RUHR-UNIVERSITÄT BOCHUM

European Academy for Industrial Management (AIM)

Advances in Industrial cyber-physical systems

THE HUMAN ROLE IN CYBER-PHYSICAL SYSTEMS

Chair of Production Systems

Prof. Dr.-Ing. Horst Meier

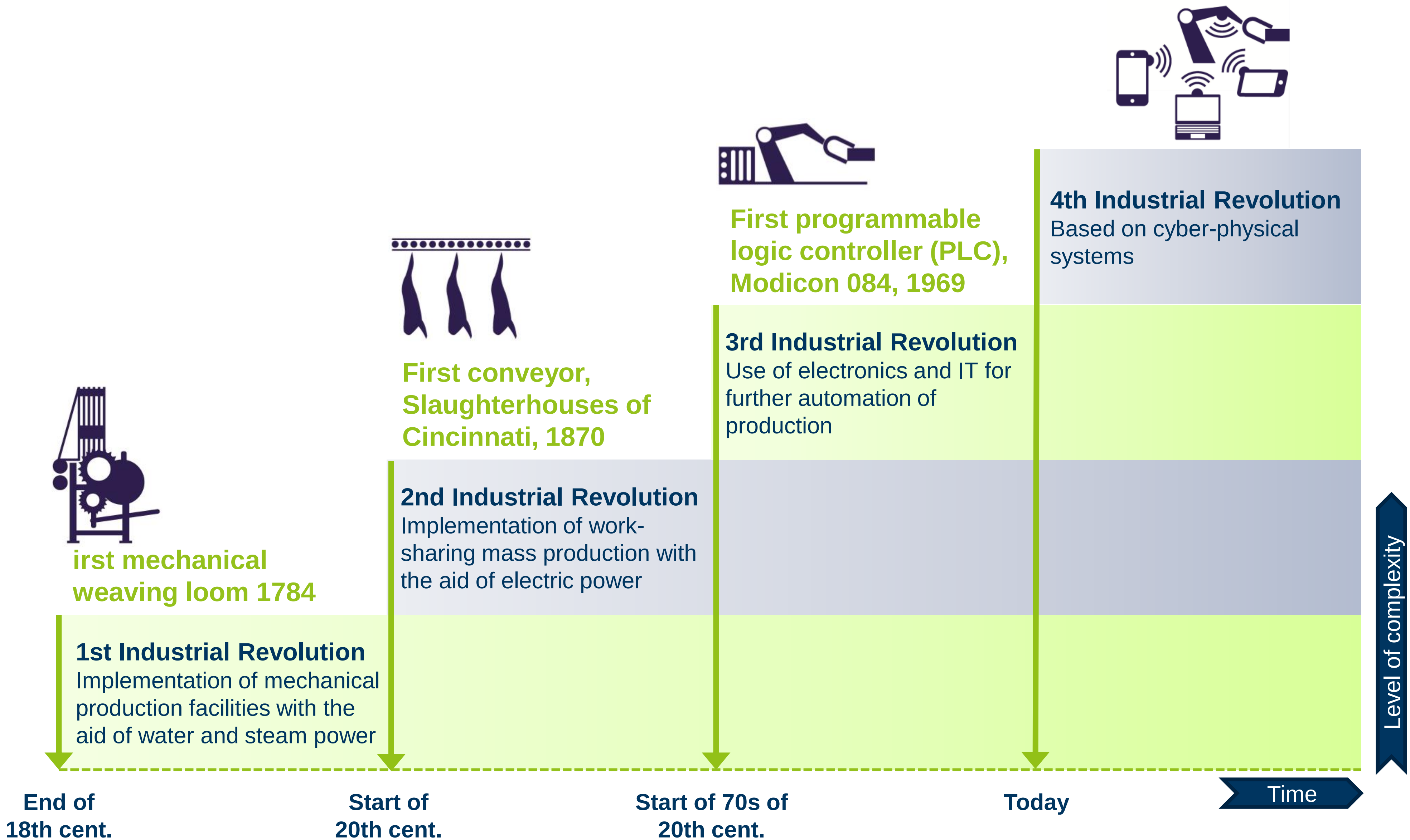
Agenda

THE HUMAN ROLE IN CYBER-PHYSICAL SYSTEMS

1. Industry 4.0
2. APPsist Project
3. Learning Factory
4. Conclusion

The 4th Industrial Revolution

LEHRSTUHL FÜR PRODUKTIONSSYSTEME



Kagermann et al. (2013), S.17

Definitions

LPS LEHRSTUHL FÜR PRODUKTIONSSYSTEME

Industry 4.0

Crosslinking of cyber-physical systems (CPS) and integration into production and logistics (KAGERMANN et al. 2013).

cyber-physical systems (CPS) – Industry 4.0

Crosslinking of the physical world (actuators, sensors, etc.) and the cyber world (net-based services, that interpret data and trigger processes in physical world) (GEISBERGER & BROY 2012).

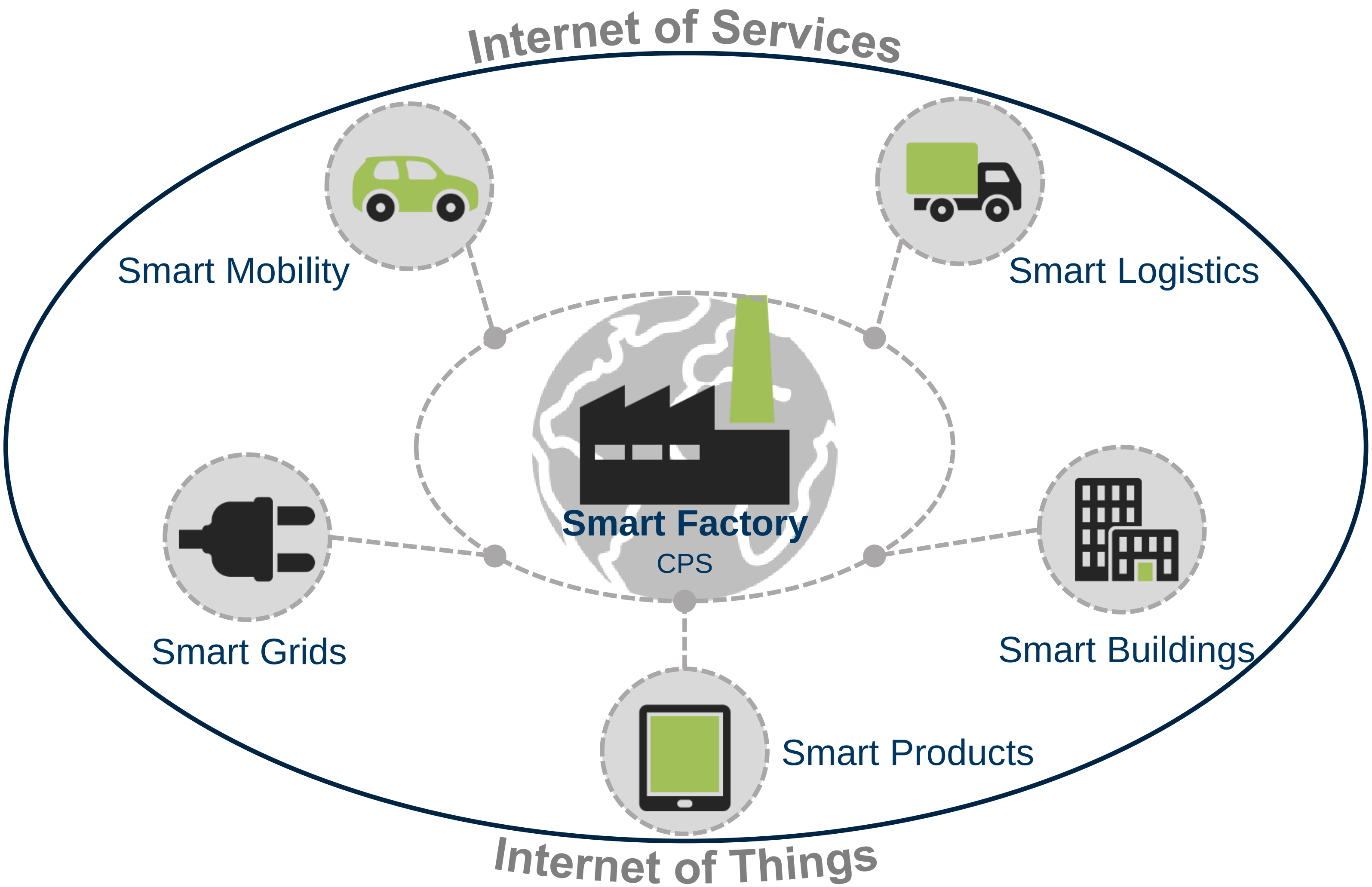
cyber-physical production systems (CPPS)

Decomposition of the automation pyramid to decentralized systems, where information is available everywhere and any time (VDI/VDE 2013).

Smart Factory

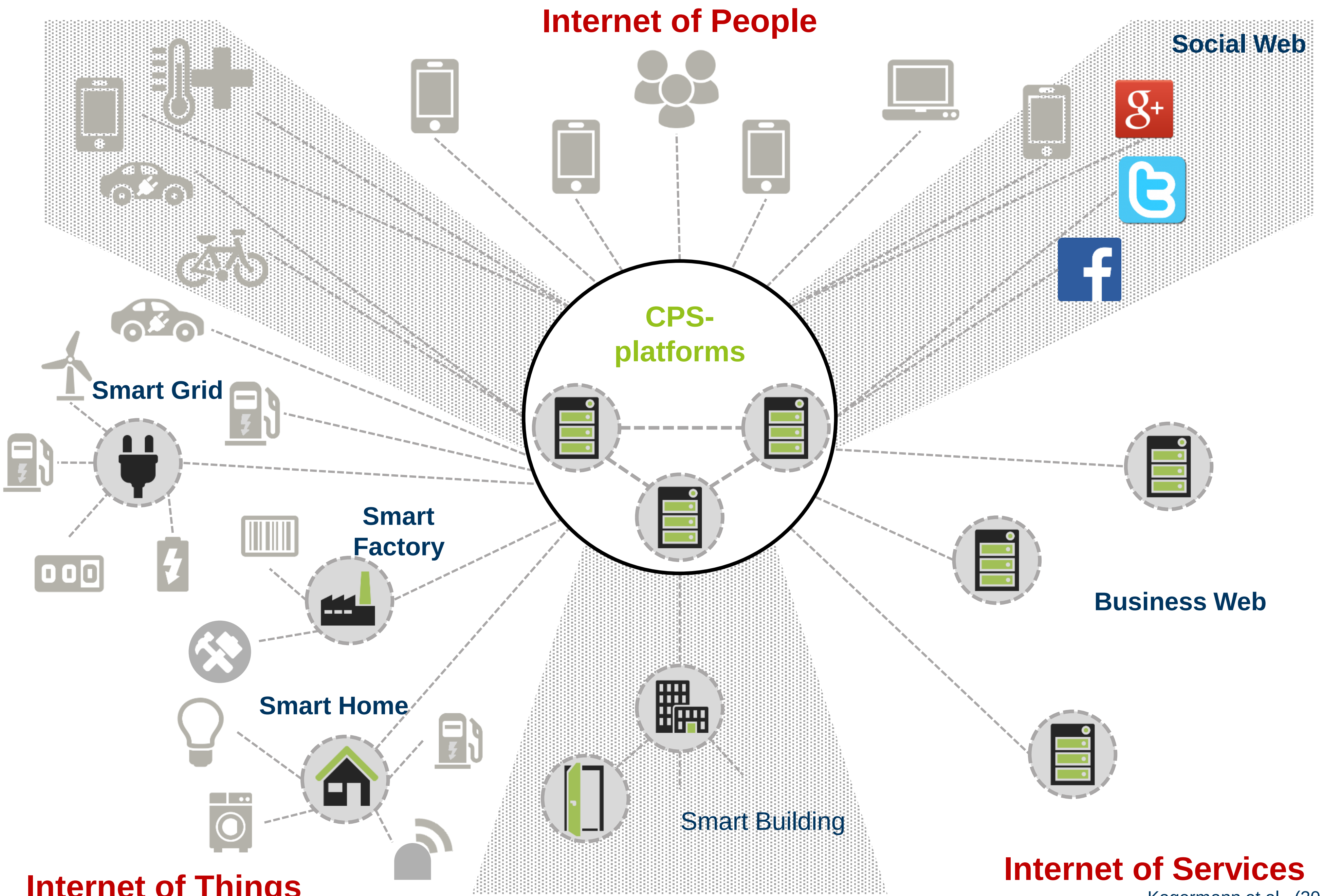
Crosslinking of machines and equipment as well as intelligent products, which can be clearly identified and located and which will “find their way through the production“ (KAGERMANN et al. 2013).

Smart Factory and intelligent infrastructure



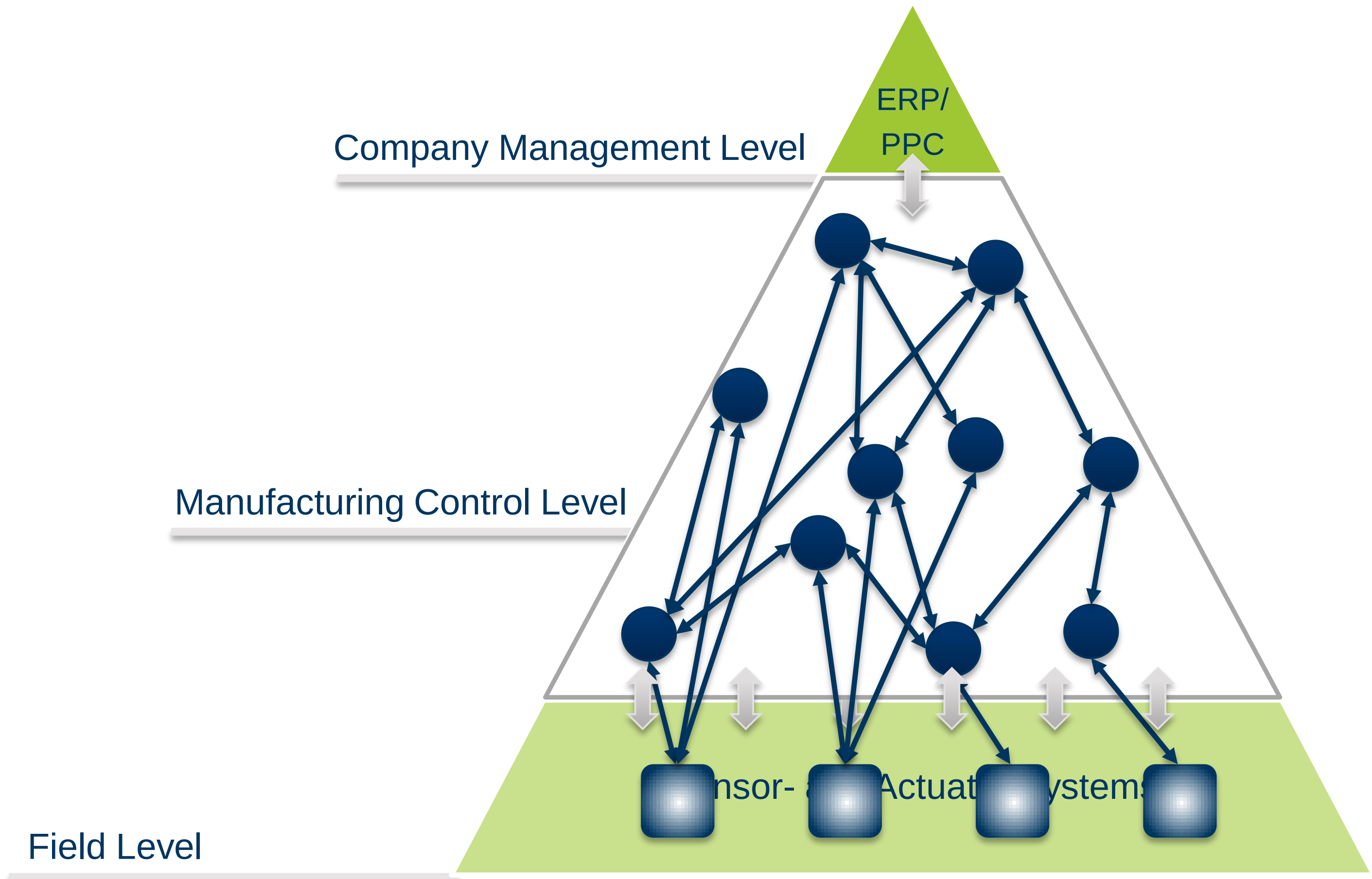
Kagermann et al. (2013)

Industry 4.0 – „Internet of Evertything“



Kagermann et al. (2013)

Automation Pyramid

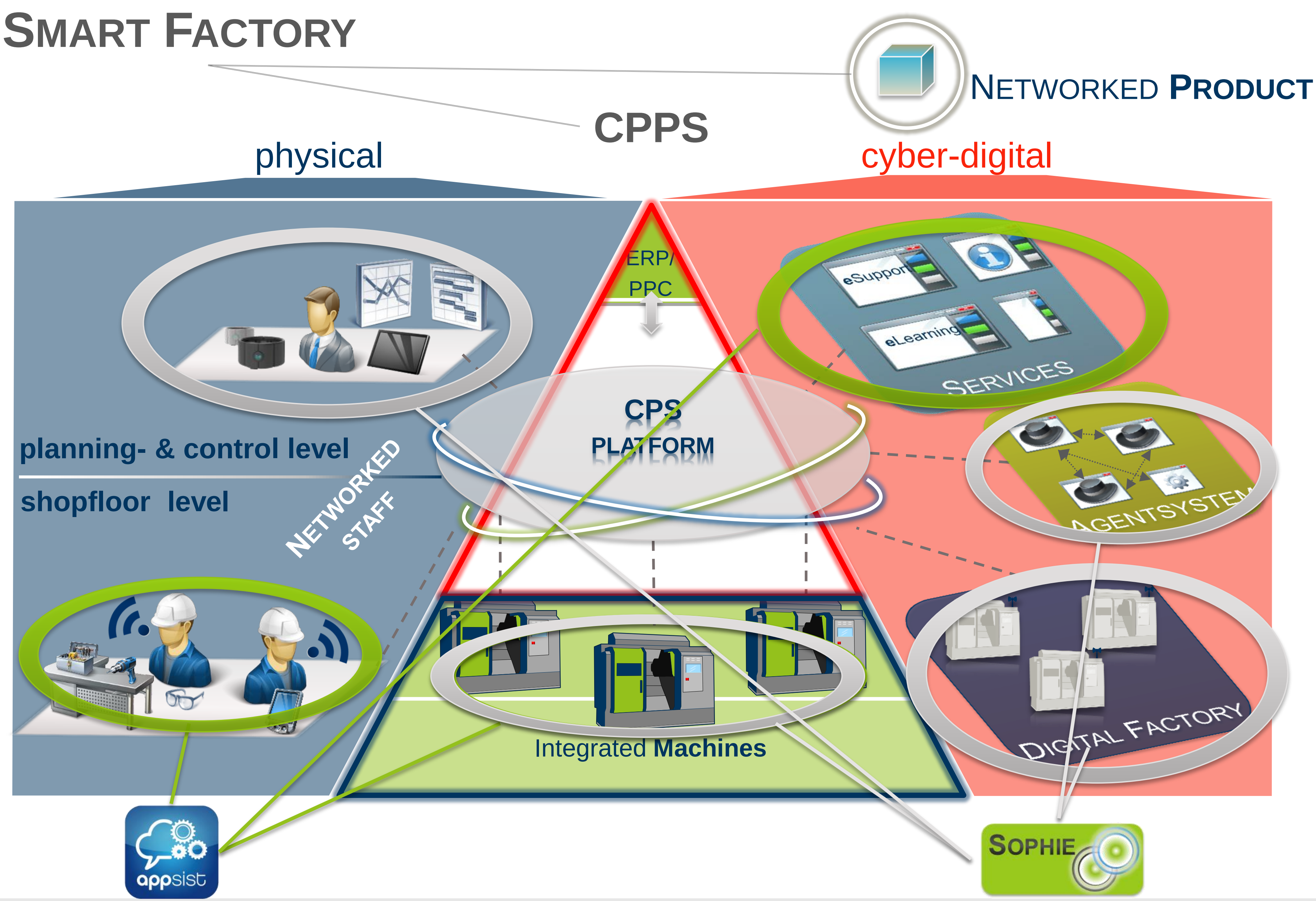


Hierarchically built-up automation pyramid

Local nodes as CPS-network

Own representation based on (VDI/VDE, 2013) (Günther & Ten Hompel, 2010)

Physical and cyber level of CPPS



Industry 4.0 = CIM 2.0?

LEHRSTUHL FÜR PRODUKTIONSSYSTEME

CIM

Main idea:
- holistic consideration of a company‘s value creation processes and support by integrated IT-systems
- continuous computer-aided information processing, based on an interdepartmental data base (CAD/CAM; flexible manufacturing systems).

Goal: unmanned factory

Human Role: planning and monitoring

“The perspective of a completely automated and unmanned factory cannot represent a realistic perspective because of technological and economical reasons.“
[Prof. Dr. Hirsch-Kreinsen]

Industry 4.0

New enablers: Internet technology, data collection storage and processing

Technical innovations shall not be considered isolated. A more integrated view of technical, organizational and personal aspects has to be considered as a socio technical system.

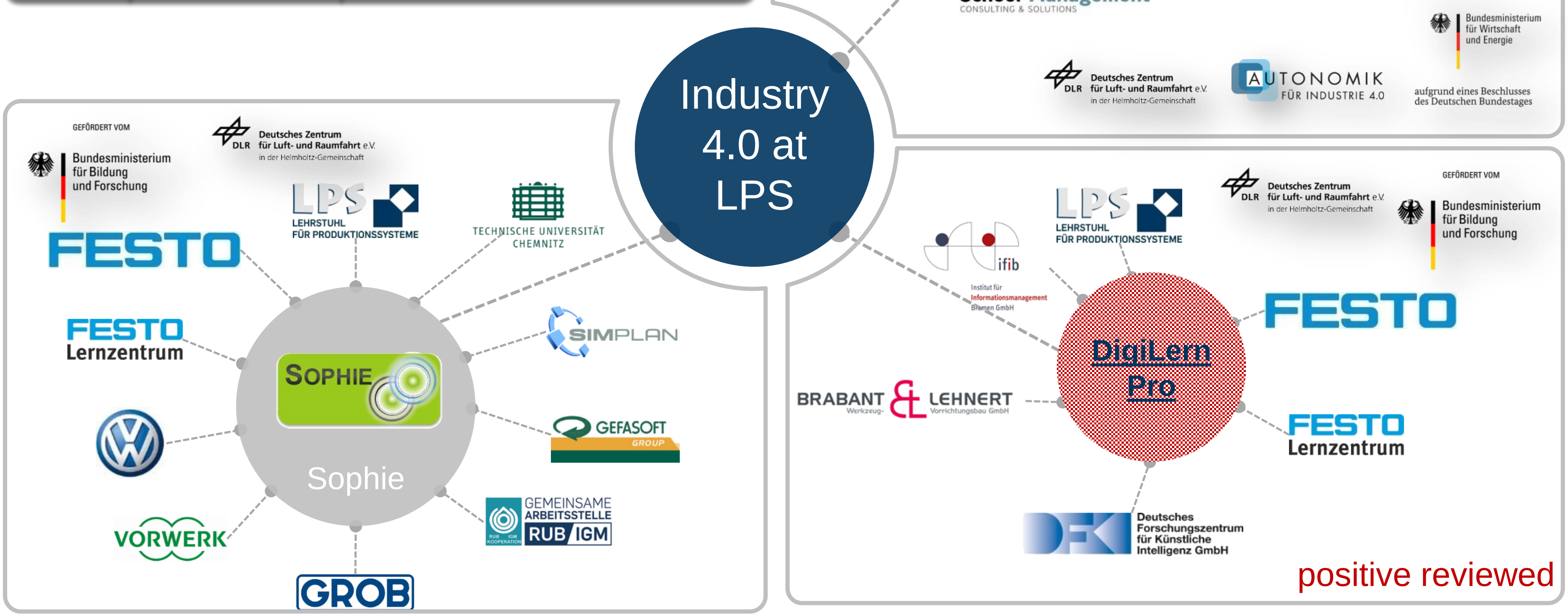
The human role within the production is still very important!

Industry 4.0 research projects at the LPS

DigiLernPro

Digital Media in Professional Education

- Development of semi-automated learning scenarios, that allow new forms of learning at the workplace.
- Sustainable competence development for staff by "Learning on the job" and „Learning near the job".



RUHR-UNIVERSITÄT BOCHUM

RUB

Research Project
APP^SIST

INTELLIGENT KNOWLEDGE SERVICES FOR THE SMART PRODUCTION

appsist

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

Betreut von:

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

Bestandteil des Zukunftsprojektes:

AUTONOMIK FÜR INDUSTRIE 4.0

project consortium

application & validation

provider
- MBB Fertigungstechnik
- FESTO

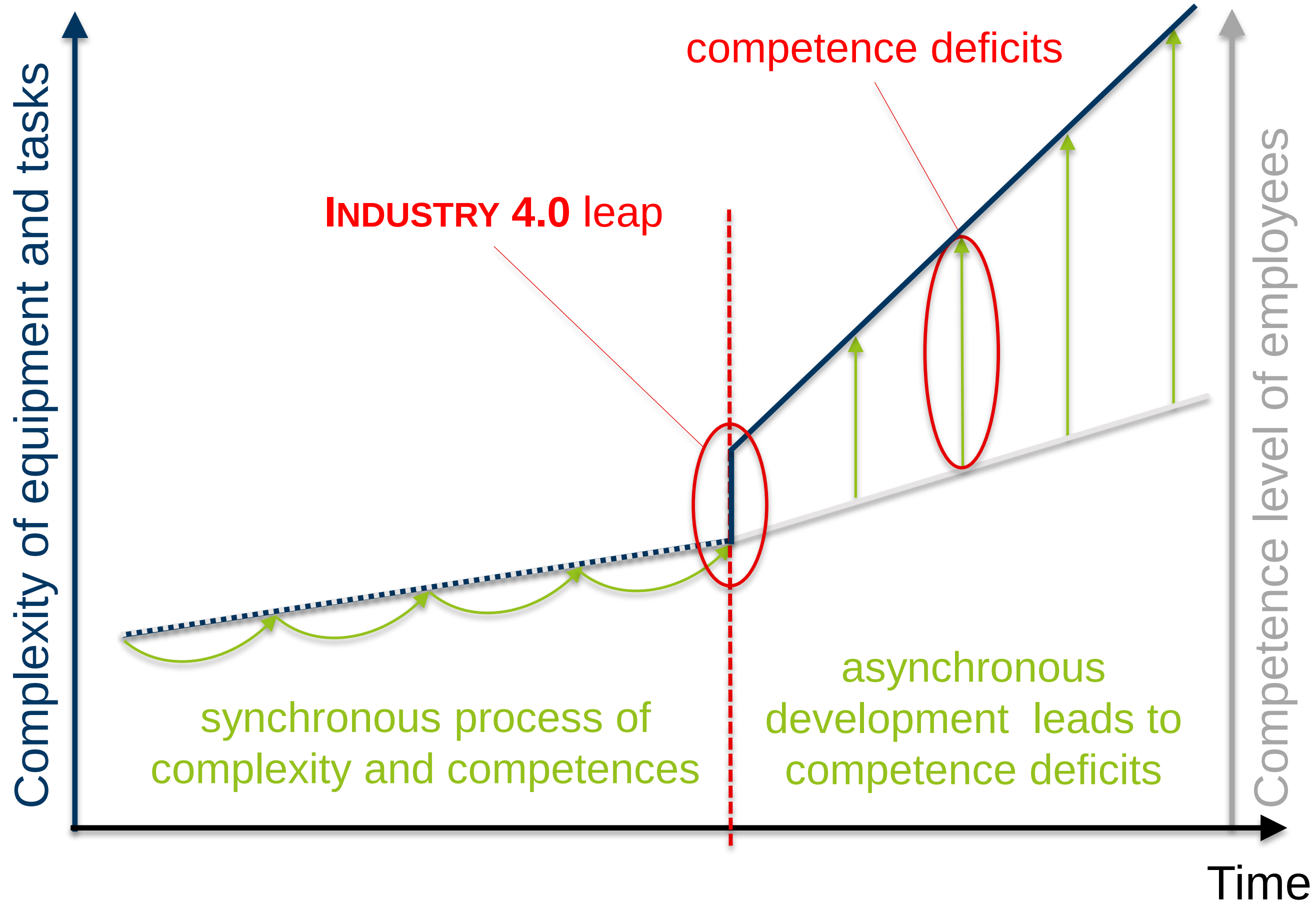
operator
- FESTO
- Brabant & Lehnert Werkzeug- Vorrichtungsbau GmbH

research & development
- LPS Lehrstuhl für Produktionssysteme
- RUB IGM Kooperation
- DFKI Deutsches Forschungszentrum für Künstliche Intelligenz GmbH
- Fraunhofer IAO
- FESTO Lernzentrum
- imc

consulting *
- DIN Deutsches Institut für Normung
- Scheer Management Consulting & Solutions
- acatech Deutsche Akademie der Technikwissenschaften
- IG M

*** subcontracted partners**

Motivation

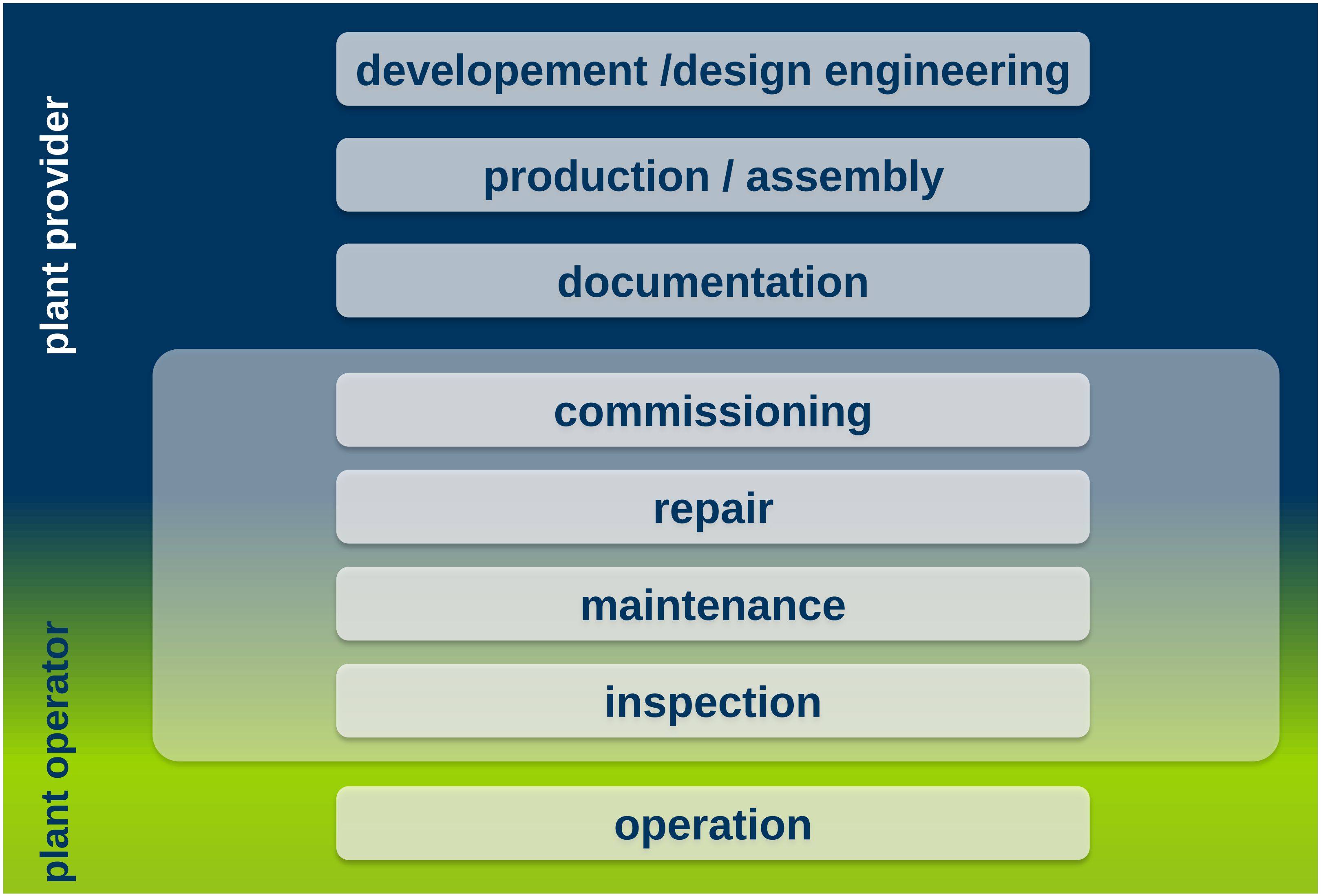


Increasing complexity of plants, as a result of the use of flexible automation-systems within the production by using cyber-physical systems

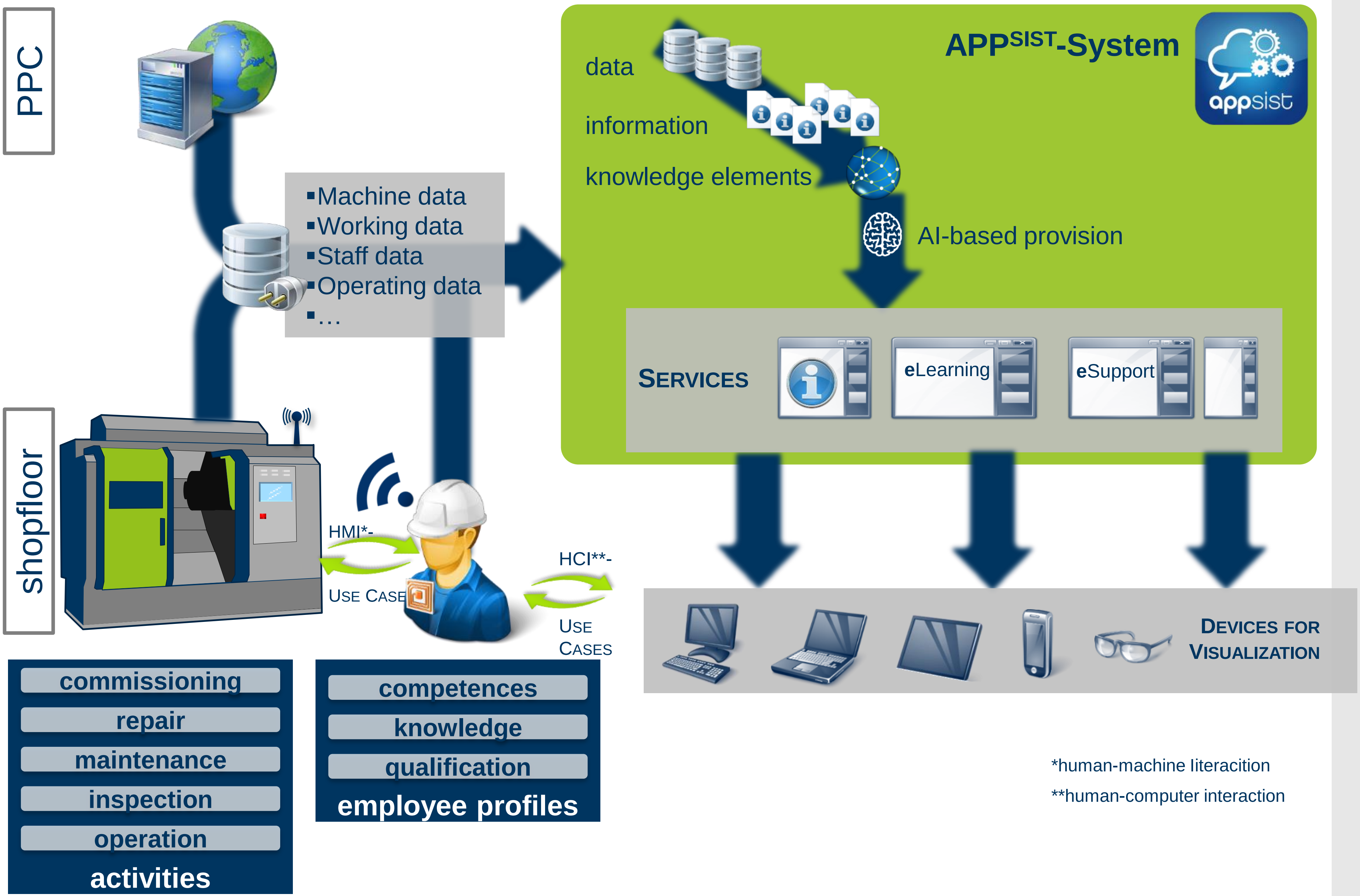
The ability to manage these activities by staff does not increase simultaneously

Accruement of competence deficits, which are to be balanced by an appropriate assistance-system!

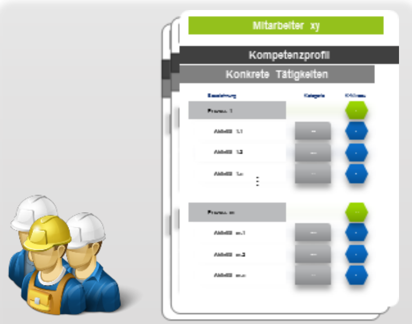
Competence deficits



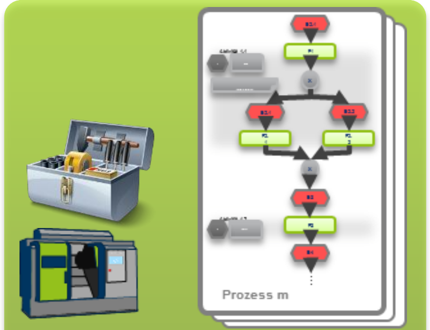
Goals of the project



Concept of Assistance



EMLOYEE PROFILES

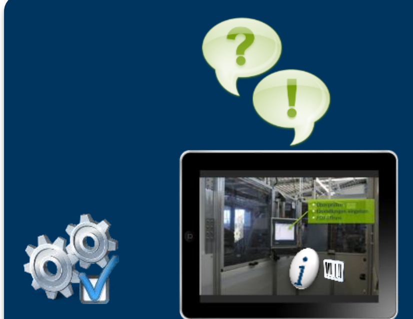


PROCESSES/ ACITIVITIES

CROSSLINKING/ HARDWARE

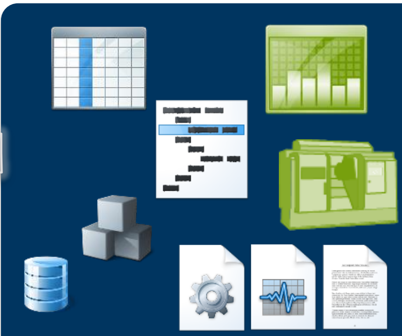
- Ethernet
- APPsist System
- PLC
- DB
- PC
- Server

- CPPS (Industry 4.0)



SUPPORT

- Context- and und competence-specific support

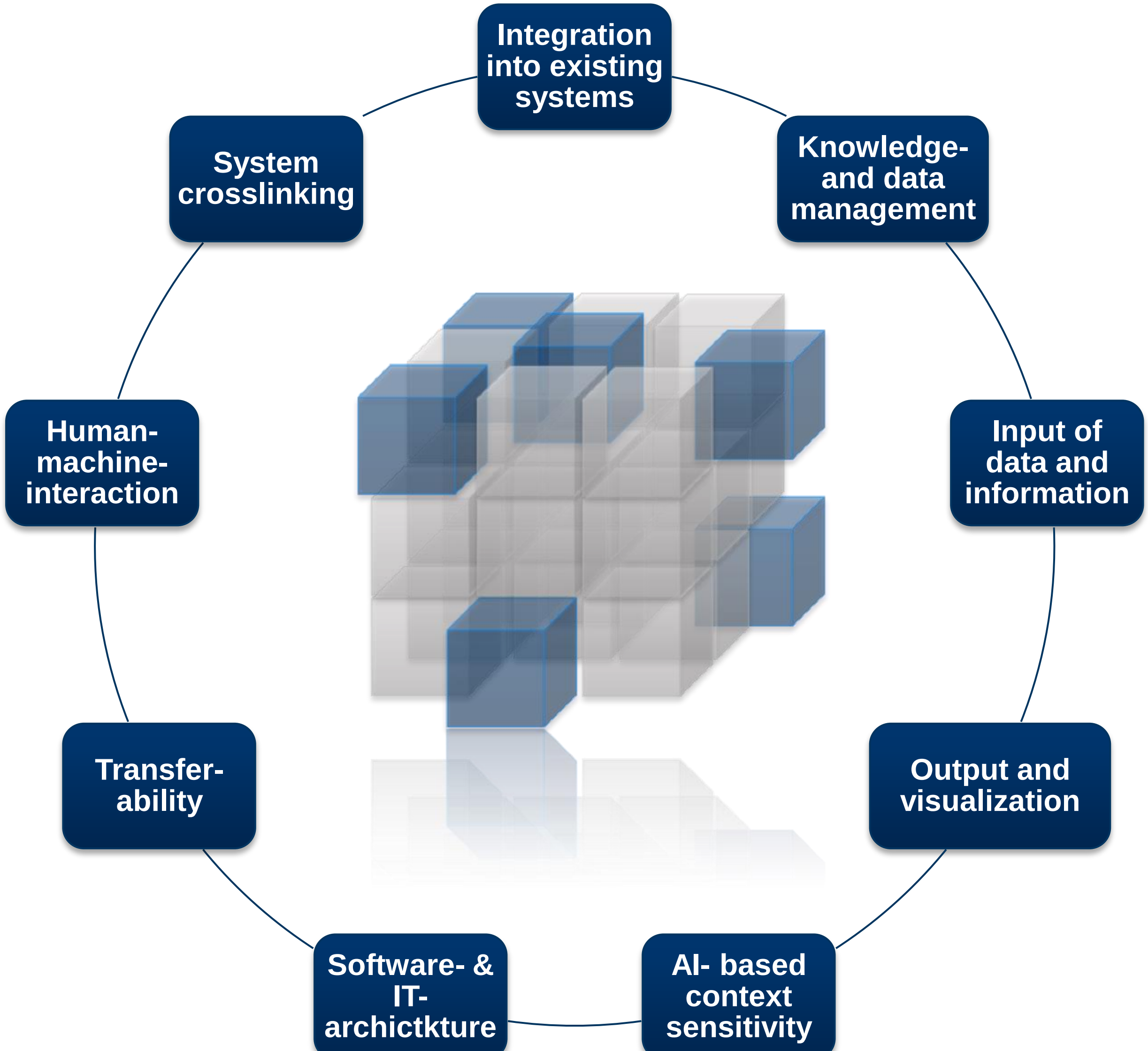


DATA(-FORMATS)

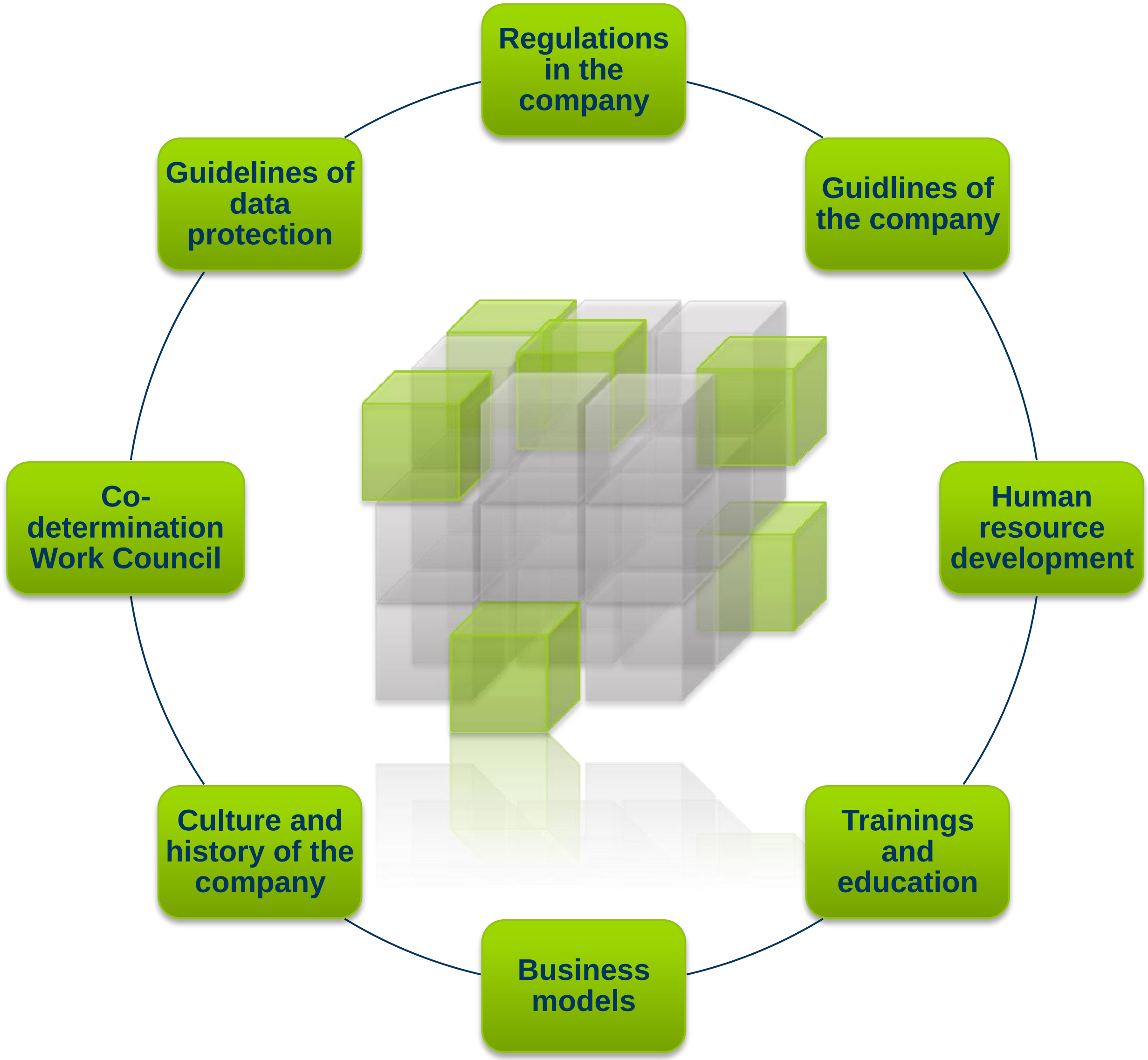
- 3D Models
- Compositions
- PDF
- Illustrations
- Failure ID
- Failure texts

- Context specific data

Technical dimensions



Success dimensions



INDUSTRY 4.0
Smart
Cloud
CPPS
CPS
LPS
LEARNING FACTORY

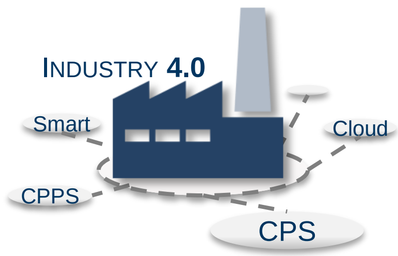
How to bring Industry 4.0 into learning factories?

Questions:

- What is supposed to be the content?
  - general overview of Industry 4.0
  - benefit and challenges of Industry 4.0
  - Examples of Industry 4.0
- What are the benefit and challenges of the training?
  - participants develop a understanding of what Industry 4.0 stand for
  - participants learn how to implement Industry 4.0 in factories
  - participants know the advantages but also risks (co determination, personal rights) of Industry 4.0
- How to implement a training environment?
  - consideration of particular workplaces (local) and production system (global); how they operate without and with Industry 4.0 “standards”
  - presentation of a fully functional and implemented Industry 4.0 production (pilot factory)
- What kind of product is needed?
  - networked product

How to bring Industry 4.0 into learning factories?

LEHRSTUHL FÜR PRODUKTIONSSYSTEME



LPS LEARNING FACTORY

Approach:

target definition

- **impact on target figures of the production:** time, cost, quality
- **impact on the production system:** technology, origination, personnel

definition of requirements:

- technology: machines (CPS), PPC, data, I&C, …
- organization: operational and organizational structure, flow of information, …
- personnel: duties/tasks, qualifications, development of competences, …
- product: networked components

development of 2 scenarios:

- **focus on technology implementation:** necessary installation of I&C-components
- **focus on human assistance:** possibilities, advantages, risks, changes for employees

implementation:

- **technical conversion of our pilot factory**
- **pilot phase**

LEARNING FACTORIES **4.0**

Conclusion

- Industry 4.0 is a complex undertaking
- Challenges regarding technical and organizational aspects
- The human role is a key factor in the implementation
- Intelligent support systems are needed to plan, control and operate smart factories
- Learning factories have to adapt to Industry 4.0

5th conference on learning factories

TOPICS

- Lean production
- Industry 4.0 / Cyber-physical systems
- Resource efficiency
- Productivity management
- Digital learning environment
- Problem-based learning
- Consideration of the product lifecycle
- Industrial implementation

JULY 7TH 2014 (START: EARLY AFTERNOON)

- Greeting and introduction
- Workshops in the LPS Learning Factory
- Welcome reception

JULY 8TH 2014 (FULL DAY)

- Keynote
- Conference session

VENUE: Ruhr University Bochum

Important Dates

2014

November 3rd	Abstract submission
November 10th	Notification of abstract acceptance

2015

January 12th	Full paper submission
January 30th	Notification of paper acceptance
February 17th	Camera-ready paper submission
February 28th	Registration deadline authors
June 30th	Registration deadline participants
July 7th - 8th	5th Conference on Learning Factories sponsored by CIRP

www.rub.de/clf-2015

LEHRSTUHL
FÜR PRODUKTIONSSYSTEME

Thank you for your attention!