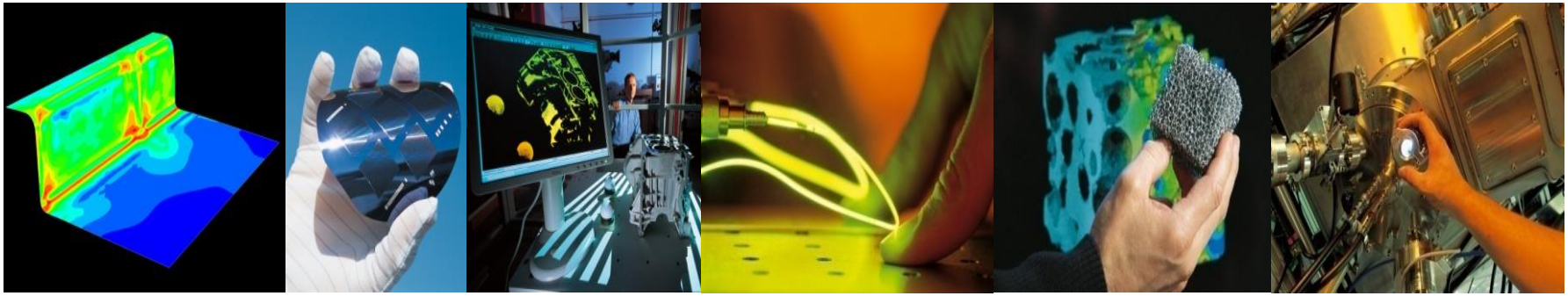
Fraunhofer Society Germany

Industry 4.0:
The Future Revolution of Productivity and Competitiveness

Fraunhofer IFF ASEAN Regional Office Bangkok
Ralf Opierzynski

Bangkok, September 2nd, 2015



Outline

Fraunhofer Society Germany – Introduction

Industry 4.0 - Definition, Scope, Priorities & Challenges

Fraunhofer Germany: R&D Portfolio / Solutions in the field of Industry 4.0

Success Stories Thailand: Center for Digital Engineering / CDE

Outlook

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Fraunhofer Profile in 2014

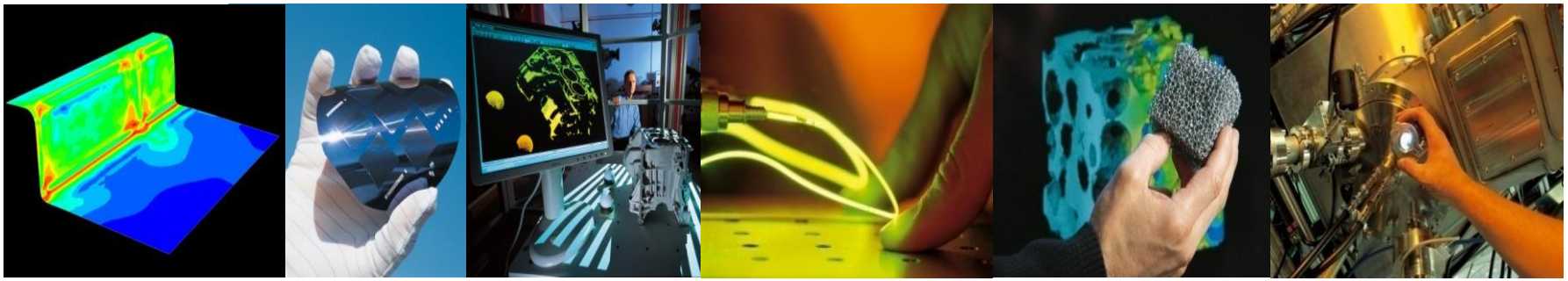
67 Institutes & independent Research Units

24 000 Employees

€ 2.2 Billion Research Budget

FhG - Alliances

- Microelectronic
- Production
- Information and Communication Technology
- Materials and Components
- Life Sciences
- Surface Technology and Photonics
- Defense and Security Research

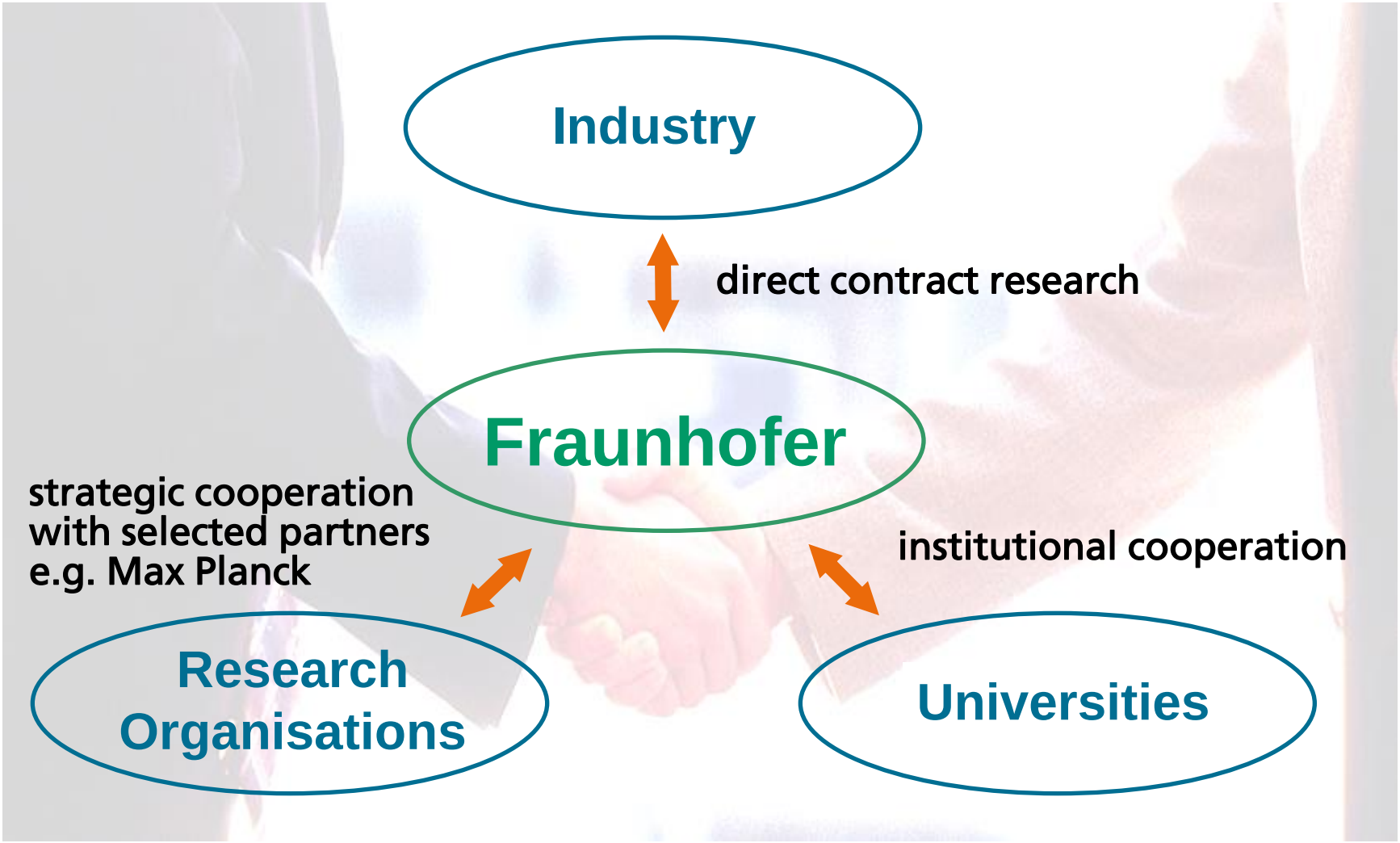


The economic benefit of Fraunhofer's work, an example:

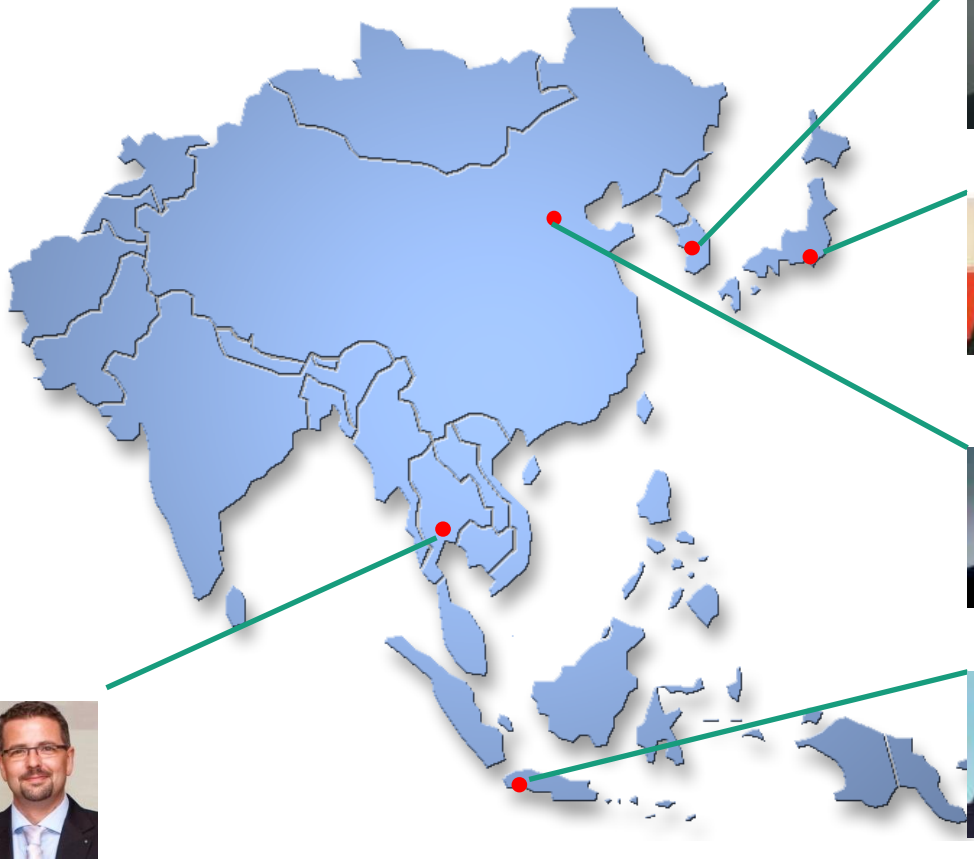
Economic benefit trough MP3
(Figures 2010)

- At least € 1,67 bill volume of sales/ turnover in Germany with MP3 devices, digital contents, equipment and audio devices with additional MP3 applications
- More than € 300 mill fiscal revenue per year
- At least 9.000 jobs in Germany in direct correlation through MP3
- Not taken into account:
  - Indirect benefit in the supplier chain and in the services
  - Indirect fiscal revenues and jobs!

Fraunhofer within the German Research Landscape



Fraunhofer Representative / Regional Offices in Asia



Fraunhofer Representative Office Korea
Mr. Joohwan Kim, Seoul

Fraunhofer Representative Office Japan
Dr. Lorenz Granrath, Tokyo

Fraunhofer Representative Office Beijing
Mr. Xiaoding Han

Fraunhofer Representative Office Indonesia
Dr. Ida-Bagus Kesawa Narayana

Fraunhofer IFF Regional Office ASEAN,
Bangkok, Thailand,
Mr. Ralf Opierzynski

Fraunhofer IFF Regional Office BKK

Rationale & Objectives

- Establishment of a regional R&D and transfer hub (technology, know-how)
- To foster existing and developing new partnerships between the Fraunhofer Institutes in the Fraunhofer-Gesellschaft (67 as of 2014) and leading-edge Asian partner organizations (e.g. TGGS, TGI, NSTDA, TISTR, KMUTT, GTCC, STI. MOST, SCG, IKRAM, KLIUC)
- Initiation and implementation of joint research cooperation and networks in innovative thematic fields (S&T priorities)
- Access to leading-edge German R&D and product development expertise

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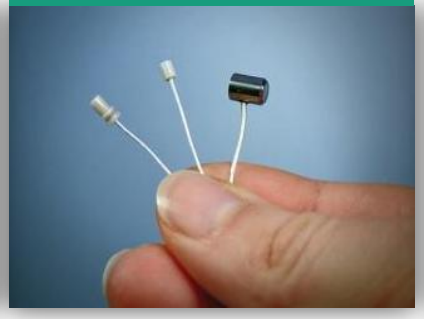
How does the Future will look like?

The future will be determined by several IT-Technology trends (Technology Push)

Calculation speed

Miniaturisation



Connectivity

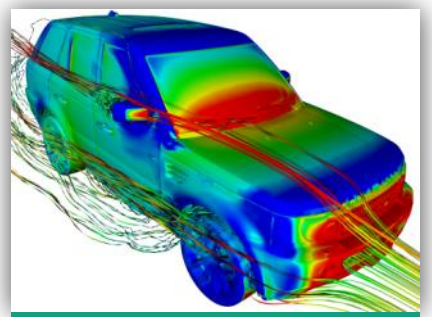
Storage

New Products, Services, Applications, Business Models

Identification

Geo-Information

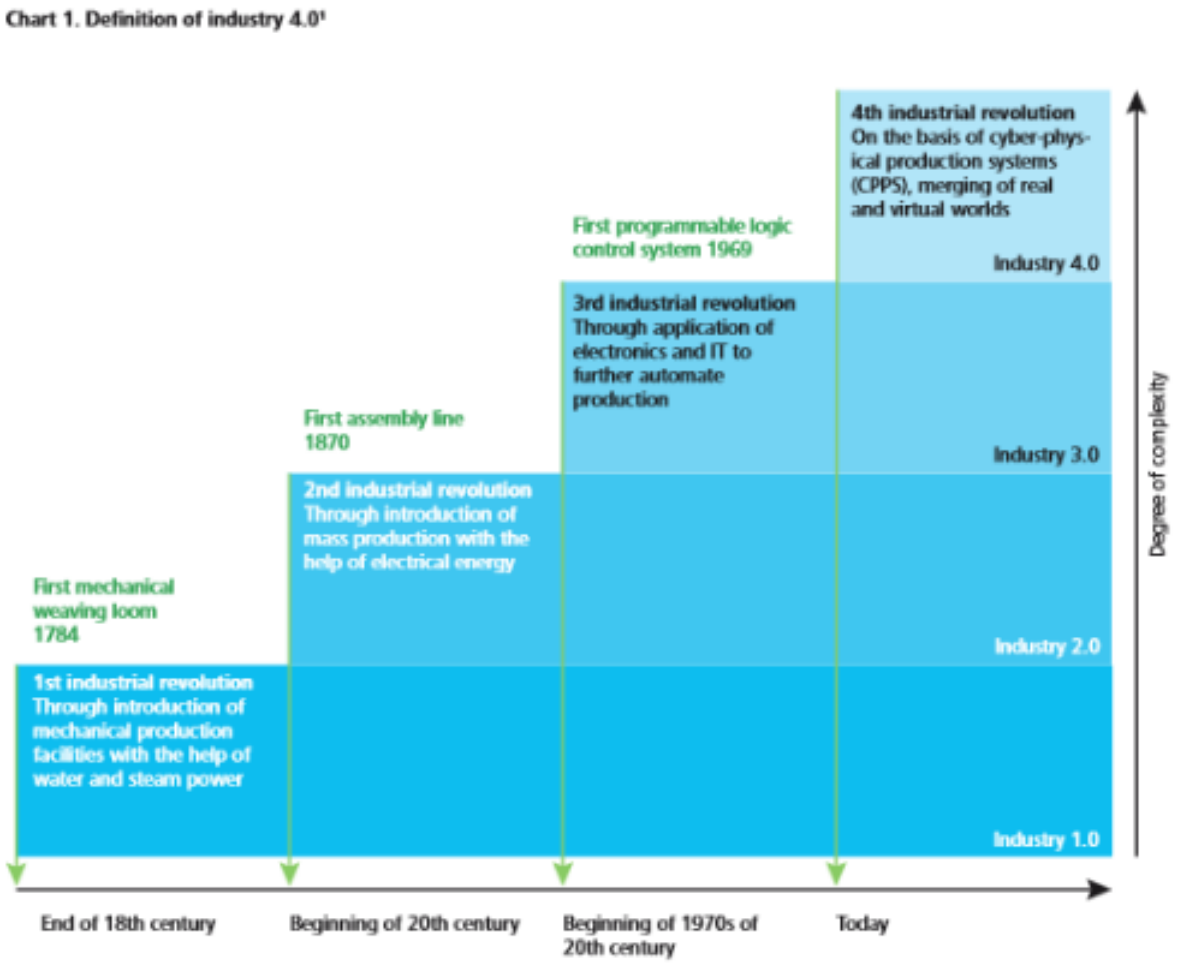
Robotics



Simulation

Bildquellen: Focus; KEM; medina IT SERVICES; taz; beobachter, telematik Dresden; globalstressengineers

Industry 4.0 – The 4th industrial Revolution



http://www2.deloitte.com/content/dam/Deloitte/ch/Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014.pdf

Industry 4.0 - Defintion

Smart industry or “INDUSTRY 4.0” refers to the technological evolution from embedded systems to **cyber-physical systems**. Put simply, INDUSTRY 4.0 represents the coming fourth industrial revolution on the way to an **Internet of Things, Data and Services.**

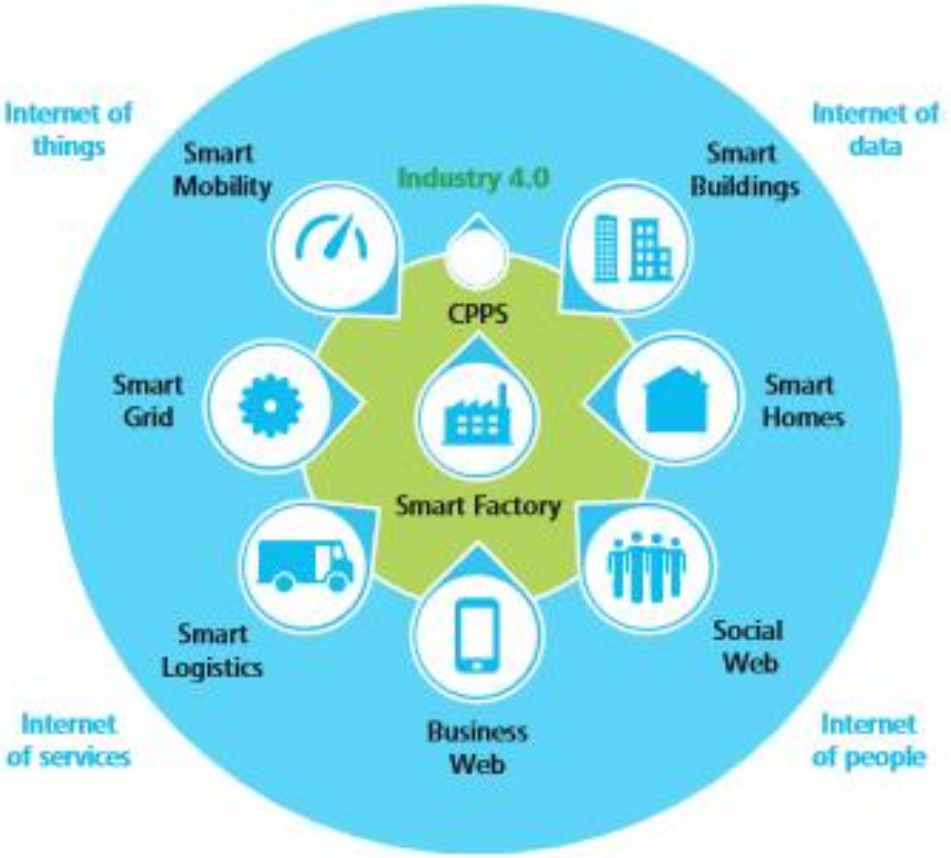
Decentralized intelligence helps **create intelligent object networking** and independent process management, with the **interaction of the real and virtual worlds** representing a crucial new aspect of the manufacturing and production process.

INDUSTRY 4.0 represents a paradigm **shift from “centralized” to “decentralized” production** - made possible by technological advances which constitute a reversal of conventional production process logic.

http://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Brochures/Industries/industrie4.0-smart-manufacturing-for-the-future-en.pdf

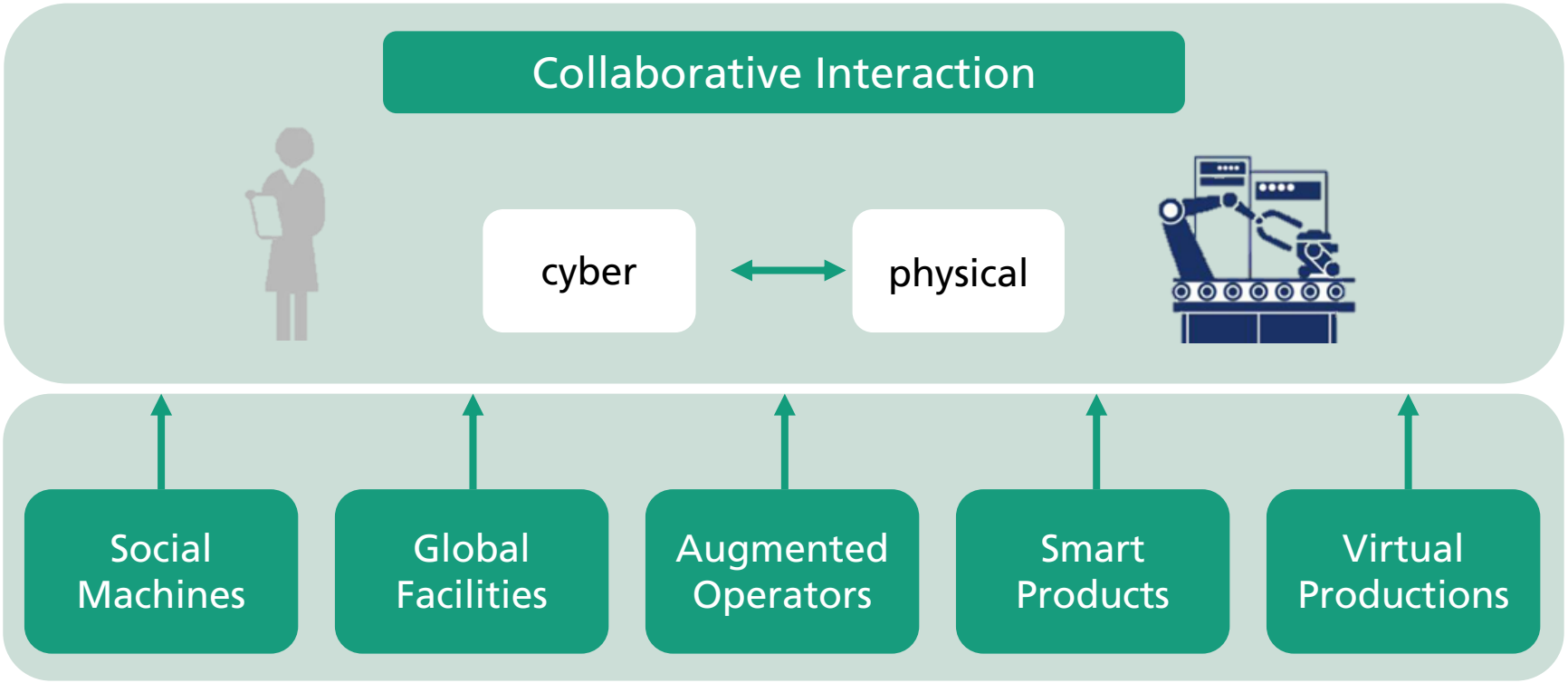
Industry 4.0 Environment

Chart 2. The industry 4.0 environment[2]



http://www2.deloitte.com/content/dam/Deloitte/ch/Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014.pdf

Industry 4.0
Elements of a Smart Factory



Quelle: Kagermann, Henning: Impuls – Zukunftsbild Industrie 4.0. 2013

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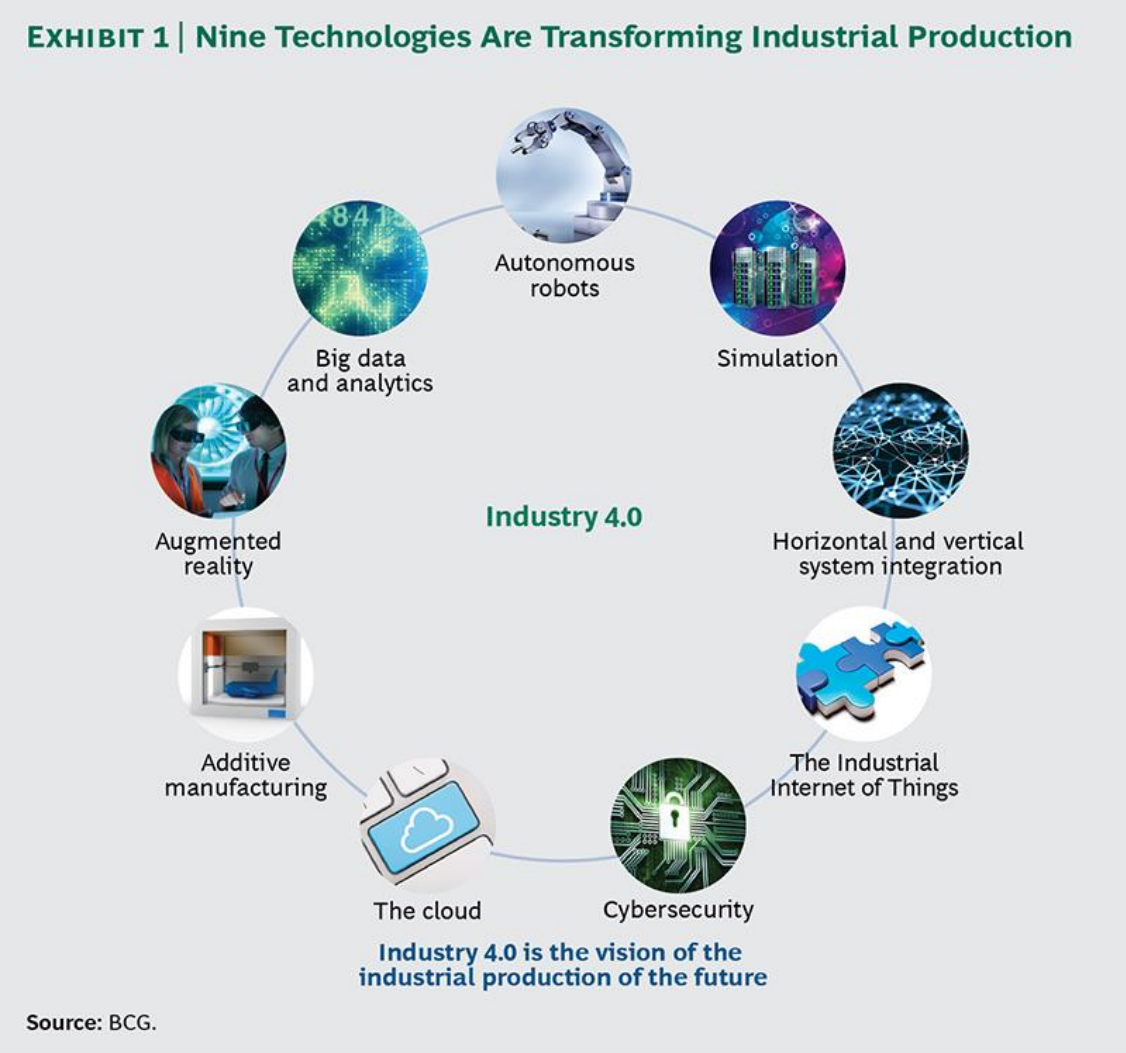
Industry 4.0 – Core Priorities



https://www.bcgperspectives.com/content/articles/engineered_products_project_business_industry_40_future_productivity_growth_manufacturing_industries/

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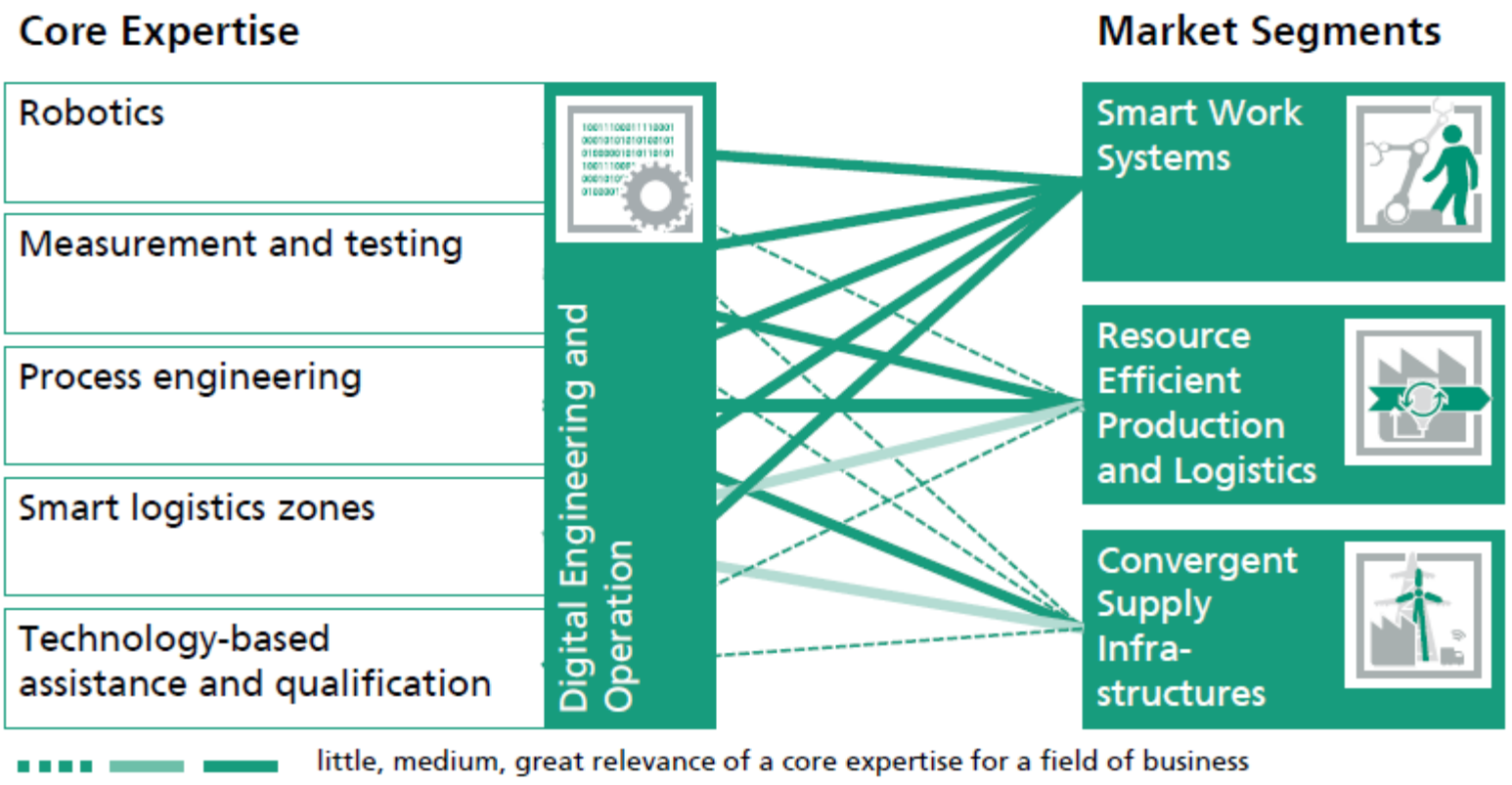
Fraunhofer Institute for Factory Operation and Automation (IFF) Magdeburg Germany

Industry 4.0 Portfolio

Fraunhofer IFF Magdeburg, Germany – Structure / Expertise

Core Expertise

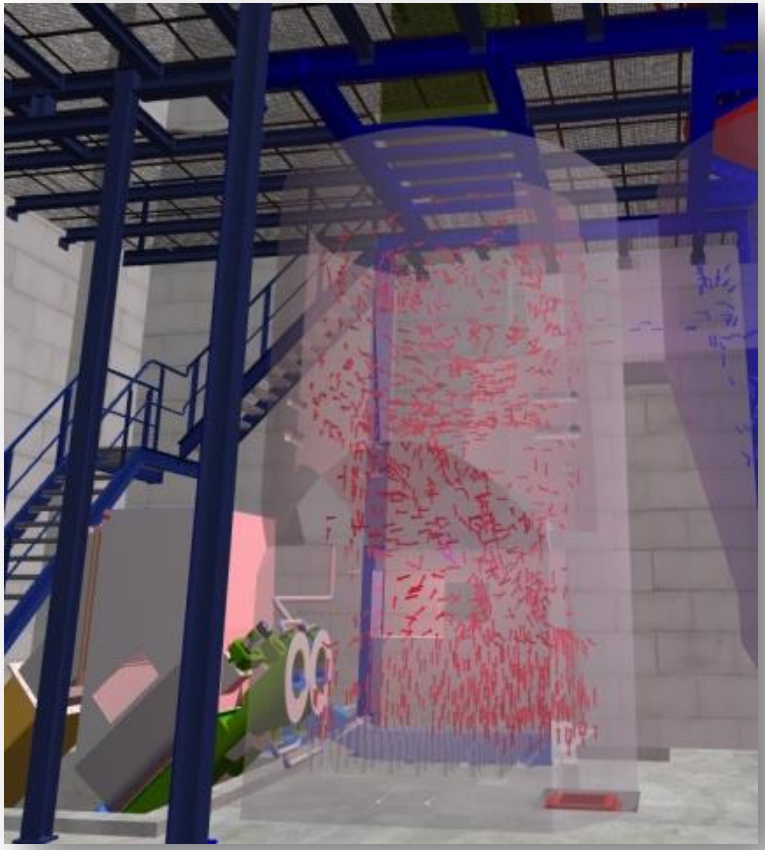
A Technology Partner by Pooling Core Expertise



The VDTC specializes in digital engineering and process and plant engineering. Our experts develop customized solutions for the engineering, testing and operation of technical systems.

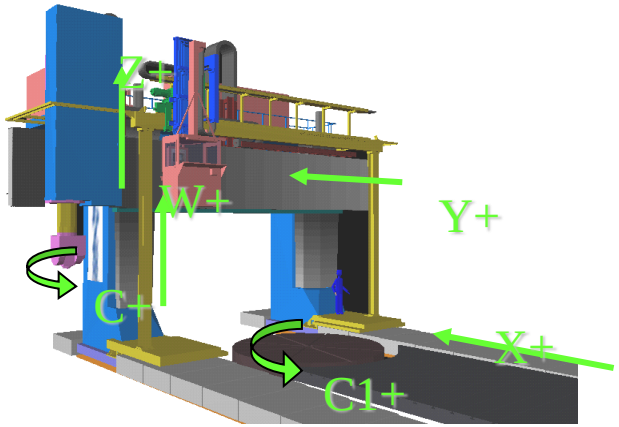
Example Industrial Safety
Risk analysis using the virtual model:

- Interactive analysis of concrete risks
  - More intensive training
    - Better learning results of
      - Individuals and
      - teams
  - Training of unexperienced workers for daily routine situations
  - Learning success control
    - Tasks from the working process



Virtual Commission of a Tooling Machine (Testing and Training)

- Coupling of a real CNC an operator device with the virtual model of the machine
- Interactive Visualization of a machine's operation
- Reproduction of NC axes, travel paths, machining heads and tools



Benefits

- CNC programs can be tested on a virtual model
- Operators can be trained before the real machine is finished
- VR technologies to commission new machinery saves approximately 20 % of the time

Training of Maintenance Staff on a High-Voltage Transformator

- Qualification of technical Staff:
  - Industrial safety
  - Inspection, servicing
  - repair
  - Working processes
- Aim and benefit:
  - Corporate Knowledge Transfer based on standardized Virtual Reality based Training Platform

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„Virtual Industrial Park“

Concept in Brief

Functionalities and Benefits

- A Virtual Industrial Park Model provides a realistic impression of existing and planned structures
- Interactive functions: information retrieval, investment simulation and planning scenario in real time
- Link modules to external / real estate data bases give full access to hard facts and park information
- Logistics simulation tool-set ensures the generation of optimized scenarios tailored to the individual needs
- Dynamic energy management concepts - virtual power plants: visualization of energy demand and supply relationships, energy flows, energy supply systems, cluster solutions

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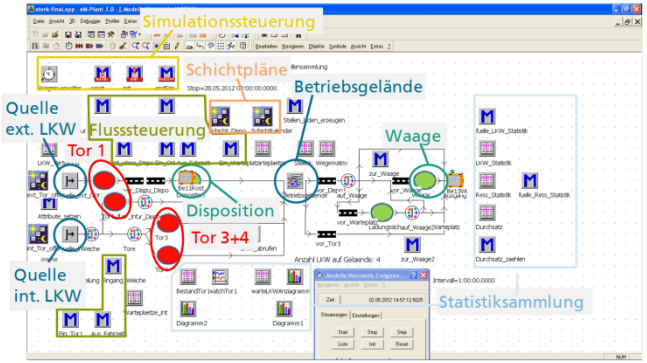
Dynamic Virtual Industrial Park Models

Logistics Process Simulation – Results & Benefits



- Discrete event driven simulation → high level of detail
- Detection / Determination of various KPIs
  - Process time
  - Degree of efficiency
  - Throughput / processing time
  - Waiting times
  - Resource demand and utilization
- Analysis of inefficiencies
  - Identification of potentials for optimization (e.g. enhancing sequence and logistics processes flow)
  - Traffic, transport, storage
  - Usage of resources and infrastructures → road planning and traffic management

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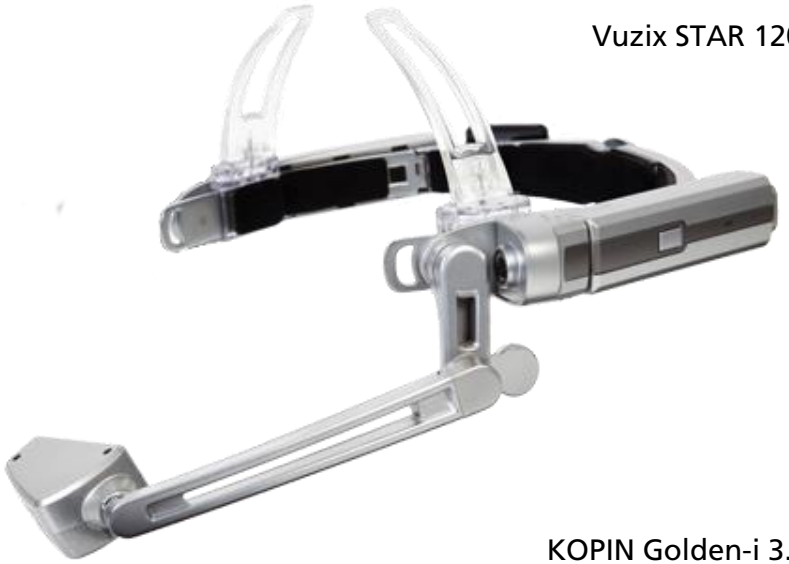
Mobile Assistance Applications / Augmented Reality

- Objective: Accurate Instructions during the Assembly Process
  - Instructions
  - Best-Practice
  - Visualization of Procedures
  - Hand-Free
- Head-Mounted-Displays (HMD)
  - Semi-transparent Display
  - Interaktion – Voice / Gesture

Vuzix STAR 1200XLD



KOPIN Golden-i 3.8

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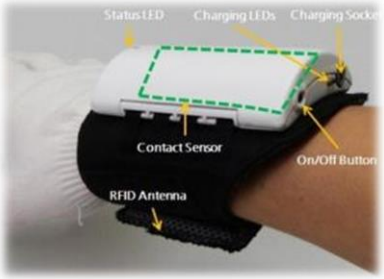
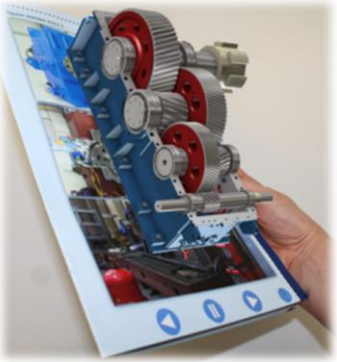
Industry 4.0 - IT in Logistics

Machine to Machine Interface

Heute:
Elektronik-frei





AR-Assistence

Handsfree-Control

Control by Gestures

Fotos: Fraunhofer IFF und Treston

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Fraunhofer Institute for Open Communication Systems (FOKUS) Berlin Germany

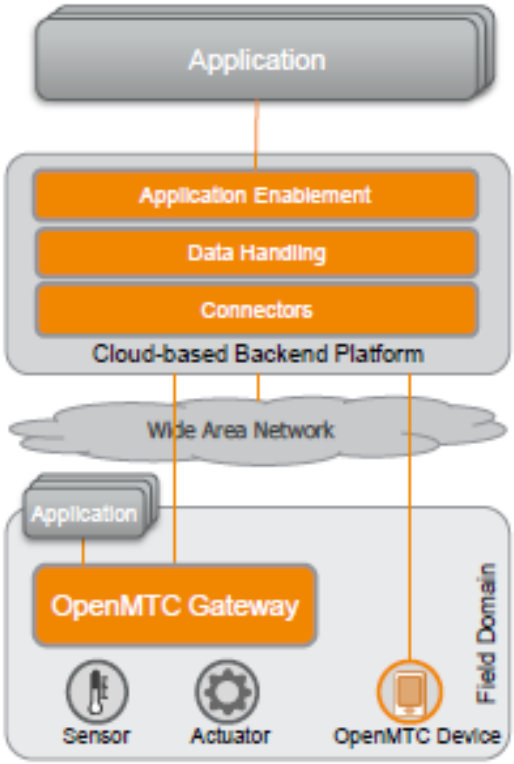
Industry 4.0 Portfolio

Open Machine-Type Communication Platform (OpenMTC)

open mtc

Comprehensive M2M platform

- **Enable the academia and industry to**
  - Develop and validate domain-specific M2M/IoT applications and service.
  - Integrate various machine devices with operator networks.
- **Comprehensive M2M/IoT deployment**
  - Over managed or unmanaged core.
- **Intermediary layer**
  - Between multiple managed domains.
  - Service platforms, the operator network, and devices.
- **Aligned with ETSI, oneM2M and OMA spec**
  - Extensible to specific research needs.
  - Configurable & high performance.
- More Information: www.openMTC.org



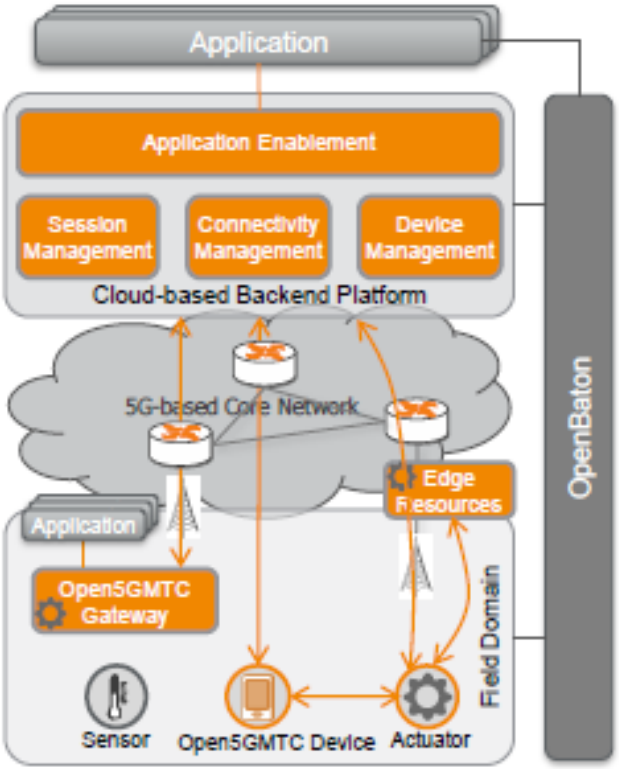
Fraunhofer FOKUS

Open5GMTC – Machine-Type Communication over 5G

open5GMTC

High scalable M2M/IoT Control Platform over 5G

- Enable the academia and industry to
  - Develop and validate domain-specific M2M/IoT applications and services over 5G core
  - Address Integrate various machine devices with operator networks
- Scalable M2M/IoT deployment
  - For serving hug number of devices
  - Connecting with different QoS requirements
- Distributed data processing
  - Between multiple managed domains
  - Cloud vs. edge computing
- Aligned with international standards
  - Extensible to specific research needs
  - Configurable & high performance
- More Information: www.open5gmtc.org



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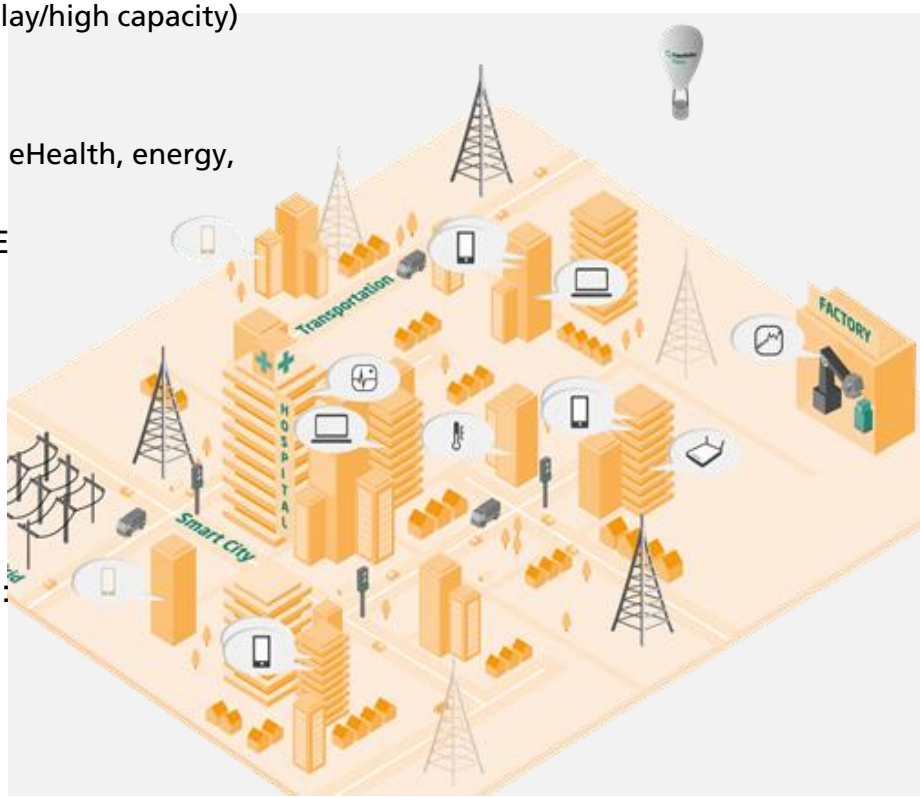
5G Core

Pre-standard Research & Test bed for the 5G ecosystem

- 5G ecosystem aims to provide the next wireless system beyond LTE/EPC
  - More efficient communication for the subscribers (low delay/high capacity)
  - Providing the users a means to control their environment (automation/reliability)
  - Providing communication for other markets (Industry 4.0, eHealth, energy, critical)
- Fraunhofer FOKUS is developing the NON-OPEN SOURCE Open5GCore toolkit enabling R&D in the fields of:
  - 5G Radio Support
  - Convergence with LTE, Wi-Fi, Fixed and Satellite
  - Intelligent network management
  - Virtualization and softwarization
  - Devices and applications
- Open5GCore is a pre-standard software implementation:
  - Addressing 3GPP, ETSI NFV, IETF, ONF standards
  - Designed for the specific R&D needs



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Center for Digital Engineering / SEAR DE Thailand

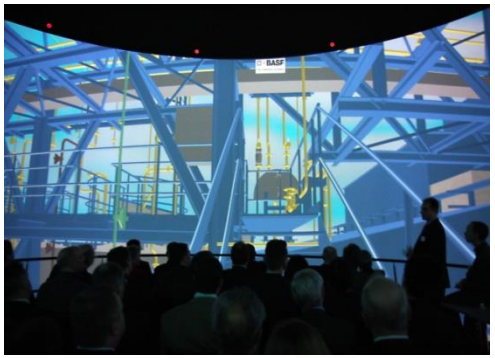
Project Kick-off Meeting: June 2013 / Bangkok
(Duration: 2013 – 2017)

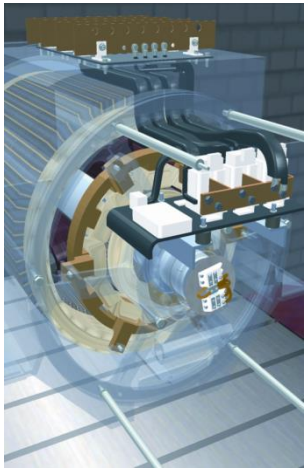
The primary objective of the project “SEAR DE” is the establishment of a sustainable, collaborative partnership between Germany and Thailand in the field of digital engineering. To this end, three key priorities are being pursued:

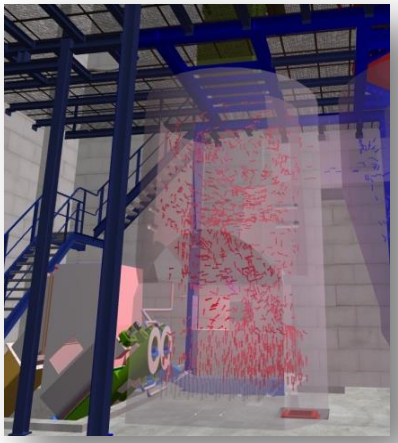
- Technology transfer: institutionalization/establishment of a national center of excellence in digital engineering in Thailand,
- Sustainable transfer of expertise by collaborating on qualification and education and
- Initiation and completion of bilateral research and development projects with the involvement of industry partners.

CDE – Potential Applications

- Virtual Engineering
- Product Development
- Process Optimization
- Vocational Education
- Smart Estates
- City / Urban Planning
- Infrastructure Planning







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Recommendations: Public-Private-Partnerships

PRESS RELEASE

2015-3-16

Launch of the Industry 4.0 platform

Federal Minister Sigmar Gabriel on a tour around CeBIT

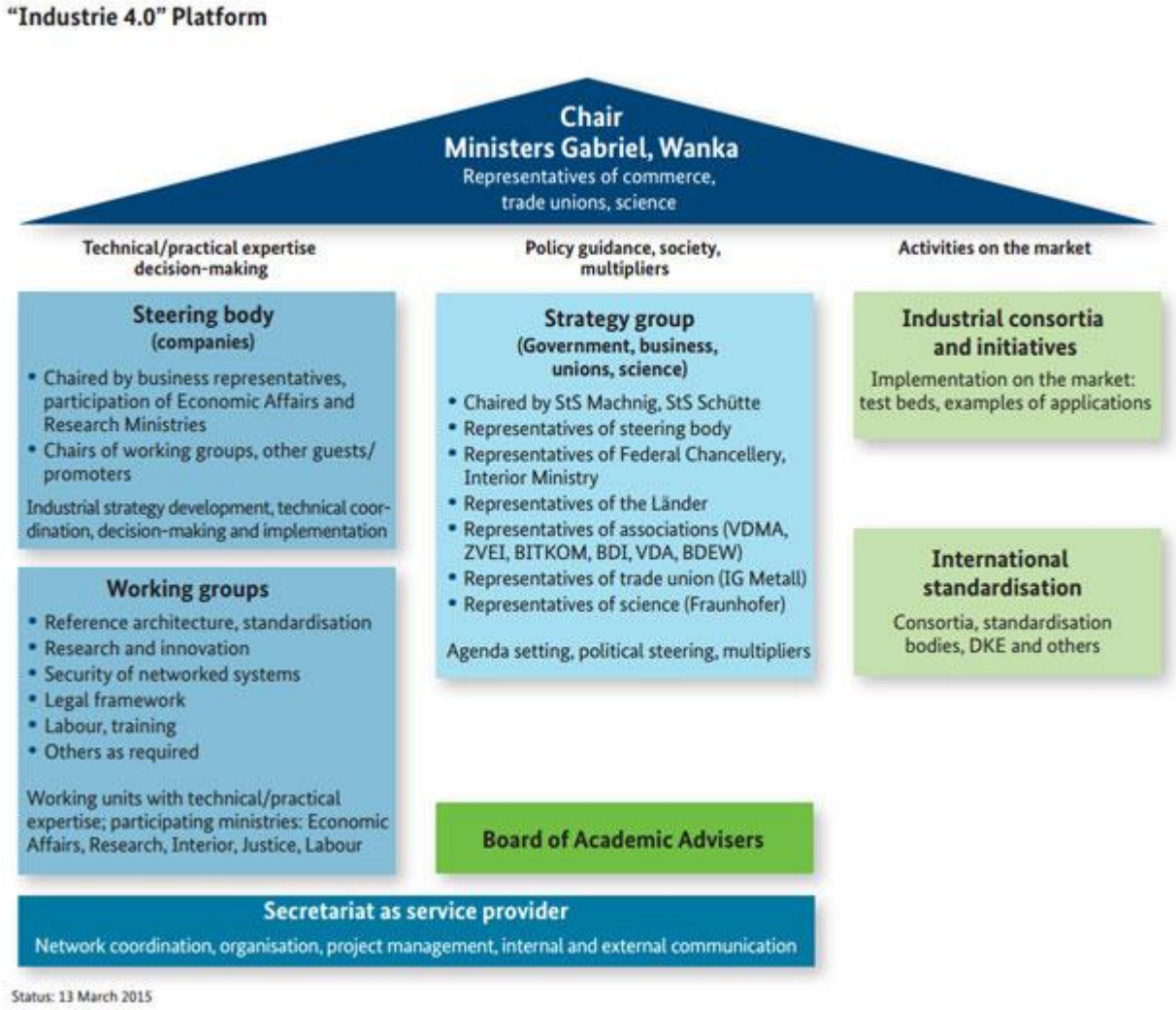
© BMWi

Federal Minister for Economic Affairs and Energy Sigmar Gabriel and Federal Minister of Education and Research Johanna Wanka today joined together to launch the Industry 4.0 platform and to assume leadership of the initiative.

Based on the successful work of the Industry 4.0 business association platform operated by the German Engineering Federation (VDMA), the German Electrical and Electronic Manufacturers' Association (ZVEI), and the Federal Association for Information Technology, Telecommunications and New Media (BITKOM), the platform has now placed the topic of Industry 4.0 on a broader political footing and has itself also undergone a thematic and structural overhaul. New areas, such as networked systems security, legal conditions, work/education and training require business, science, government, and society to all work together.

http://www.bmwi.de/EN/Press/press-releases,did=697920.html

Industry 4.0 Platform - Germany



http://www.bmwi.de/EN/Topics/Economy/Industrial-policy/industrie-4-0,did=708234.html

Industry 4.0 Transformation Process – Priorities:

More efficient Usage of Data
(entire supply chain, product life cycle, predictive maintenance, etc.)

Human Resource Development / Qualification
(new qualification profiles / Requirements / skills, digitalization, BigData, etc.)

Access to Customers
(identification of strategic interfaces, etc.)

Getting faster
(shorter innovation cycles, „Two-speed IT“, etc.)

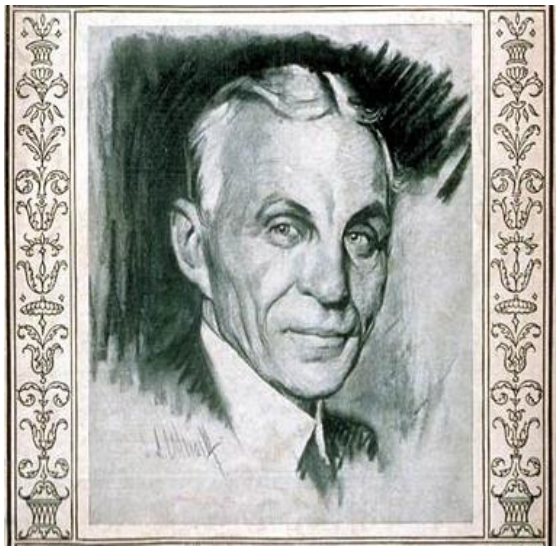
Data Security
(prevention of cyber attacks, etc.)

http://www.mckinsey.de/mckinsey-studie-zu-industrie-40-deutsche-unternehmen-trotz-wachsender-konkurrenz-zuversichtlich

Coming together is a beginning,

keeping together is progress,

working together is success.



Henry Ford

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Co-ordination and Management of the Activities in the ASEAN-Region

by the
Fraunhofer IFF Regional Office ASEAN, Bangkok, Thailand

- References
- Reputation (IFF / FhG)
- Continuity
- Reliability

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