PAN-EUROPEAN ROBOTICS RESEARCH NETWORKS: AN INSIDER'S PERSPECTIVE

Florian Krebs, **CANADIAN ROBOTICS COUNCIL 2022 SYMPOSIUM,** 22.09.2022

Personal introduction

- Diploma in applied computer science
- Industry experience at **KUKA** R&D
- At **DLR Center for lightweight production technology** (part of DLR Institute of Structures and Design) in Augsburg for 13 years
  - 2008: Researcher
  - 2013: Team leader: Flexible Automation Systems
  - 2017: Deputy head of department: Center of lightweight production
- Network participation (non-comprehensive):

  IEEE Robotics and Automation Society, **euRobotics**, European Open Science Cloud, **Plattform Industrie 4.0**, NFDI4Ing, HMC, BITKOM, Composites United, **Center Digitization.Bavaria**, **AI Production Network**, Cluster Mechatronics

German Aerospace Center (DLR) at a glance

- Research institution
  - Aeronautics
  - Space research and technology
  - Transport
  - Energy
  - Security (cross-sectoral area)
  - Digitalisation (cross-sectoral area)
- Space Administration
- Project Management Agency

More than 9000 employees work in 54 institutes and facilities at 30 sites across Germany.

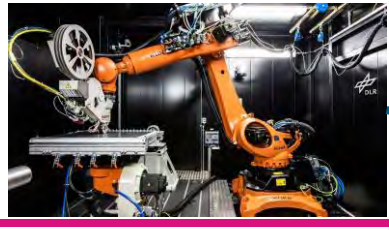
International offices in Brussels, Paris, Tokyo and Washington D.C.

Robotics @ DLR
(selected examples)

- Robots at DLR are
  - research subject by itself (fundamental research)
  - tool for conducting research (robotic applications)
- Embedded in space and aeronautics programs (except self driving vehicles)



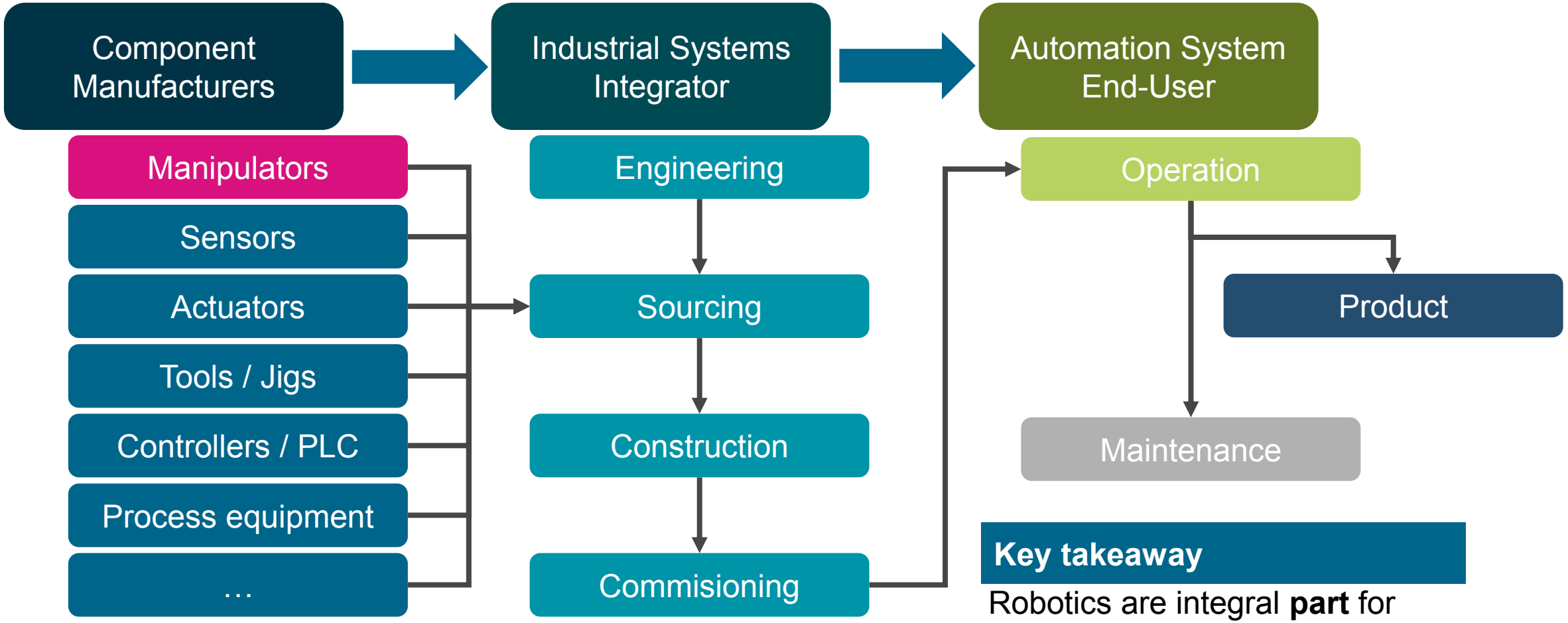





Pan-European Robotics Research Network Ecosystem

A bit of context first:
Industrial automation systems value chain



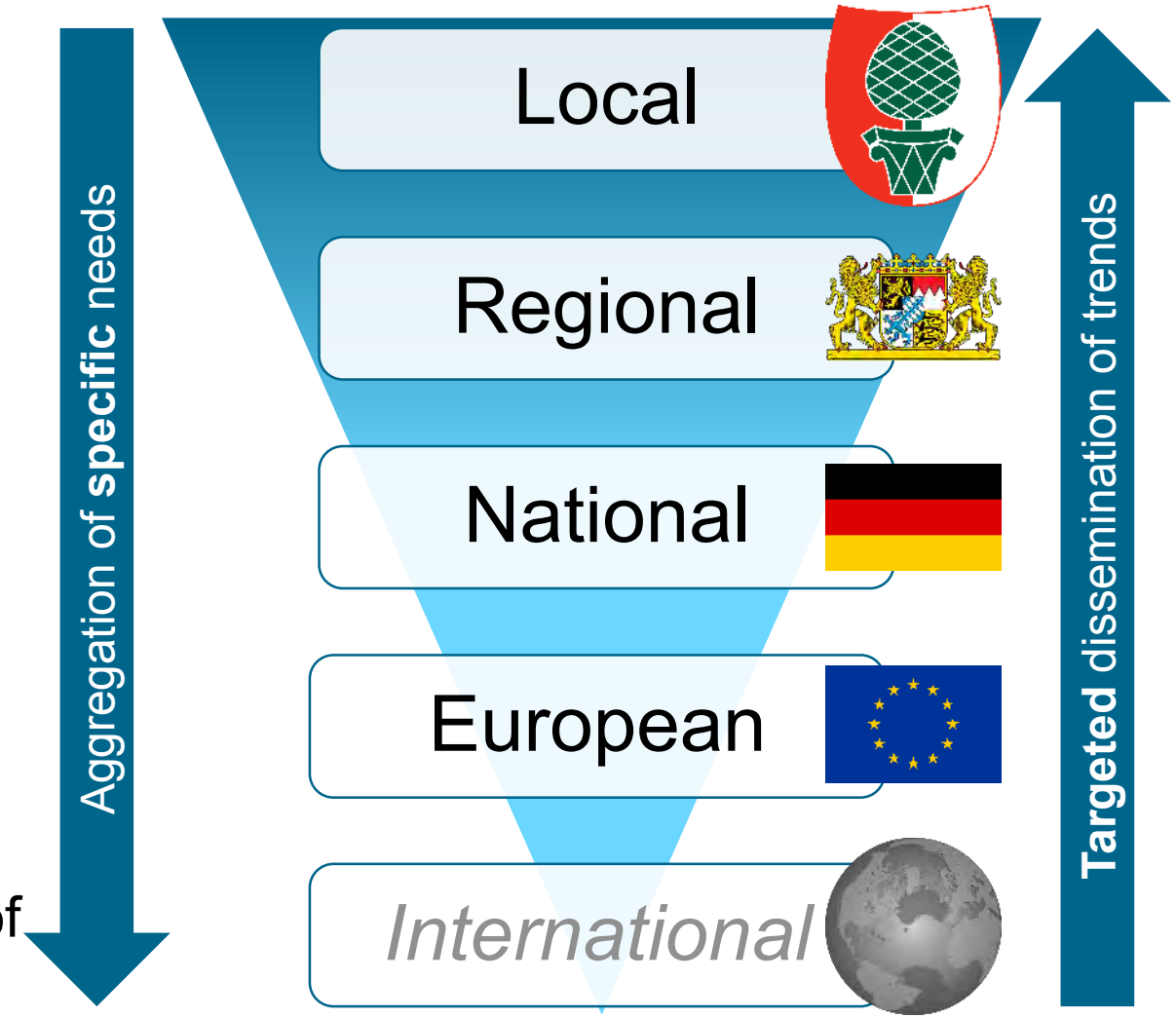
Key takeaway

Robotics are integral **part** for advanced manufacturing systems.

Network landscape in Germany and Europe

- Networks have different scopes:
  - Locality: Local, Regional, National, European
  - Topical: Science, Application, Process, …
  - Stakeholder:
    Academia, End-User, Solution provider, …
  - *and many more*

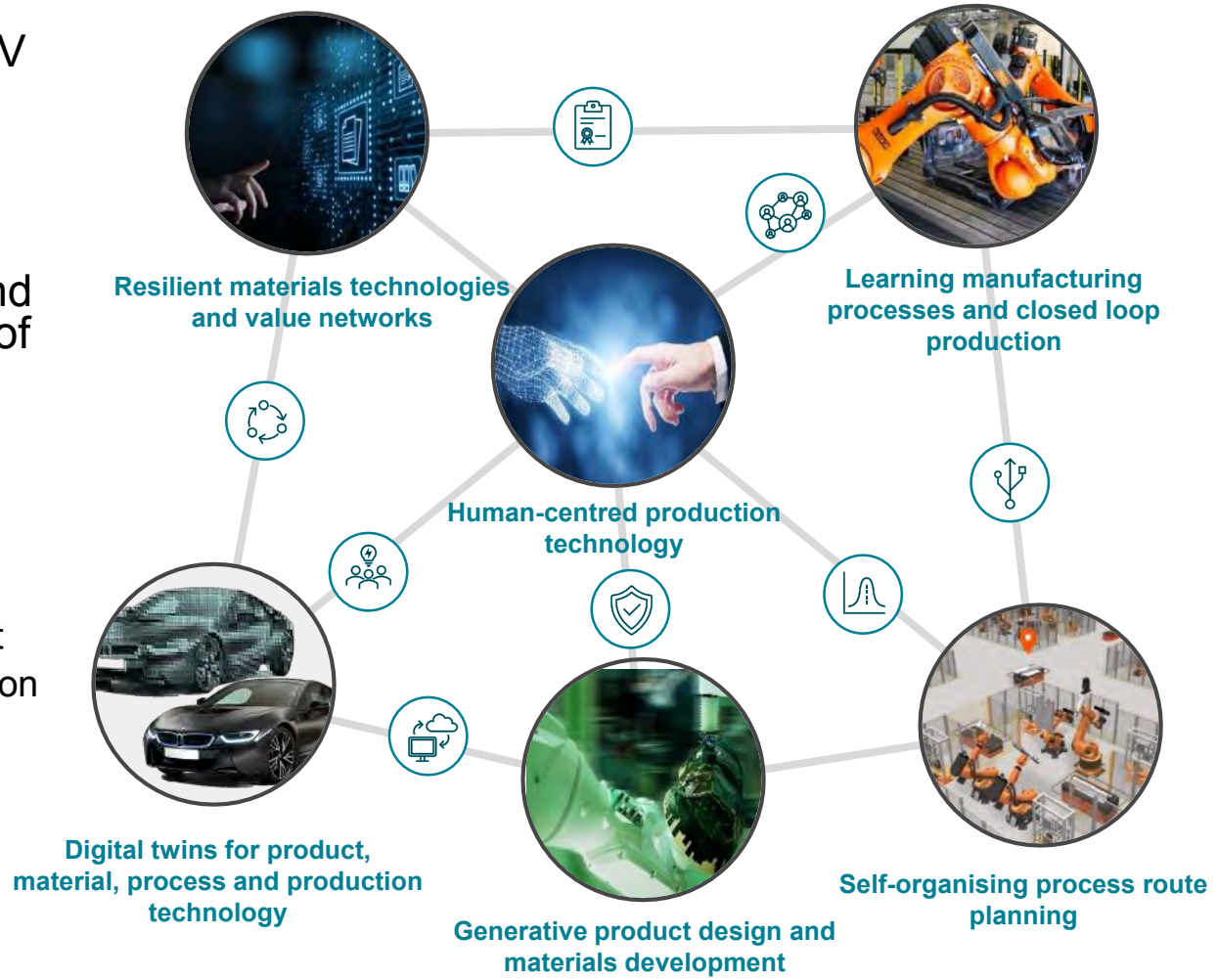
  Essential for finding ones **“place”** in the landscape
- Two important effects
  - Funnel effect (from local to global):
    Local stakeholders can voice their specific needs
  - Spray nozzle effect (from global to local):
    Overarching trends and technologies can be disseminated
- Often (applied) scientists take on the role of bidirectional communicators



AI Production Network Augsburg

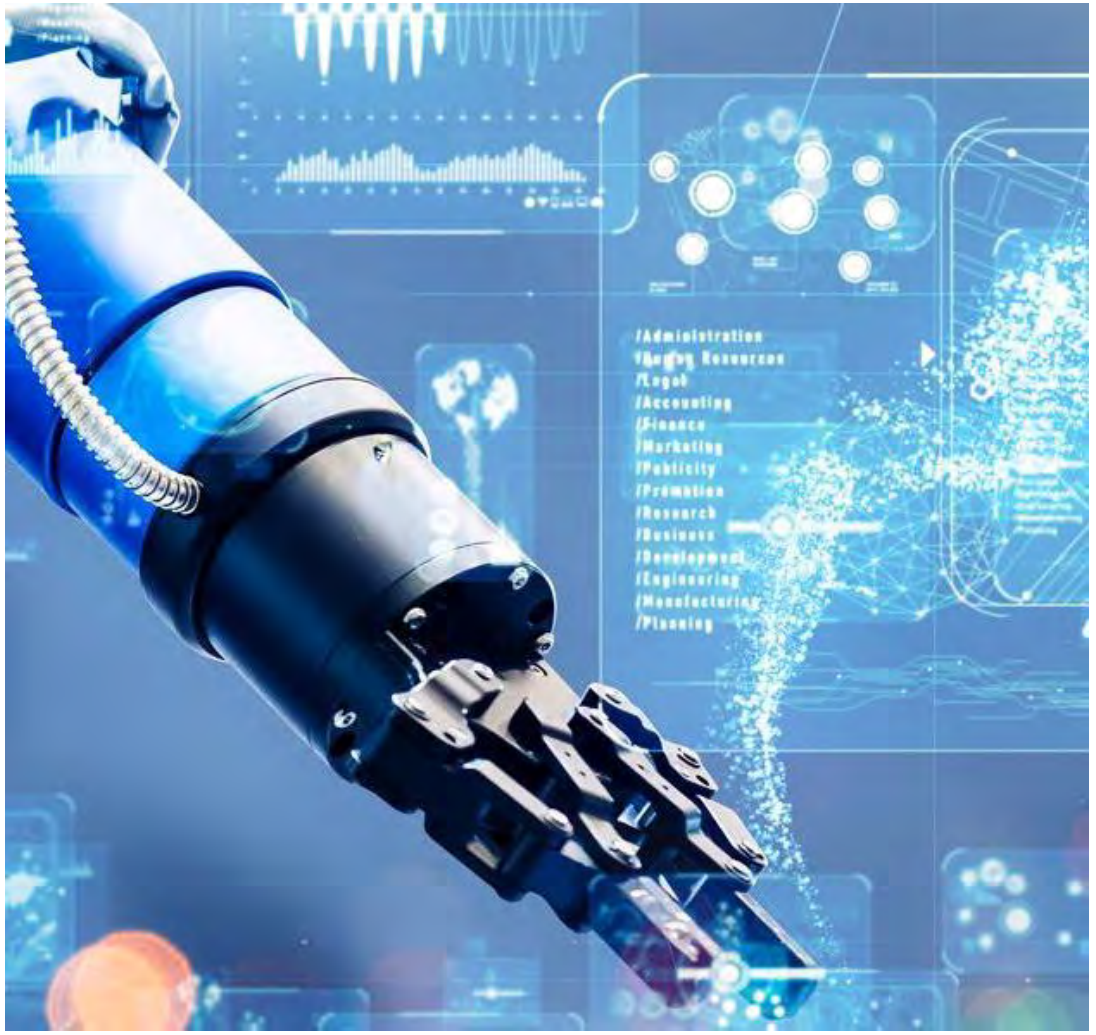
KI PRODUKTIONS-NETZWERK AUGSBURG

- Joint research network of University of Augsburg, DLR ZLP, Fraunhofer IGCV as well as further governmental and commercial partners
- Aim of the AI Production Network Augsburg: AI-based production technologies at the interface between materials, manufacturing technologies and data-based modeling as well as the development of sustainable business models.
- The thematic focus of the participating research institutions is as follows:
  - Human Centered Production Technologies
  - Self-organizing-process-route-planning
  - Generative design methods and materials development
  - Digital twins for product, material, process and production network
  - Learning Manufacturing Processes & Closed-Loop Production
  - Resilient Value Creation Networks and Supply Chains



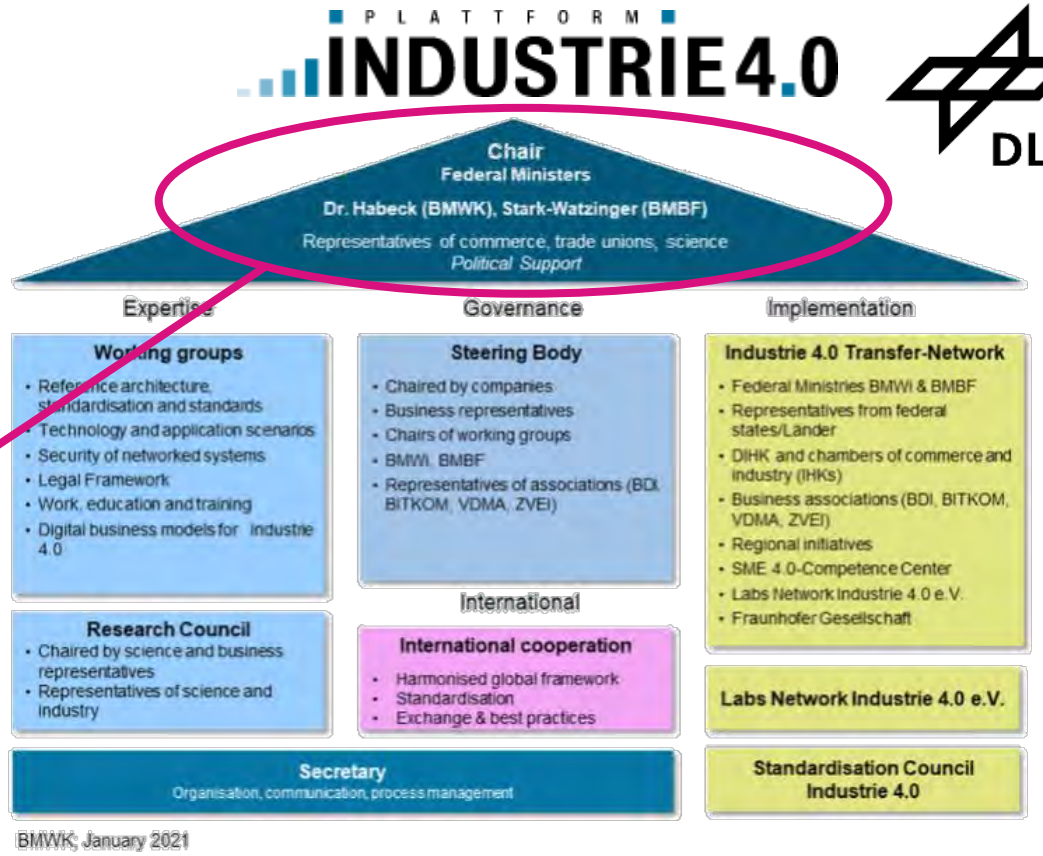
Center Digitisation.Bavaria
Digital Production & Engineering

- Integrative platform, impulse generator and innovation accelerator for manufacturing companies, development service providers as well as research institutions
- Focus on utilization of digital technologies in production and development, whereby we closely interlink both fields to ensure a holistic approach.
- Core Topics:
  - Information and communication technology (I&C)
  - Cyber-physical (CPS) and embedded systems
  - Machine and plant engineering
  - Development and production processes
- Augmented by several overarching topic areas: e.g. Data security and reliability; Interoperability and digital pervasiveness;
- As part of the EU initiative Digitising European Industry the ZD.B is registered as Digital Innovation Hub (DIH).



Plattform Industrie 4.0

- More than 400 stakeholders from over 200 organizations
- 10 year anniversary this year
- Lead by
  - Federal Ministry for economic affairs and climate action (BMWK)
  - Federal Ministry of education and research (BMBF)
- → direct impact on national policy
- Six main working groups (open, pre-commercial)
  - Standardization
  - Application scenarios
  - Security
  - Legal Framework
  - Work, education and training
  - Digital Business Models
- Industry 4.0 transfer network (network of networks) for technology dissemination (including GAIA-X)



Example output

The **Asset Administration Shell** is the implementation of the digital twin in Industrie 4.0. It is thus the "standardized connector" between the analog and virtual world. The AAS has been included in the IEC series of standards.

euRobotics

- Association for **all European robotics stakeholders**, with over 250 members from industry and research
- Initiator and coordinator of Topic Groups for structuring various content and interests
- **Coordinates the road-mapping process for European robotics**
  - Is a central source of information on robotics and artificial intelligence (AI) for the European Commission, policy makers and Member States (giving input to Horizon 2020, Civil laws on robots, Horizon Europe, Digital Europe Programme, AI Strategy etc.)

→ SRIDA AI, Data and Robotics Partnership

Side note

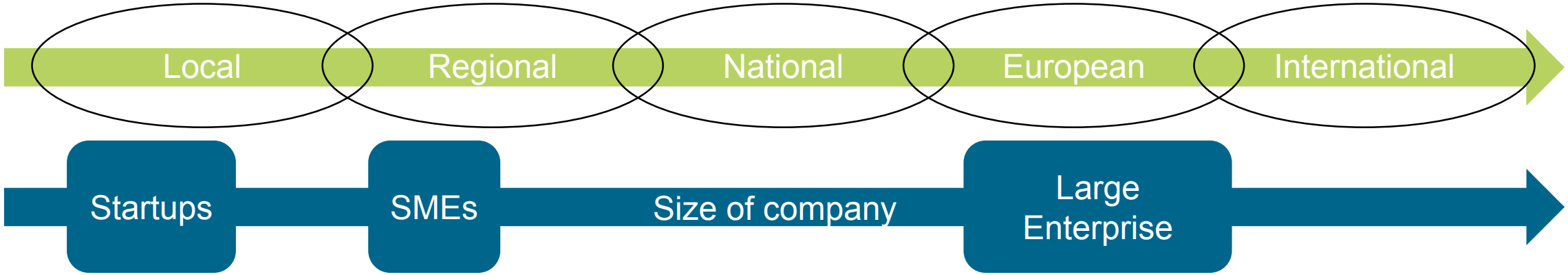
Horizon Europe (2021-2027) includes a dedicated budget for Cluster ‘Digital, industry and space’. (including Robotics based on SRIDA) **€15.349 billion** (of €95.5 billion Horizon Europe total)

Effects of multi-layered network of networks (w.r.t. locality)

- Local networks are more focused on specific innovation needs
- Larger networks provide a link to *“the big picture”*
- Interplay and **intended overlap** of participants of different networks is key

Personal insight

- Startups / SME tend to gravitate more towards local networks → closeness to potential customer
- Larger enterprises lean more towards larger networks → closeness to policy makers



Success story “Space Robotics: Down to Earth”
Light-weight robotics
(@ DLR Institute of Robotics and Mechatronics)

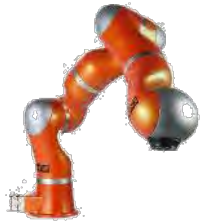
- From ROTEX experiment on SpaceLab D2 Mission to commercialized advanced industrial cobot KUKA iiwa

ROTEX (1993)

DLR LWR I (1995)

DLR LWR II (2000)

DLR LWR III (2003)



KUKA LBR 4+ (2009)

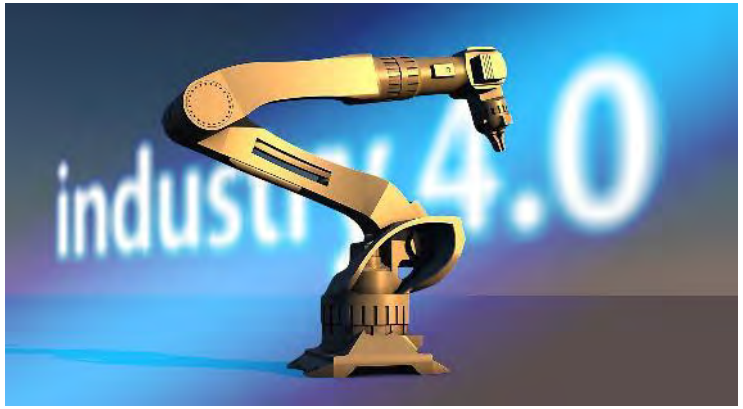
From March 2009 the KUKA LBR 4 has been used in the fully automated assembly of rear axle gearboxes at the **Mercedes-Benz** Untertürkheim plant.

KUKA LBR iiwa (→ now)

Summary

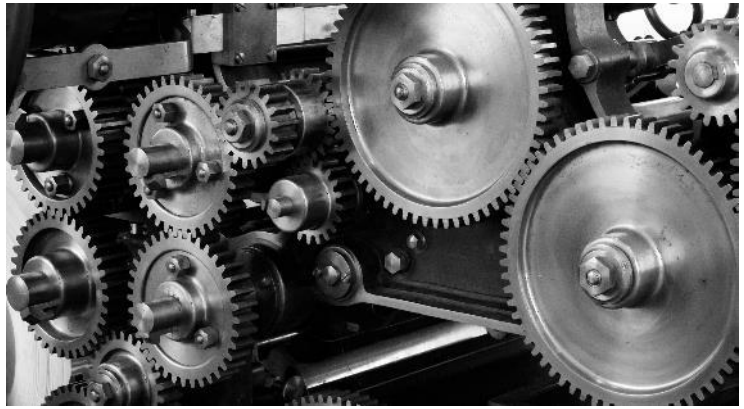
Main takeaways

Robotics are integral **part** for advanced manufacturing systems.



Multi-level/dimensional networks **foster participation** of stakeholder by addressing their needs.

Interlinking networks provide open discussion spaces to further innovation.



"The **true value of networking** doesn't come from how many people we can meet but rather how many people we can introduce to others."

-- Simon Sinek on Twitter 18.02.2022

(Author of "Start with Why: How Great Leaders Inspire Everyone to Take Action", "golden circle" methodology)


DLR
Wissen für Morgen
Thank you…