AI – Artificial Intelligence Industrial applications

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Overview

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1	**Digitalization and AI**
2	**Industrial Examples of AI**
3	**Vision for an AI PPP in Europe**

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Digitalization and AI is disrupting entire customer value chains

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Data analytics

Artificial Intelligence

Simulation tools

Cloud & platform technology

Secure connectivity

Cyber-Security

Enabling the next level of ...

... productivity and time-to-market ...

... flexibility and resilience ...

... availability and efficiency ...

Design and engineering

Automation and operation

Maintenance and services

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AI is based on a portfolio of technologies that are combined to generate value

Safety

Security

HPC

Cloud

Data

Connectivity

Edge

IoT
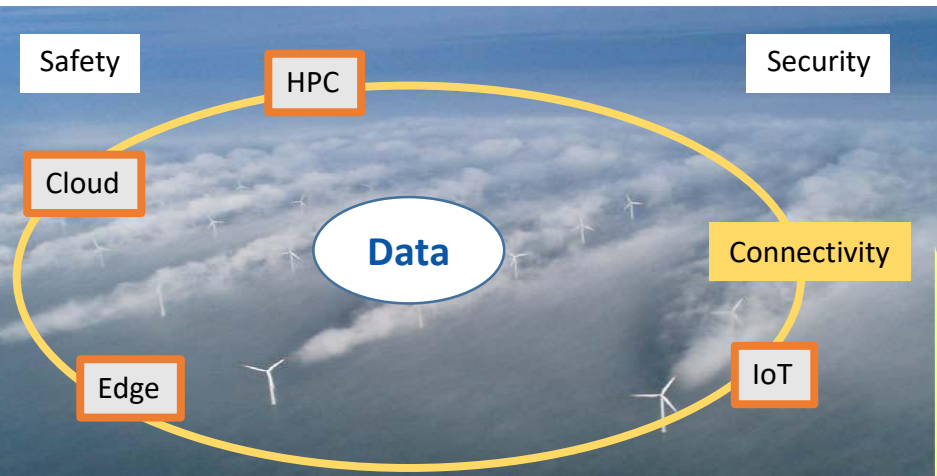
Reinforcement Learning
Learning from labeled data (actions and rewards)
Identify optimal action strategies

$$\max_a \sum_{t=0}^{T} \gamma^t r(s_t, a_t)$$

sensor data stream

Data Store

selected data

New policies are tested in simulations

Classical control loop

Machine learning loop

actions

Agent executes the policy on current turbine data to optimize the operation

NEW CONTROL POLICY

Reinforcement learning produces an optimized control policy

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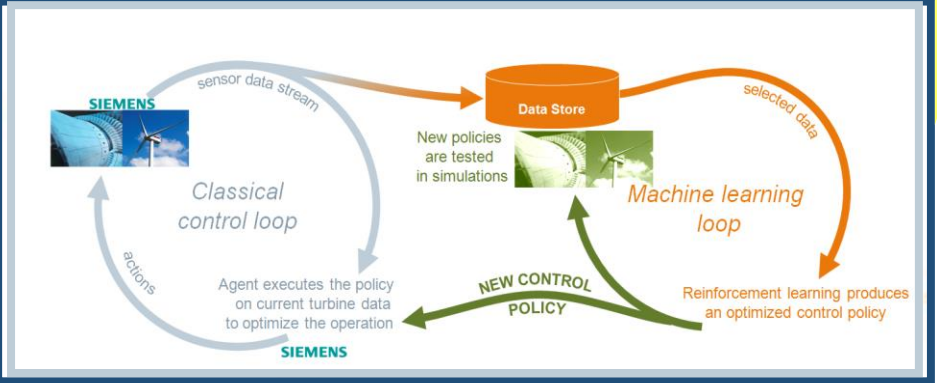
Defintion

From an industrial point of view, AI means **algorithm-based and data-driven computer systems** that enhance machines and people with digital capabilities such as **perception, reasoning, learning** and even **autonomous decision making**.
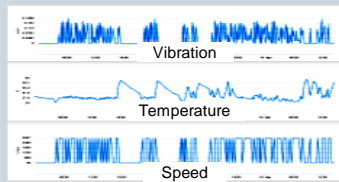
Technology

Perception	Cognition	Decision

Sensor Processing	Reasoning → Draw conclusions	Decision making (also in uncertainty)
Image Processing	Learning → Adapt and improve	
Speech recognition	Creativity → Generate hypotheses	
Text Processing		

Industrial Knowledge Graph & Memory
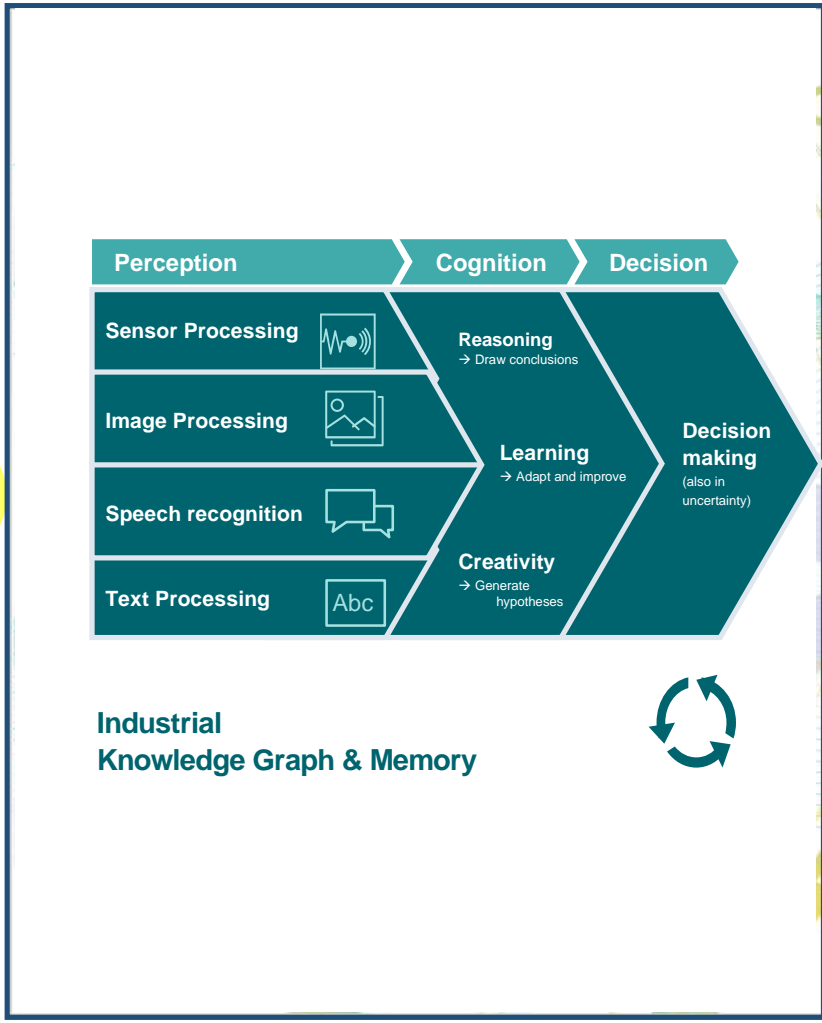
Perception/Cognition/Decision/Knowledge are key elements

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Perception

Signals and data

e.g. temperature, acceleration, pressure, force, magnetic field, …

Vibration

Temperature
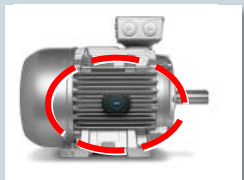
Speed

Cognition
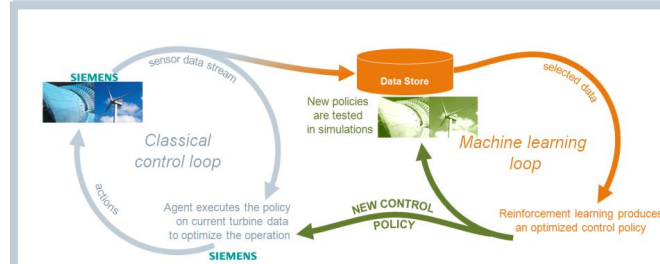
Decision

Speed

Flexibility

Quality

Efficiency

Knowledge
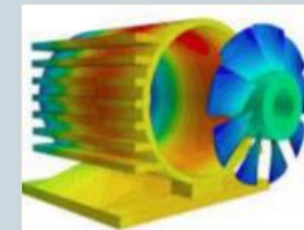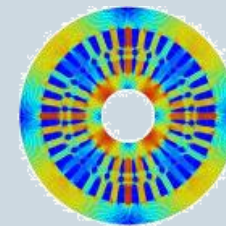
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Our IoT operating system MindSphere – enhanced by Edge and mendix

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Applications
Powerful industry solutions with advanced analytics

mx mendix
the app platform

Open PaaS
Develop robust industrial IoT solutions faster with global scalability

MindSphere
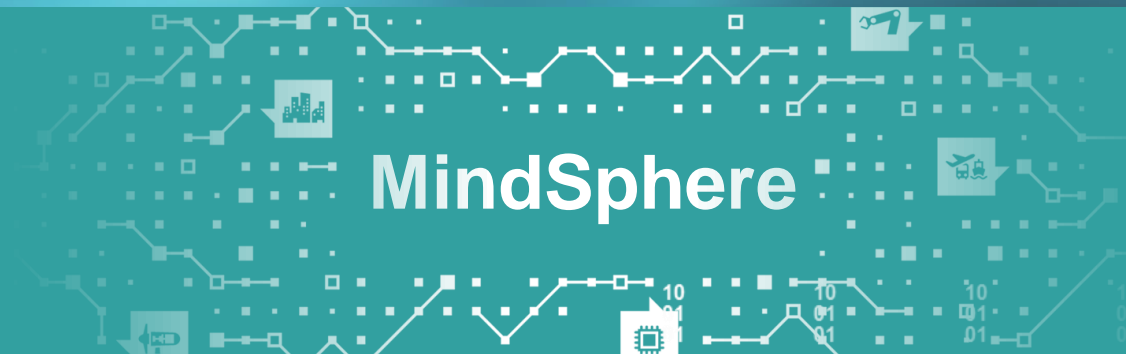
Edge Management
Edge Device Management, Edge App Management, and Edge App Store

Connectivity
Connect products, plants, systems, machines and enterprise applications
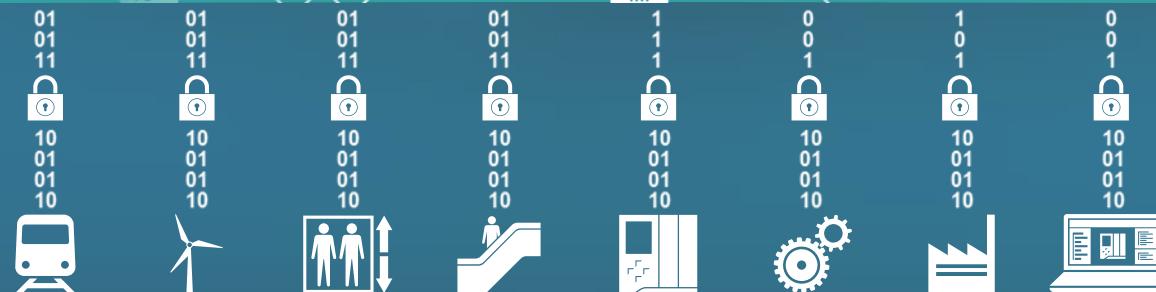
Edge Apps
Applications for intelligent data use

Edge Devices
Secure, future-proof basis for running edge applications

Building a world-class ecosystem

Examples

TATA

software AG

accenture

Tech Mahindra

Patti Engineering

pwc

Deloitte.

Bentley

bluvision

FPT

wipro digital

BISTel

HCL

chemtech
A Siemens Business

Cognizant

Microsoft

amazon web services

Alibaba Cloud

intel

SQS

OMNETRIC
A Siemens Company

evosoft

senseye

BearingPoint

HEITEC

Mindtree

ctp Cloud Technology Partners

Capgemini

orange Business Services

ENGINEERING

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MindSphere

Partner Types

- Consulting and Strategy

- Application Developers

- System Integrators

- Technology

- Hybrid OT

- Connectivity

Edge computing – much more than a cloud gateway

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Analysis and (pre-)processing
on the shop floor

Low-latency and processing
of high bandwidth data

IT/OT convergence

Data security and privacy

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Industrial Edge

Control level

Siemens Industrial Edge brings IT mechanisms into the OT world

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Edge Management System
Central infrastructure to manage
Edge devices

Industrial Edge
Applications for intelligent
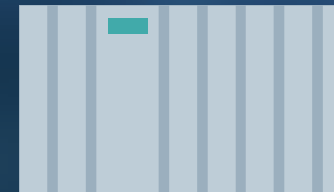data use

Control level + Edge Devices
Secure, future-proof basis for running
Industrial Edge applications

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X-ray-based PCB quality assurance

Siemens Electronics Factory Amberg, Germany

Challenge

Production output of SMT line limited by time consuming X-ray Quality tests

Every further X-ray machine requires additional invest of €500,000

Non Production Critical Level

AI

Training of Algorithm

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Continuous data storage

App Deployment/Update

🔒 **Proxy**

Production Critical Level

Captured Data Real time capturing of >40,000 production parameters

Peak volume of 10 MB/s

Edge Device

AI

PCB Quality Prediction Algorithm

X-RAY Testing necessary? **YES** or **NO**
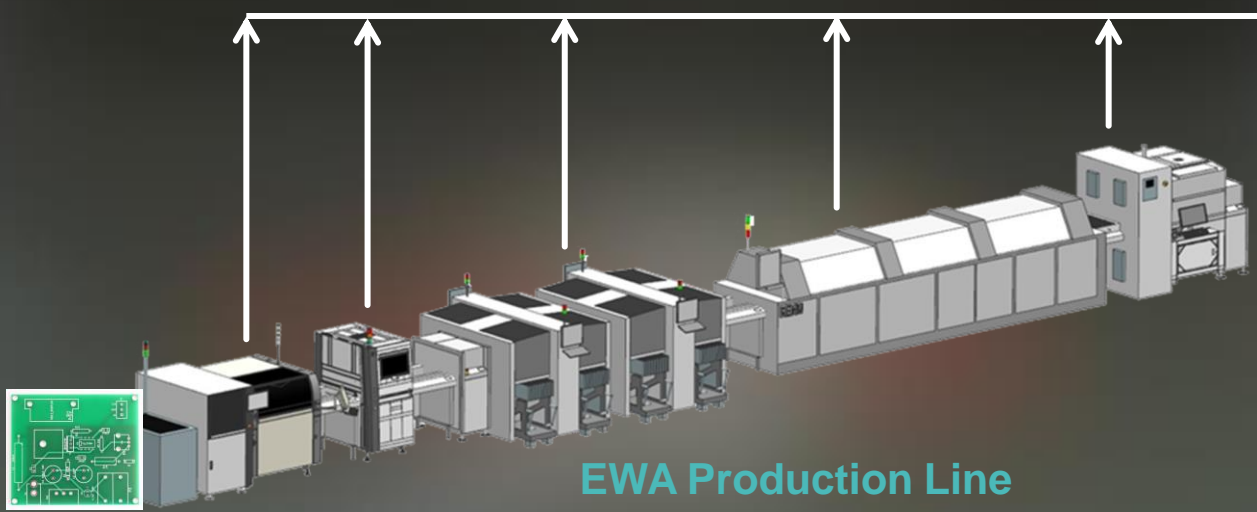
X-RAY

No X-Ray
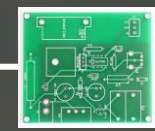
Assembly line

EWA Production Line

Manufacturing Execution System

Minimization of necessary X-ray tests by up to

30%

Quality rate of

100%

Reduced capital invest for further X-ray machines of

€500,000

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Magazine
optimization

HELLER GmbH

Magazine optimization

HELLER GmbH

Cycle-time reduction enabled by program focused optimization of tool magazine right at the machine

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Magazine optimization

Machining profile

Machine profile

Optimization

Cloud Level

MindSphere

Factory Level

Connectivity

Machine Level

Edge Apps

Edge Device

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AI strategies …

2017

| March: Pan-Canadian AI Strategy | May: AI Singapore Announced | October: AI Strategy 2031 | December: Finland's AI Strategy | January: Budget for AI Taiwan | March: AI at the Service of Citizens | April: First Workshop for Strategy | April: UK AI Sector Deal | May: White House Summit on AI | May: Sweden's AI Strategy | June: Towards an AI Strategy in Mexico | Fall 2018: EU's AI Strategy |

2018

| March: AI Technology Strategy | July: Next Generation AI Plan | December: Three-Year Action Plan | January: Blockchain and AI Task Force | January: Strategy for Digital Growth | March: France's AI Strategy | April: Communication on AI | May: Australian Budget | May: AI R&D Strategy | June: National Strategy for AI | Fall 2018: Germany's AI Strategy |

2018-07-13 | Politics + AI | Tim Dutton

BDV BIG DATA VALUE ASSOCIATION

DATA-DRIVEN ARTIFICIAL INTELLIGENCE
FOR
EUROPEAN ECONOMIC COMPETITIVENESS
AND SOCIETAL PROGRESS

BDVA Position Statement
November 2018

BDV BIG DATA VALUE ASSOCIATION

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The vision for an AI PPP in Europe

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European AI Framework
- European Fundamental Rights, Principles, and Values
- Value-Driven for Business, Society, and People
- Policy, Regulation, Certification, and Standards

Cross-Sectorial AI Technology Enablers

| Acquisition & Sensing | Data Processing & Analysis | Decision-Making | Physical and Human Action & Interaction |

AI Ecosystem Enablers
- Business and Technical Skills and Knowledge Sharing
- Systems Development & Data for AI
- Experimentation and Innovation

AI PPP

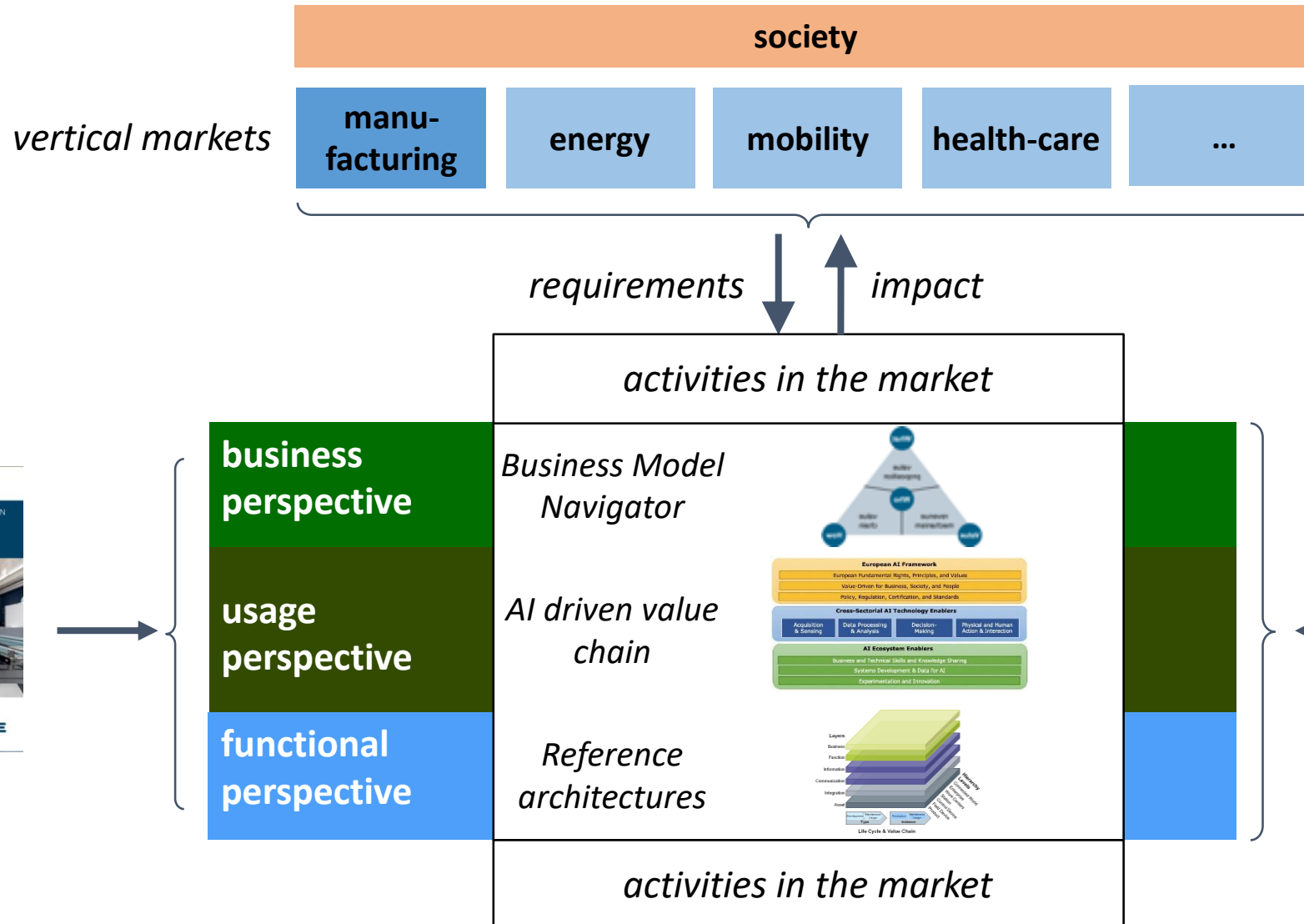**Europe's coordinated plan on AI:** https://ec.europa.eu/digital-single-market/en/news/coordinated-plan-artificial-intelligence
BDVA AI positioning paper: http://www.bdva.eu/sites/default/files/AI-Position-Statement-BDVA-Final-12112018.pdf
BDVA/euRobotics AI visioning paper: http://www.bdva.eu/downloads

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Big Picture …

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vertical markets

society				
manu-facturing	energy	mobility	health-care	...

requirements ↓ ↑ impact

activities in the market

business perspective	*Business Model Navigator*
usage perspective	*AI driven value chain*
functional perspective	*Reference architectures*

activities in the market

exchange

other stakeholder, e.g. HPC, Plattform Industrie 4.0, etc.

DIN/DKE – ROADMAP
GERMAN STANDARDIZATION ROADMAP
Industrie 4.0
Version 3

DIN **DKE** **VDE**

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Thank you!

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Contact and further information

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