Manufacturing-X

Make Data Work. Competitive, Resilient & Sustainable

The Open Initiative to Build a Cross-Sectorial Data Ecosystem for the Industry
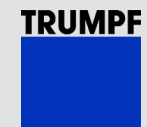
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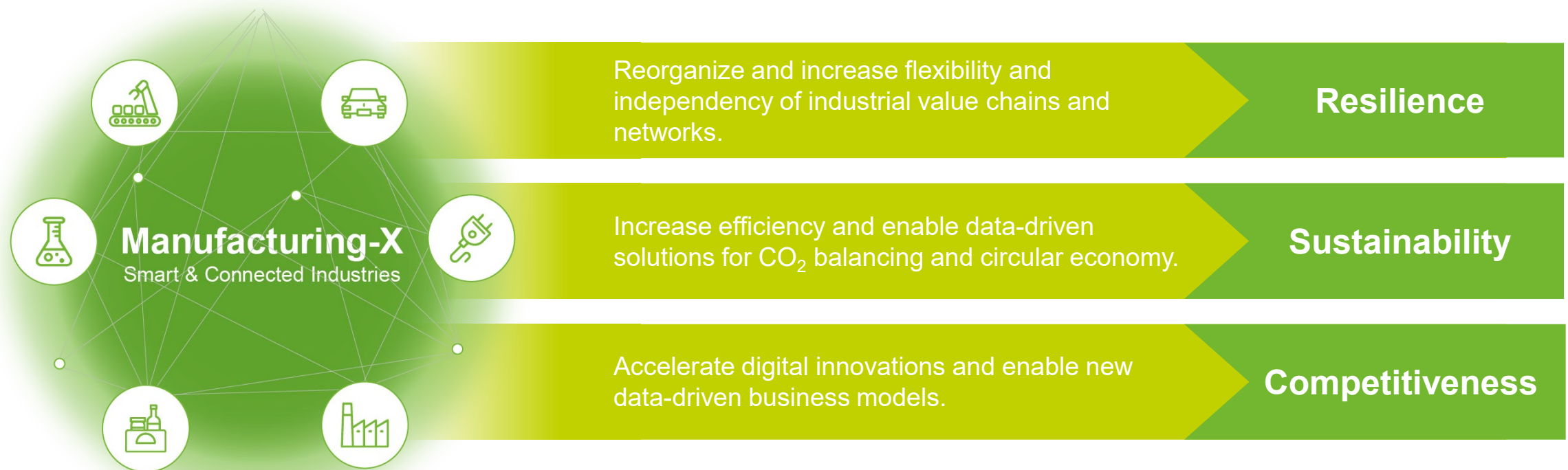**Architecture & Technology**

#4

Conclusion & Next steps

Manufacturing-X. Make Data Work.

Manufacturing-X will implement the decentral and collaborative Industrial Data Spaces for Industrie 4.0. Open, global and cross-sectoral.

Manufacturing-X
Smart & Connected Industries

Reorganize and increase flexibility and independency of industrial value chains and networks.

Resilience

Increase efficiency and enable data-driven solutions for CO_2 balancing and circular economy.

Sustainability

Accelerate digital innovations and enable new data-driven business models.

Competitiveness

Vision and mission for Manufacturing-X

⭐ **Manufacturing-X**
Vision

1 Connects value chains and manufacturing networks across sectors and countries

2 Implements the global foundations for resilient, sovereign and climate-neutral production

3 Enables innovative value creation in an interoperable and sovereign data ecosystem

Manufacturing-X
Smart & Connected Industries

Develops use cases on collaborative use of data in all sectors of manufacturing industry **1**

Implements the basic infrastructure to deploy federated data-ecosystem **2**

Provides easy-to-use applications to scale the ecosystems dynamically **3**

Sets-up organizational structures to facilitate the cooperation of the global MFX-community **4**

Manufacturing-X
Mission ⭐

#1 | Motivation & „Big Picture"
The Foundational Framework for Manufacturing-X

The Foundational Framework as common guideline for Manufacturing-X activities & international stakeholders.
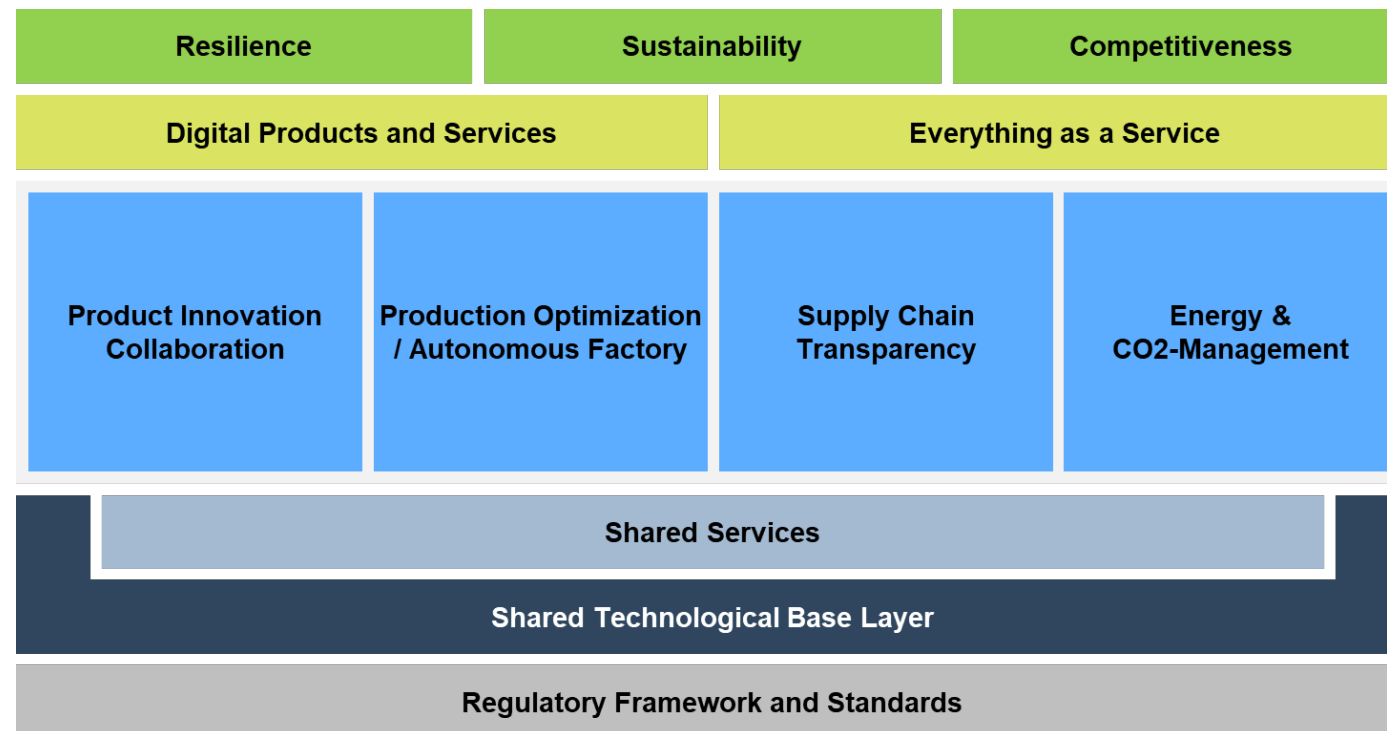
Strategic Goals

Manufacturing-X develops the foundations for a resilient and competitive industry in a sustainable society.

Business Models

Manufacturing-X enables innovative business models based on a unique data-infrastructure.

Exemplary Cross-Industry Use Cases

Manufacturing-X addresses cross-sectorial use cases based on a collaborative use of data with high economic and ecologic impact.

Resilience	Sustainability	Competitiveness

Digital Products and Services	Everything as a Service

Product Innovation Collaboration	Production Optimization / Autonomous Factory	Supply Chain Transparency	Energy & CO2-Management

Shared Services

Shared Technological Base Layer

Regulatory Framework and Standards

Capabilities

Manufacturing-X enables development and deployment of fundamental services driving the federated data ecosystem.

Foundation

Manufacturing-X defines global standards and runs a basic technical infrastructure to guarantee interoperability and sovereignty.
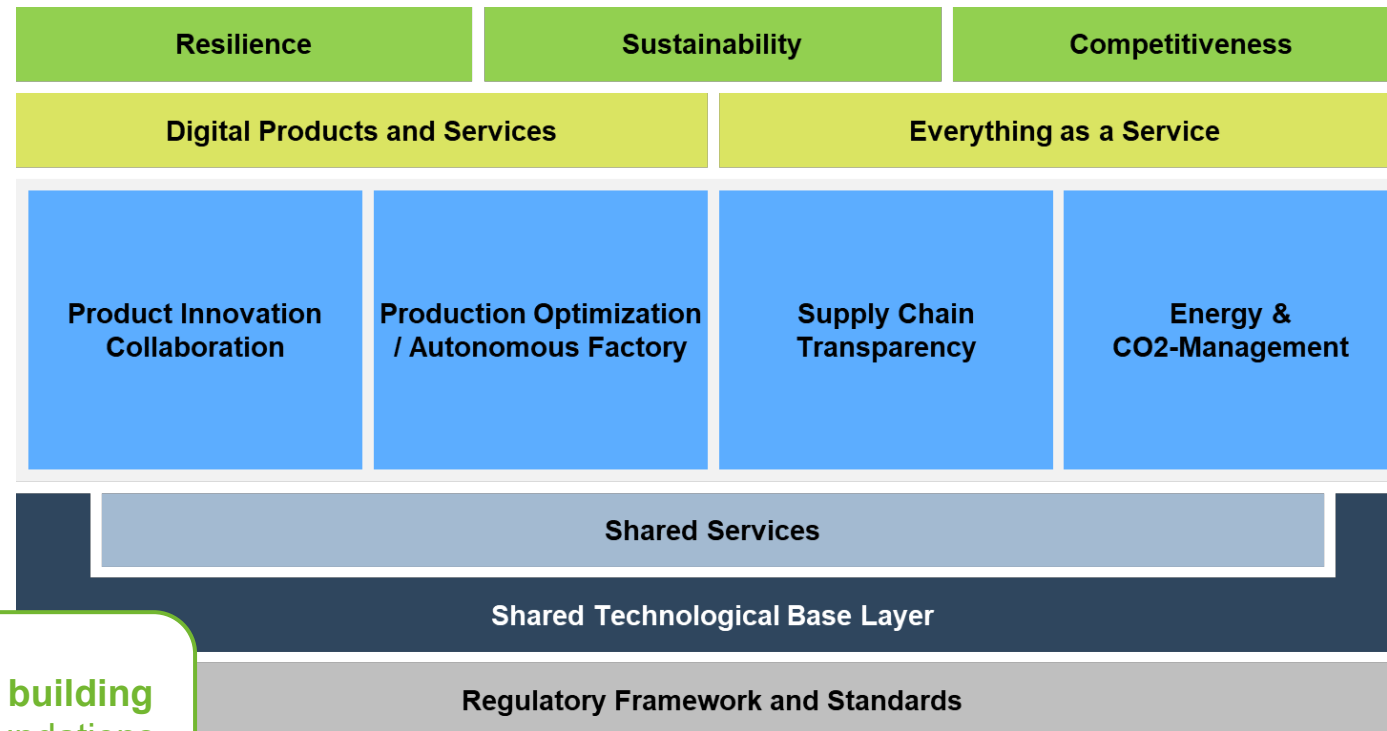
Constraints

Manufacturing-X builds on a common technical, organizational and legal framework and contributes to the future development in cooperation with European and international legislative.

#1 | Motivation & „Big Picture"
The Foundational Framework for Manufacturing-X

The Foundational Framework as common guideline for Manufacturing-X activities

2 Iterative interplay between **individual implementation** of use cases & **joint development** of basic infrastructure

Resilience	Sustainability	Competitiveness
Digital Products and Services		Everything as a Service

Product Innovation Collaboration	Production Optimization / Autonomous Factory	Supply Chain Transparency	Energy & CO2-Management

Shared Services

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Regulatory Framework and Standards

Catena-X
Automotive Network

IDTA

OPC UA

gaia-x

Individual Industry Business Challenge

Design and implementation of innovative business models based on data-driven use cases.

Joint Community Challenge

Building the common technical foundation cross-industry wide to guarantee compatibility and interoperability

1 Fitting of **established building blocks** as modular foundations for Manufacturing-X

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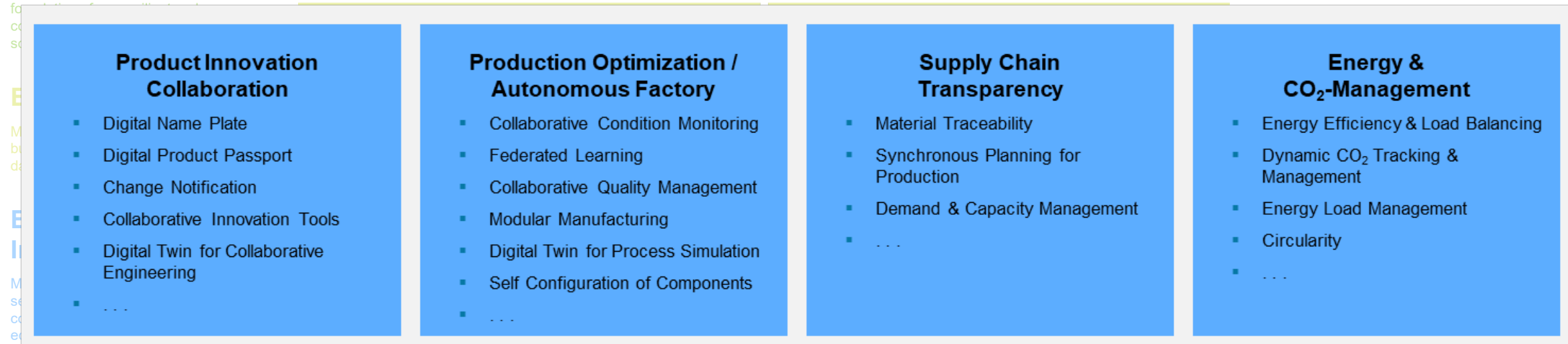
Manufacturing-X Use Cases

Manufacturing-X implements cross-industry use cases and application with both: High business impact and significant ecologic benefit.

Strategic Goals

Manufacturing-X develops the foundation

Resilience	Sustainability	Competitiveness

Product Innovation Collaboration

- Digital Name Plate
- Digital Product Passport
- Change Notification
- Collaborative Innovation Tools
- Digital Twin for Collaborative Engineering
- . . .

Production Optimization / Autonomous Factory

- Collaborative Condition Monitoring
- Federated Learning
- Collaborative Quality Management
- Modular Manufacturing
- Digital Twin for Process Simulation
- Self Configuration of Components
- . . .

Supply Chain Transparency

- Material Traceability
- Synchronous Planning for Production
- Demand & Capacity Management
- . . .

Energy & CO_2-Management

- Energy Efficiency & Load Balancing
- Dynamic CO_2 Tracking & Management
- Energy Load Management
- Circularity
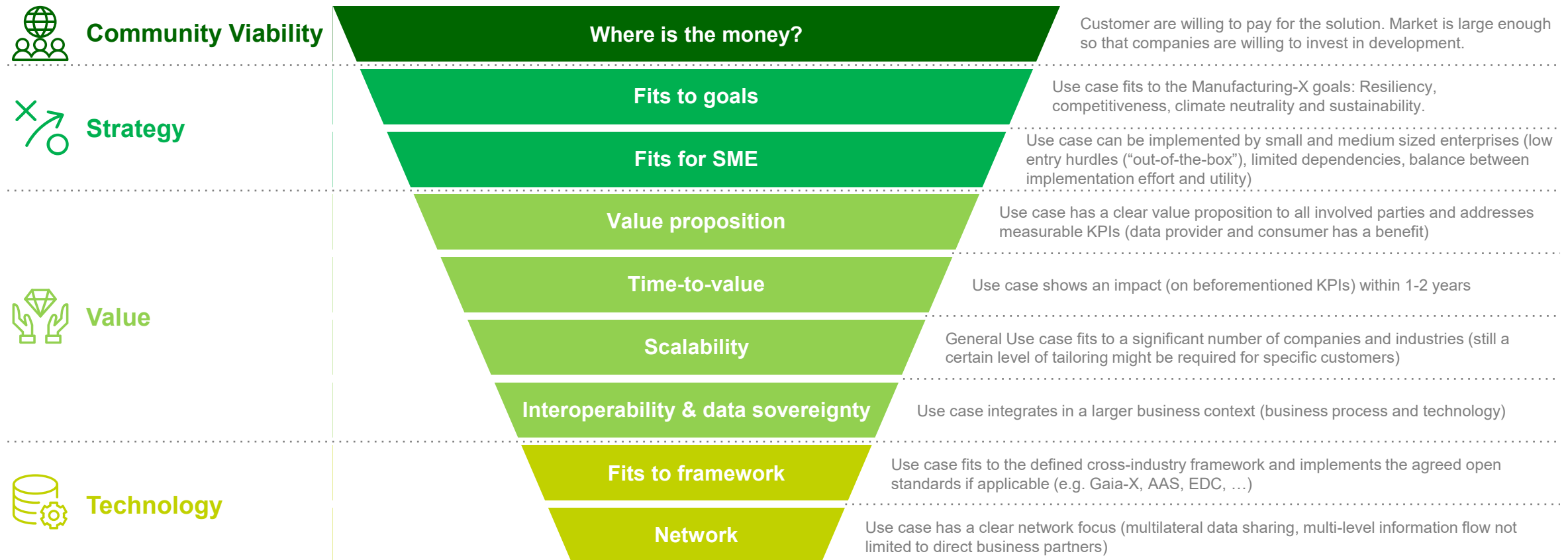- . . .

Shared Technological Base Layer

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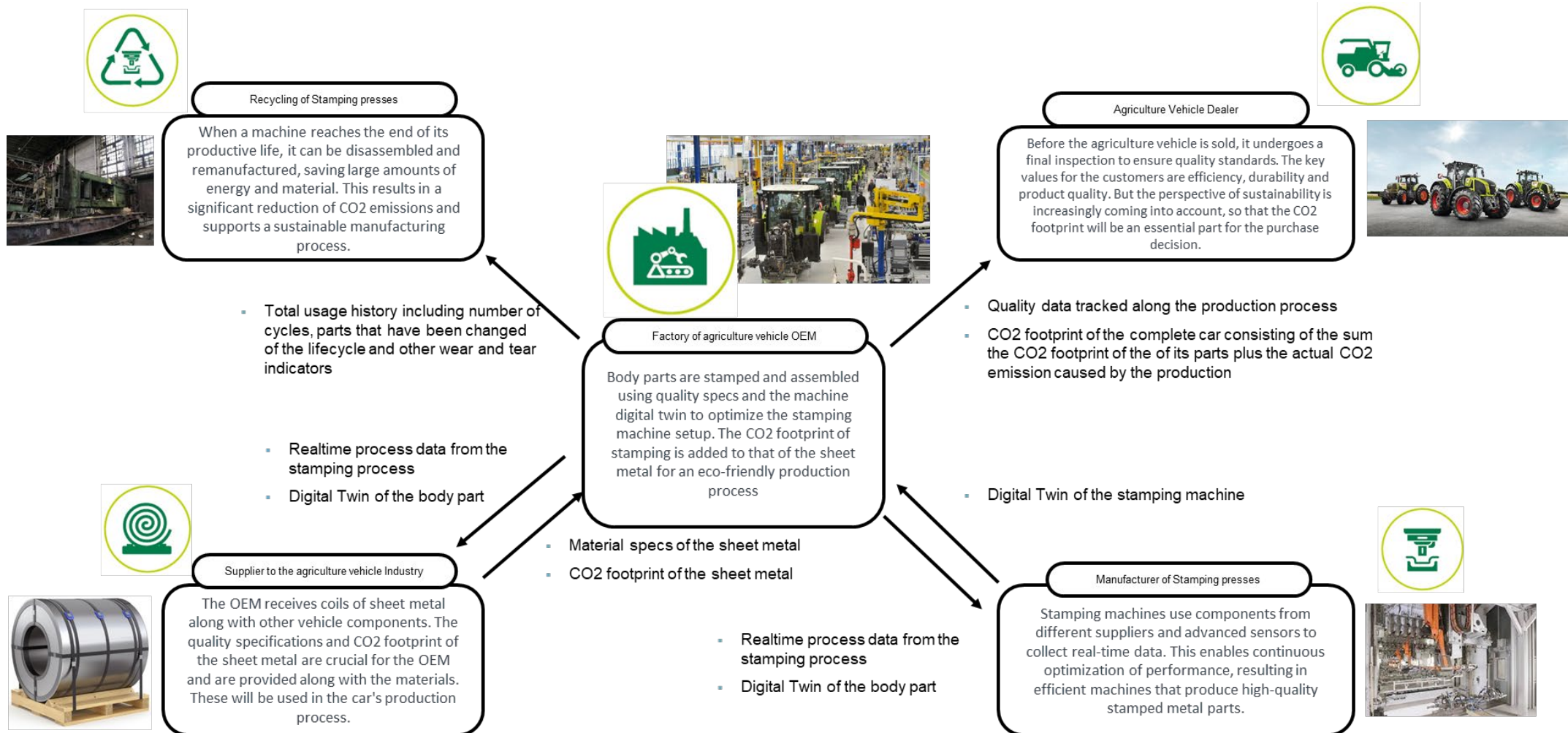
Manufacturing-X Use Case: Value-assessment

Value-assessment to identify collaborative, data-driven use cases within an industrial ecosystem

Category	Funnel stage	Description
Community Viability	**Where is the money?**	Customer are willing to pay for the solution. Market is large enough so that companies are willing to invest in development.
Strategy	**Fits to goals**	Use case fits to the Manufacturing-X goals: Resiliency, competitiveness, climate neutrality and sustainability.
Strategy	**Fits for SME**	Use case can be implemented by small and medium sized enterprises (low entry hurdles ("out-of-the-box"), limited dependencies, balance between implementation effort and utility)
Value	**Value proposition**	Use case has a clear value proposition to all involved parties and addresses measurable KPIs (data provider and consumer has a benefit)
Value	**Time-to-value**	Use case shows an impact (on beforementioned KPIs) within 1-2 years
Value	**Scalability**	General Use case fits to a significant number of companies and industries (still a certain level of tailoring might be required for specific customers)
Value	**Interoperability & data sovereignty**	Use case integrates in a larger business context (business process and technology)
Technology	**Fits to framework**	Use case fits to the defined cross-industry framework and implements the agreed open standards if applicable (e.g. Gaia-X, AAS, EDC, …)
Technology	**Network**	Use case has a clear network focus (multilateral data sharing, multi-level information flow not limited to direct business partners)

An exemplary use case as role model for further action

Recycling of Stamping presses

When a machine reaches the end of its productive life, it can be disassembled and remanufactured, saving large amounts of energy and material. This results in a significant reduction of CO2 emissions and supports a sustainable manufacturing process.

- Total usage history including number of cycles, parts that have been changed of the lifecycle and other wear and tear indicators

- Realtime process data from the stamping process
- Digital Twin of the body part

Agriculture Vehicle Dealer

Before the agriculture vehicle is sold, it undergoes a final inspection to ensure quality standards. The key values for the customers are efficiency, durability and product quality. But the perspective of sustainability is increasingly coming into account, so that the CO2 footprint will be an essential part for the purchase decision.

- Quality data tracked along the production process
- CO2 footprint of the complete car consisting of the sum the CO2 footprint of the of its parts plus the actual CO2 emission caused by the production

Factory of agriculture vehicle OEM

Body parts are stamped and assembled using quality specs and the machine digital twin to optimize the stamping machine setup. The CO2 footprint of stamping is added to that of the sheet metal for an eco-friendly production process

- Digital Twin of the stamping machine

- Material specs of the sheet metal
- CO2 footprint of the sheet metal

Supplier to the agriculture vehicle Industry

The OEM receives coils of sheet metal along with other vehicle components. The quality specifications and CO2 footprint of the sheet metal are crucial for the OEM and are provided along with the materials. These will be used in the car's production process.

- Realtime process data from the stamping process
- Digital Twin of the body part

Manufacturer of Stamping presses

Stamping machines use components from different suppliers and advanced sensors to collect real-time data. This enables continuous optimization of performance, resulting in efficient machines that produce high-quality stamped metal parts.

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Core elements for a cross-industry architecture

Common building blocks of a unique technical architecture ensure cross-industry and inter-application interoperability

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Manufacturing-X develops the foundations for a resilient and competitive industry in a sustainable society.

Business Models

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Exemplary Cross-Industry Use Cases

Manufacturing-X creates sectorial and cross-sectorial collaboration projects with high economic impact.
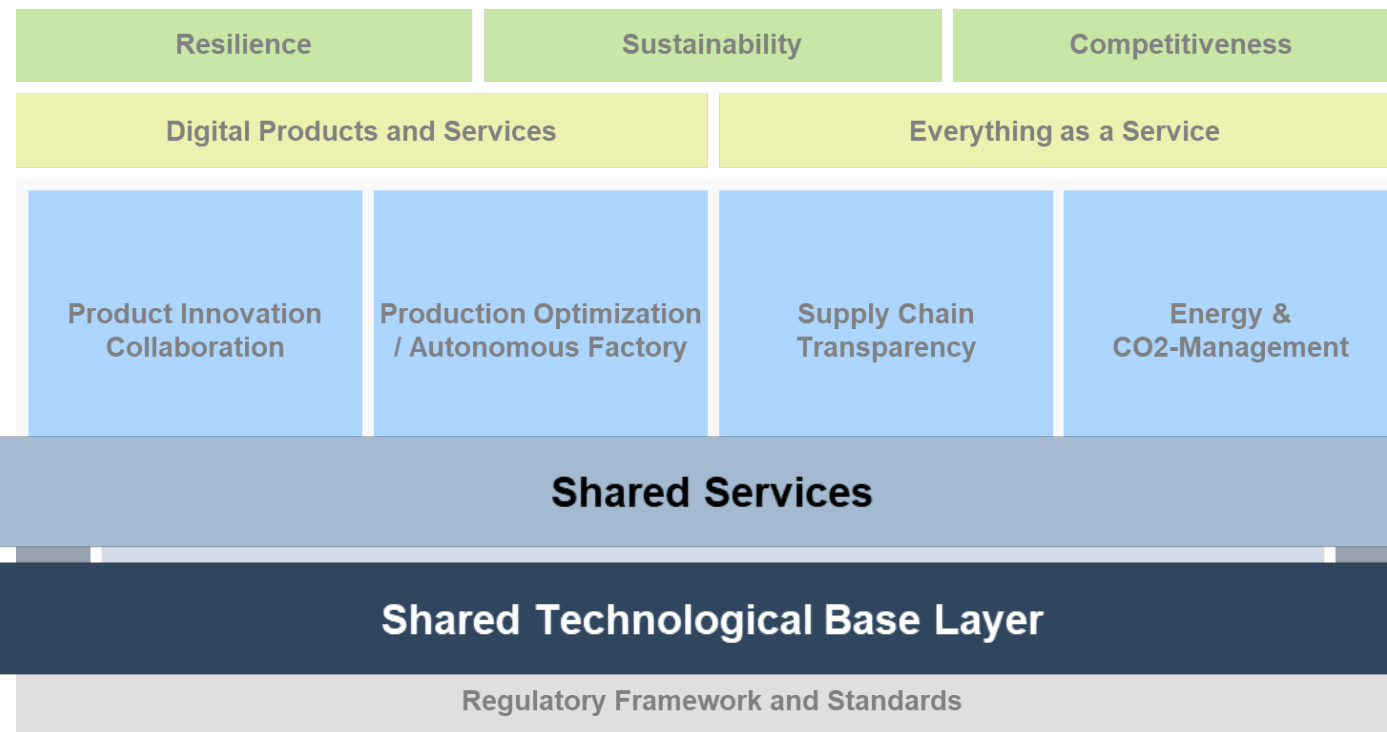
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Shared Technological Base Layer

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Foundation

Manufacturing-X defines technical standards and infrastructure to guarantee data sovereignty.

Manufacturing-X defines a common legal framework and contributes to the future development in cooperation with European and international legislative.

Core elements for a cross-industry architecture

Common building blocks of a unique technical architecture ensure cross-industry and inter-application interoperability

Manufacturing-X
Smart & Connected Industries

An **overarching technical architecture** for Manufacturing-X is THE key-enabler for interoperability within and across manufacturing industries.

MFX-architecture aims to ensure the **technical integration** of existing and to-be-developed systems within manufacturing data spaces.

MFX-architecture is being built based on a **number of building blocks**. Those building blocks shall be developed in a designated cooperative approach.

Interoperable data-ecosystems build on a unique kernel

Data-economy in industrial applications rely on a solid core of basic architectural elementes and services – with identical requirements for different use cases and industries!

Identity & Trust
Transactions are only carried out if you know and trust each other.

Executions are only possible if sender and recipient can be clearly identified.

Visibility & Access
Equal access with the same performance for all participants.

Transparent access prevents abuse and protects participants.
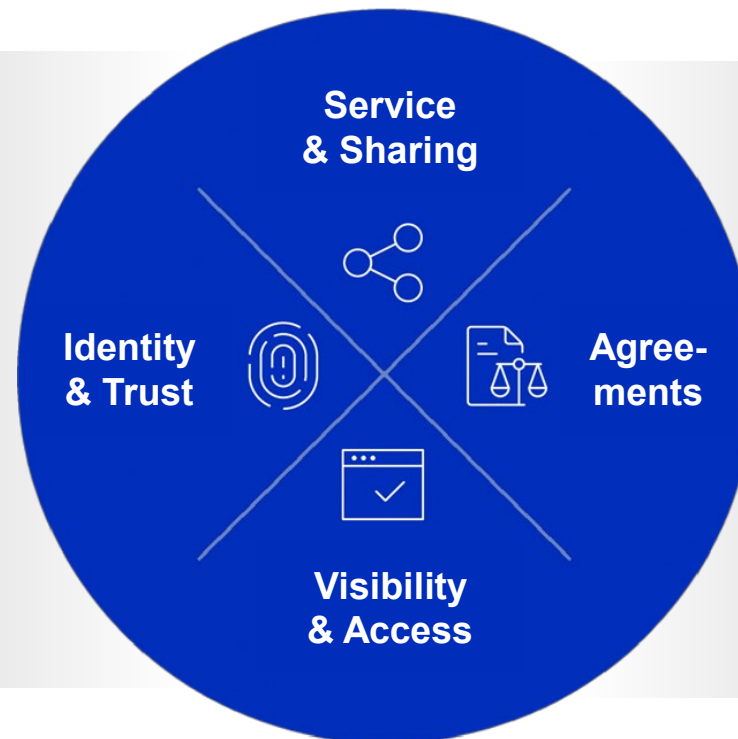
Service & Sharing
Sharing uniform and standardized services avoids waste and saves energy.

Agreements
New agreements lead to new business models and value creation between participants is realized.

Basic elements of core MFX-architecture

Interoperable data-ecosystems build on a unique kernel

Core elements of basic architecture
for a federated data-ecosystem…

- ✓ are **identical for different applications**
- ✓ ensure **cross-industry interoperability**
- ✓ **have to be developed only <u>once</u>**

Interoperable data-ecosystems build on a unique kernel

Core elements of basic architecture
for a federated data-ecosystem…

✓ are **identical for different applications**
✓ ensure **cross-industry interoperability**
✓ **have to be developed only <u>once</u>**

Individual use cases build around
core services allow for innovative use
cases *within* and *across* industries
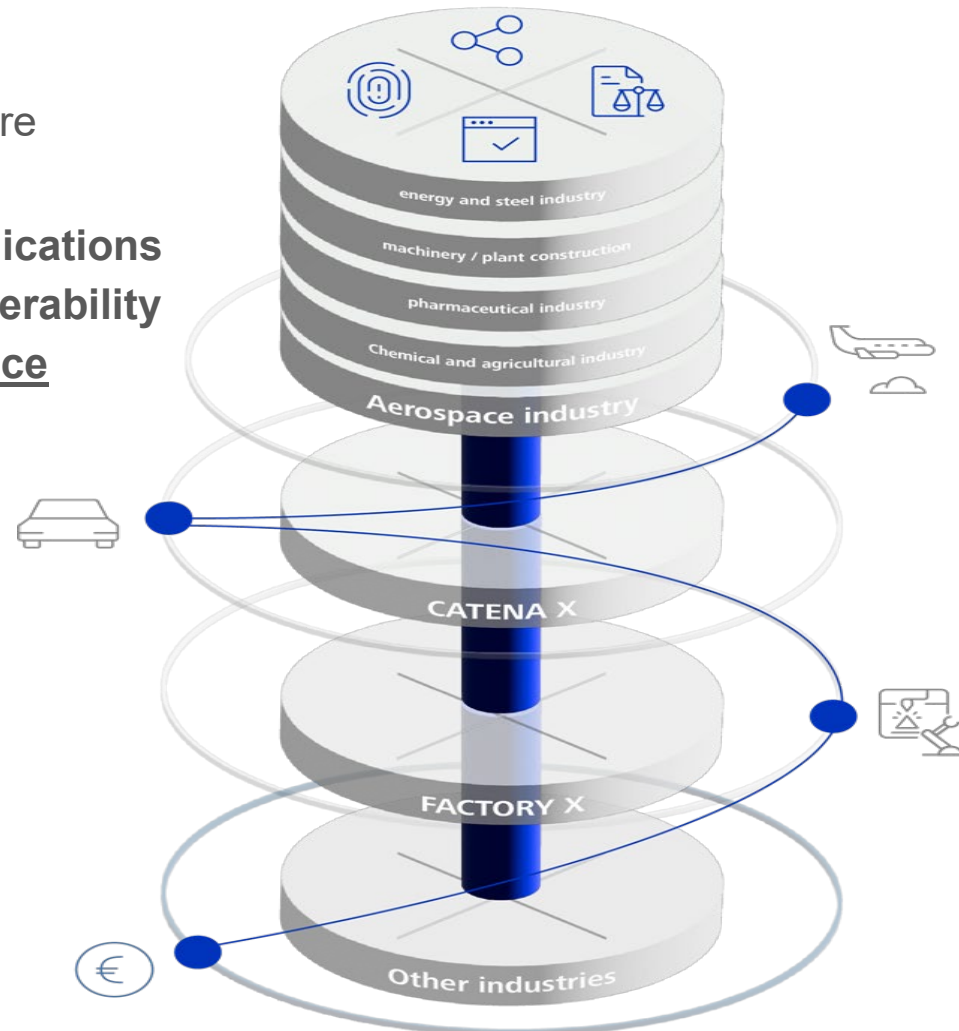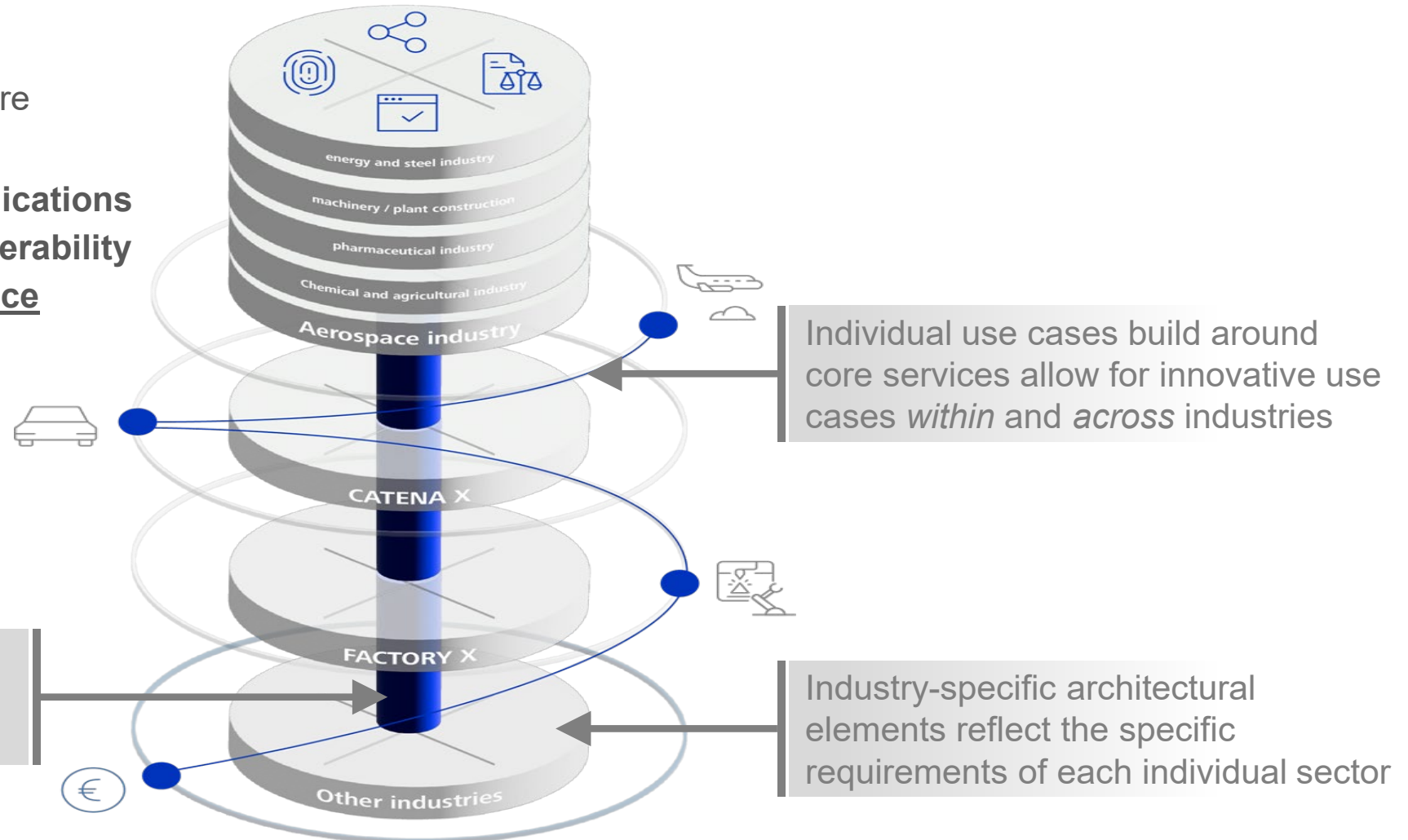
Core elements are the joint
adhesive holding all industries
together

Industry-specific architectural
elements reflect the specific
requirements of each individual sector

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Make data work. Competitive, Resilient & Sustainable.

Manufacturing-X implements the basic infrastructure to deploy **federated data-ecosystems for industrial applications**:

In an international **approach** Manufacturing-X connects value chains and manufacturing networks across all industrial sectors.

A **common technical core** build on basic cornerstones from recent developments of Industrie 4.0 guarantees interoperability.

A use-case based approach focuses on the **economic & ecologic impact** of collaborative use of data and ensures a dynamic scaling of the ecosystem.

Setting-up an organizational structure will facilitate the **open cooperation of the global MFX-community**.

Manufacturing-X
Smart & Connected Industries

Join in, participate and contribute to the collaborative development of the Data Space Industrie 4.0!

Manufacturing-X

Make data work. Competitive, Resilient & Sustainable.

Want to learn more about Manufacturing-X?

Manufacturing-X
Smart & Connected Industries

Visit Manufacturing-X on Plattform Industrie 4.0

www.plattform-i40.de/manufacturing-x