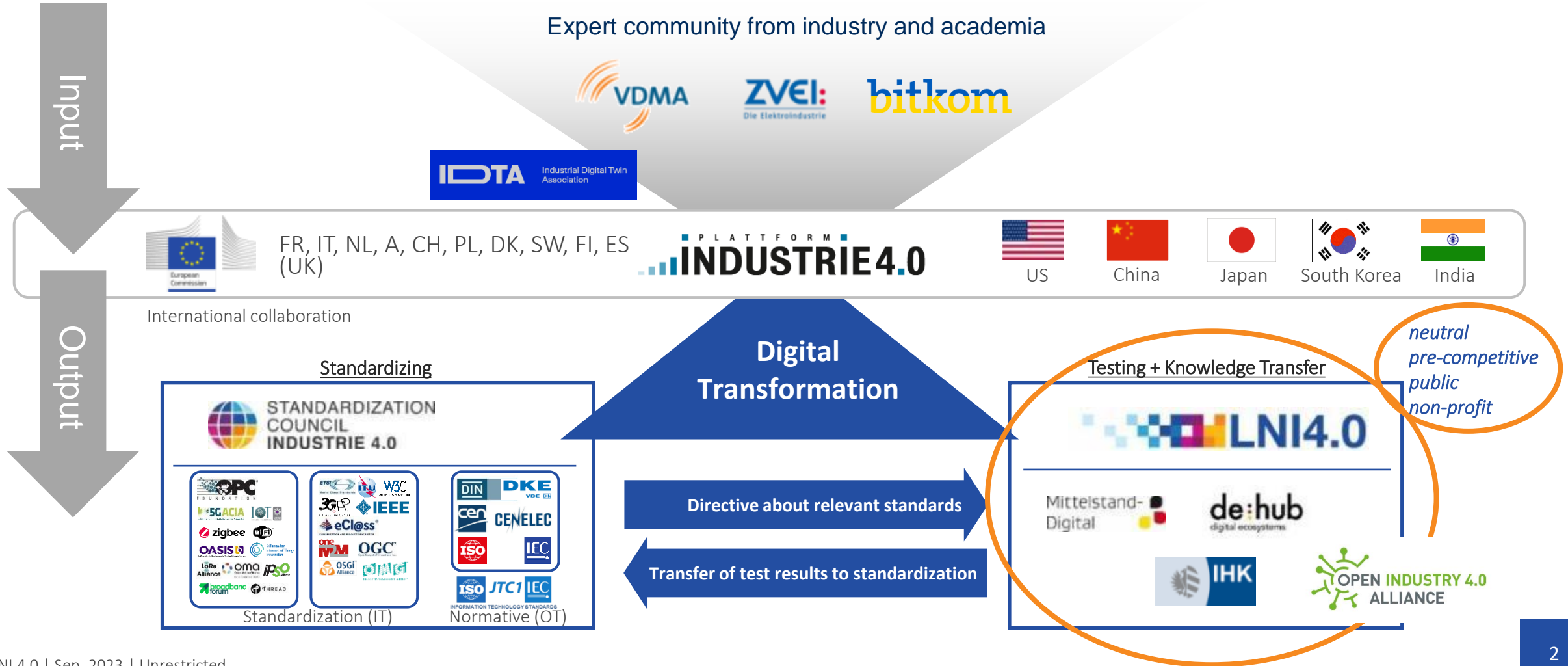
SME use cases and testbeds for Industrie 4.0 innovations
– *pre-competitive* – *non-profit* – *neutral* – *since 2015*

21 September 2023



Industrie 4.0 Stakeholders

Setup in Germany



LNI 4.0 – Roadmap interlinked to Industrie 4.0 and its Vision 2030



Machine Interoperability



Industrie 4.0 Communication of Machines:

- Machines talk to each other in an interoperable manner in networked digital ecosystems

Human Integration



Human-Machine-Process Interaction:

- Human work together with machines and in processes as companions
- Immersive integration of human, using Industrie 4.0 technologies

Data Management & Analytics



Data Spaces for Industrie 4.0:

- Global agreement on similar/ uniform reference architectures
- Use of higher-level metadata models including the associated infrastructure services

Digital Economy Drivers

European Associations and Projects (public + private)		European Initiatives (public + private)	
Smart Services (in and across verticals)	Industry 4.0 Europe, Catena-X, etc.	2030 Digital Compass	European Alliance for Digital Innovation Hub (EDIH)
Data Value Creation (AI)	AI4EU, etc.	European Data Innovation Hub (EDIH)	Task Force on AI
Data Spaces	DS4EU, etc.	Task Force on Quantum	Task Force on Quantum
Data Infrastructure	GAIA-X, etc.	Task Force on Quantum	Task Force on Quantum
Software Infrastructure	AI4EU, etc.	Task Force on Quantum	Task Force on Quantum
Hardware Infrastructure	Quantum, etc.	Task Force on Quantum	Task Force on Quantum

Digital Economy Drivers:

- Carbon reporting
- Supply chain resilience
- Circular economy
- Data Act, AI Act, Cyber Resilience Act, EU Data Governance Act, etc

Digital Business Models



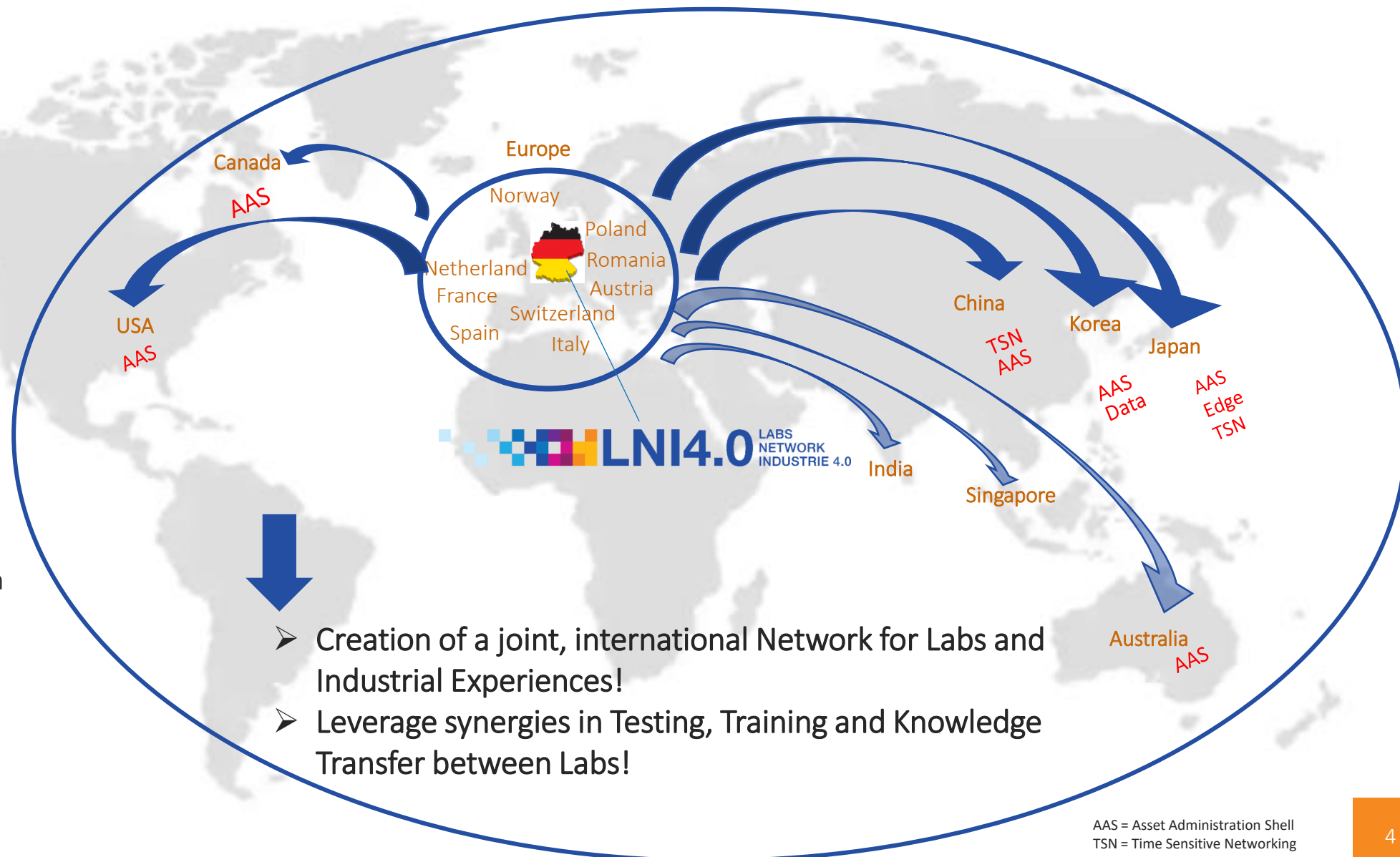
Industrie 4.0 BizMo:

- Value creation in the context of digital transformation
- Development of customer benefits based on digital technologies (e.g. peer to peer tender)

The international network of LNI 4.0 – together towards Industrie 4.0

Focus of International cooperation:

- International use cases & test scenarios
- Facilitate knowledge exchange
- Coordinate standardization effort



- Creation of a joint, international Network for Labs and Industrial Experiences!
- Leverage synergies in Testing, Training and Knowledge Transfer between Labs!

LNI 4.0 Testbeds at a Glance

Two LNI-Testbeds with direct link to industrial communication



new

Machine Interoperability

1 Time-Sensitive Networking (TSN)

2 Asset Administration Shell (AAS) (IEC63278)

3 Shopfloor Communication via OPC UA

4 Neutral and open Edge Management

Human Integration

Data Management & Analytics

5 Human – Machine – Process-Integration (HMPI)

6 Network of Data Labs & Analytics

- TSN is a **toolbox to enable Time-Sensitive Networking of machines and devices**
- Further validation of **extensions to the IEEE 802.1 standard family** for time-sensitive networking (TSN)
- **Further participation at**
 - OPC UA PubSub TSN prototyping
 - Inter-domain stream establishment, distributed or centralized domain control
 - TSN application in 5G
- **Continuous plug-festivals based on SME requirements and LNI 4.0 Use Cases.**
- **Evaluation of a simple approach for production lines, fostering stepwise collaboration between automation system integrators and machine builders**

- **Asset Administration Shell is a Metamodel and diagram**
- **Information and further Modules in the AAS (energy efficiency, de-carbonization, etc.) and providing input for its standardization**
- **Build up of a AAS Demonstrator and Network to other demonstrators**

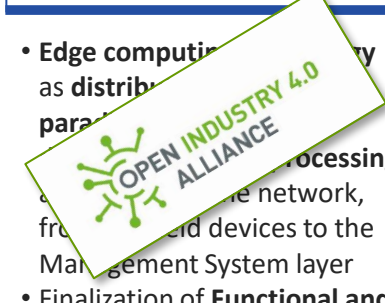
- **Validation of Human and vertical communication network**
- **Edge computing and processing**
- **Edge computing and processing from field devices to the Management System layer**
- **Finalization of Functional and Implementation view**
- **Compatibility test of the Implementation View on different products and devices**
- **Validation of the proposal for standardization of the management of edge and field devices**

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- **Edge computing and processing from field devices to the Management System layer**
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Creation and Validation of proposals for intelligent and immersive human machine integration and interaction

Entry point for the integration of humans: = technical solutions and applications, whilst Linking to existing initiatives from the overall context (e.g. ethical, social, legal activities)

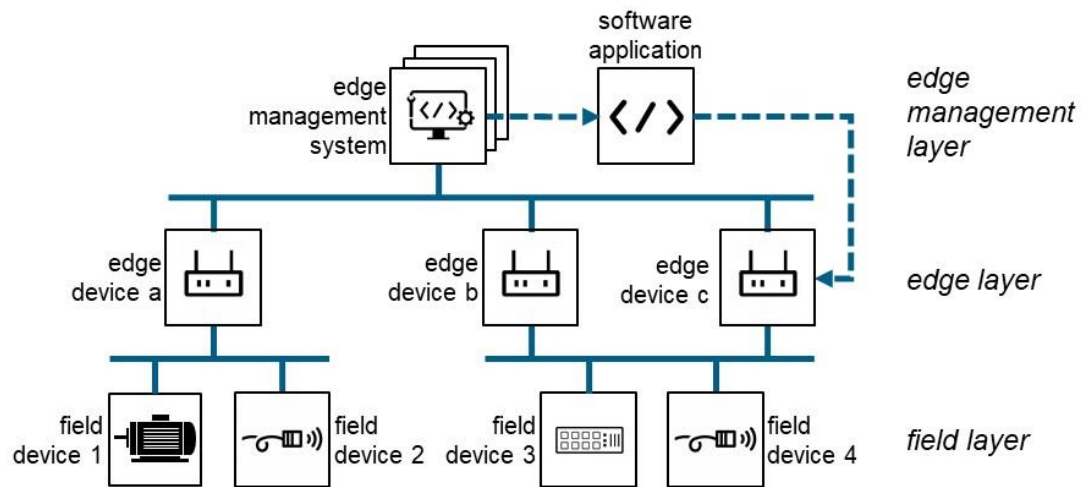
- **Data Management as fundamental basis for Industrie 4.0**
- **Network of existing activities at German and European level**
- **Extension to Artificial Intelligence and Digital Twin / Simulation**



Testbed Edge Management

Demonstrator for Edge Management Interoperability

What is Edge Management?



Partners



Motivation & Industry example: Battery production

Manufacturing-X. Make Data Work.



Example: Battery production

- Massive ramp up of battery cell production
- Battery production is enormously energy and water intensive
- Minerals supply chain depends on other countries
- **96% of the ingredients of a battery are recyclable per se**

→ With consistent and transparent use of digital twins, we can design more sustainable products - and produce them more sustainably.

→ Requires data transparency along the entire value chain

→ Can technically be implemented by “**Data Spaces**” and requires **data economy!**

Data economy, data ecosystems and Data Spaces

Industrial context

Drivers of economy (examples)

Customer needs/values

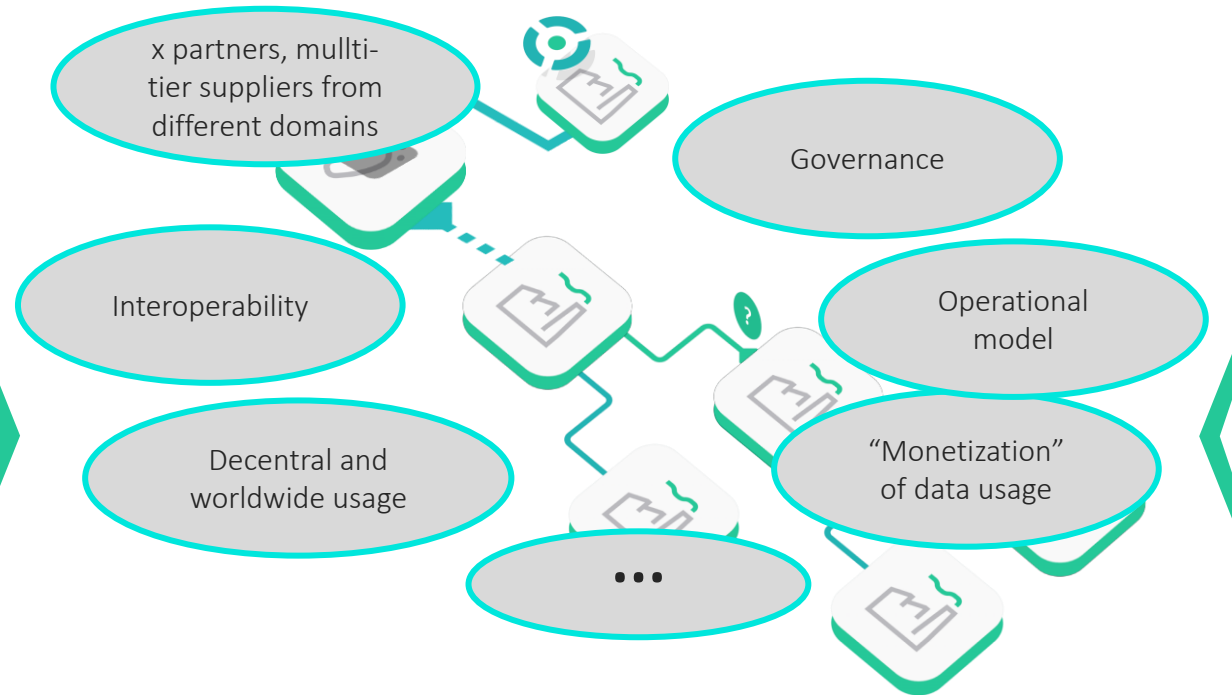
Market needs

Public needs/values

- Responsibility
- Sustainability
- Trust
- Sovereignty

Regulation

- Data Act
- Dig. Product pass



... reflected by companies (examples)

Company values

Competitive Advantage

- technology
- market access,
- resilience, supply chain, ...

Technology

- Towards a de-central architecture
- Enabling Trustworthiness

Business strategy

- Value creation
- business model
- IP protection
- partners

Pre-requisite: Trust across multiple (unknown) entities

Contributions to „Factory-X“ a Manufacturing-X project:

- IM-X
- Transfer

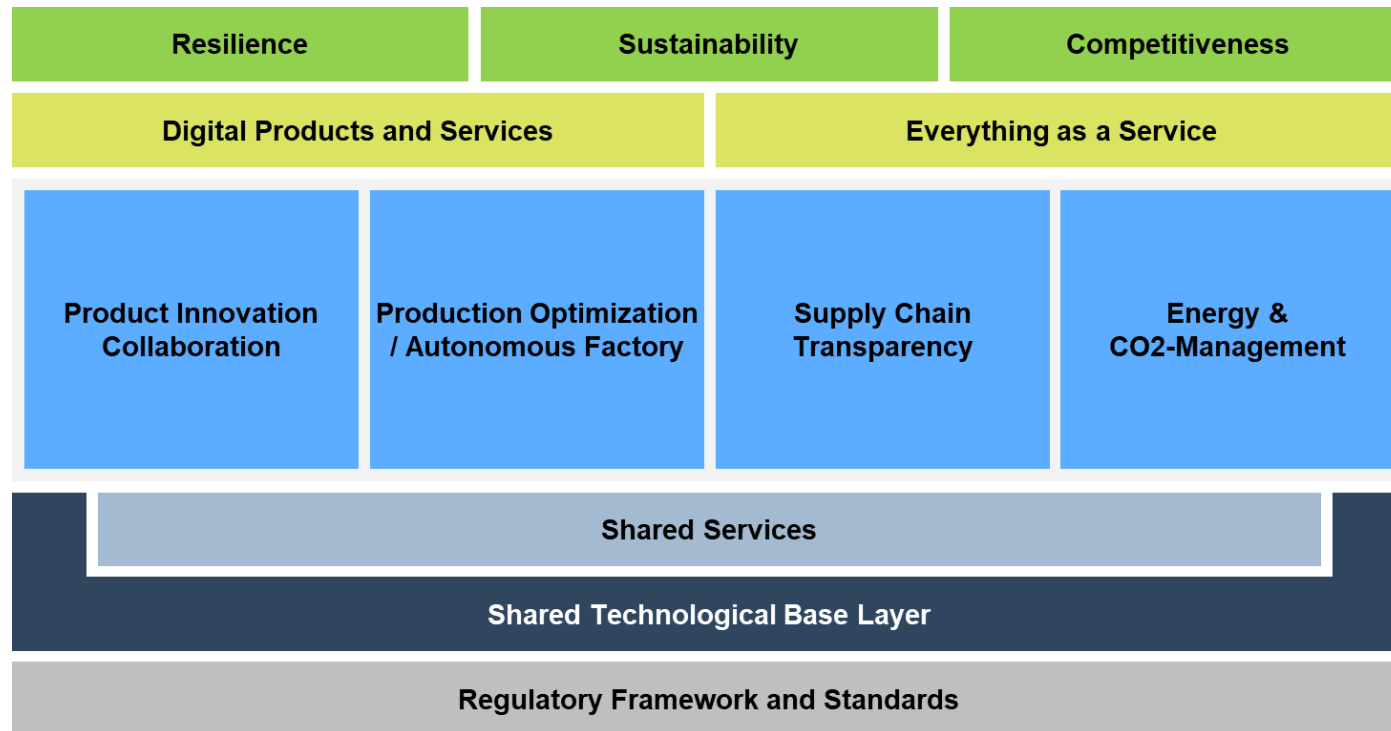
IM-X



IDTA

OPC UA

gaia-x



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Thank you!