Webinar, 2020

Webinar on digitalization potential analysis and IIoT experiences

Mittelstand 4.0 Kompetenzzentrum Chemnitz

Betrieb 4.0 machen!

Laura Salomon, Anton Mauersberger, Annegret Schimmang-Esche, Marc Münnich, Marian Süße, Adrian Singer

Agenda

RIS3 Regional - Training & Mobility Action IIoT experiences and digital assessment tools	Time
1| Welcome and introduction - Introduction of the IWU - Introduction of Regional RIS3 actors - Welcome by regional DIH representative	13:00 – 13:30
2| Classification and objectives of the workshop	13:30 – 14:00
3| Current Status I4.0 of an example company	14:00 – 14:30
4| Conceptual Work: Ideas – Concepts	14:30 – 14:45
5| IIoT Experiences	14:45 – 15:00
6| Networking and Leave-Taking	After 15:00

Agenda

1| Welcome and introduction

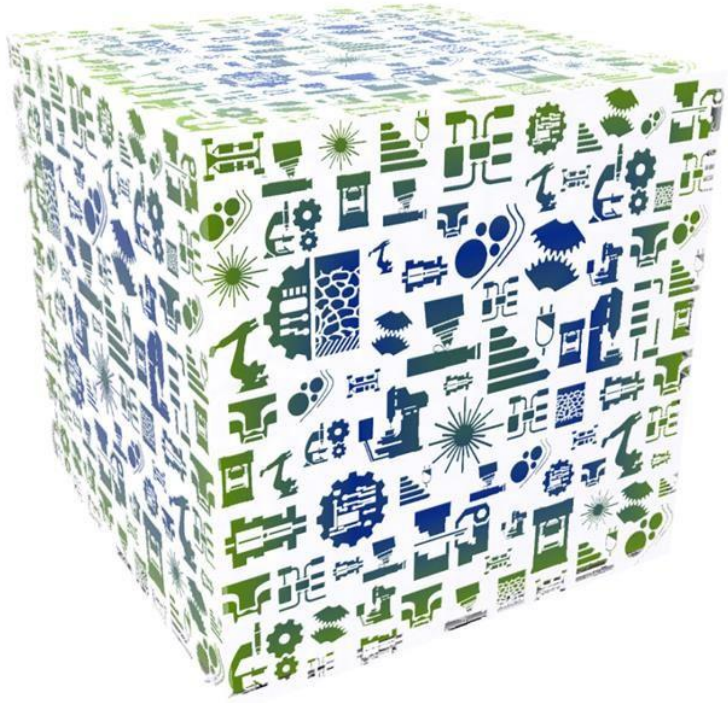
2| Classification and objectives of the workshop

3| Current Status I4.0 of an example company

4| Conceptual Work: Ideas – Concepts

5| IIoT Experiences

6| Networking



Introduction Fraunhofer and the IWU

72 institutes and research institutes at locations in Germany
largest organization for applied research and development services in Europe

Research locations of the Fraunhofer IWU

Chemnitz

Dresden

Zittau

Wolfsburg

IWU Locations

Fraunhofer IWU

Introduction Fraunhofer and the IWU

Research under the heading “Resource-Efficient Production“

- Founded July 1st 1991
- Currently approx. 530 employees
- Approx. € 40 million annual budget
- Locations: Chemnitz (headquarters)

  Dresden, Zittau, Wolfsburg, Leipzig
- 3 scientific fields:

Mechatronics and Lightweight Structures	Forming Technology	Machine Tools, Production Systems and Machining

Introduction Fraunhofer and the IWU

Next generation of production technique

- How can **we** keep production up-to-date?
- How can **we** keep production in EU, Germany & Saxony?

The E³ concept of production

- **E**nergy- und Resource efficiency
- **E**mission neutral and energy independent
- **E**mbedding of people into production in a new way

R&D focus in manufacturing

- Powertrain components
- Body-in-white structures
- Energy management “2.0”

Digital Innovation Hub

Digitalization in industry is firmly anchored in both national agendas and the European Strategy 2020. The »Innovation Platform Smart Production Systems Saxony - InnoSax« faces this challenge and combines the competencies for a digital Saxony.

Our goal is: »To help Small and Medium Sized Enterprises to improve their processes, products and services through the use of digital technologies.«

A skill sample:

Robotics
Human-robot interaction, sensitive robotics for complex assembly tasks

Machine concepts and body construction
Flexible technologies for handling, fixtures and joining

Smart Data
Linked factory, AI, AR, IIoT, self regulating systems, intelligent process chains

Micro and precision manufacturing
Cutting technologies, removal processes, micro-forming, metrology and tribometry for microstructures

Our tool kit:

Workshops
We transfer our knowledge on technology and digitalization in workshops or trainings

Project pitches
We offer the facilities and our expertise for your project ideas on smart production

Testbed
Our E³ research factory is the appropriate testbed for testing components for I4.0 solutions

Best-Practice
In small groups you will learn from and with our partners how to use ICT technologies efficiently in production

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Partners

- Research & Technology: Fraunhofer IWU, TU Chemnitz, University of Tampere
- Network/cluster organization: Arbeitskreis Werkzeugmaschinen e.V. , VEMAS innovativ, Kompetenzentrum Maschinenbau
- National goverments
- Chamber of Commerce
- small and medium-sized enterprises from the region

Contact

Digital Innovation Hub Smart Production Systems - Innosax

Fraunhofer Institute for Machine Tools
and Forming Technology IWU
Reichenhainer Straße 88
09126 Chemnitz, Germany

Annegret Schimmang-Esche

www.innosax.de

info@innosax.de

Introduction M4.0 Competence Center Chemnitz

Federal Ministry for Economic Affairs and Energy

Our network

https://betrieb-m achen.de

Mittelstand 4.0 Kompetenzzentrum Chemnitz

Betrieb 4.0 machen!

TECHNISCHE UNIVERSITÄT CHEMNITZ

Fraunhofer IWU

ICM Institut Chemnitzer Maschinen- und Anlagenbau e.V.

IHK Industrie- und Handelskammer Chemnitz

TECHNOLOGIETRANSFER UND INNOVATIONSFÖRDERUNG MAGDEBURG GmbH

Introduction M4.0 Competence Center Chemnitz

Introduction M4.0 Competence Center Chemnitz

Information

- Company forums
- Theme days
- Online Information Services

Qualification

- Basic Workshops
- Advanced Workshops
- Online Qualifications

Collaboration

- Experience circles
- Groups of experts
- Online Collaboration Services

Support

- Projects
- Technology testbeds
- Online Support Services

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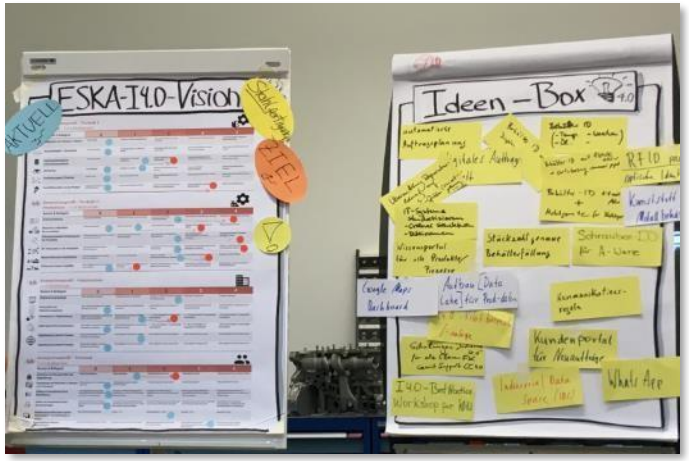
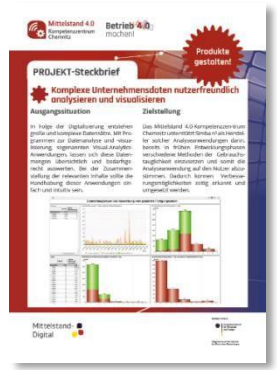
Events & Roadshows

Projects & Workshops



Media



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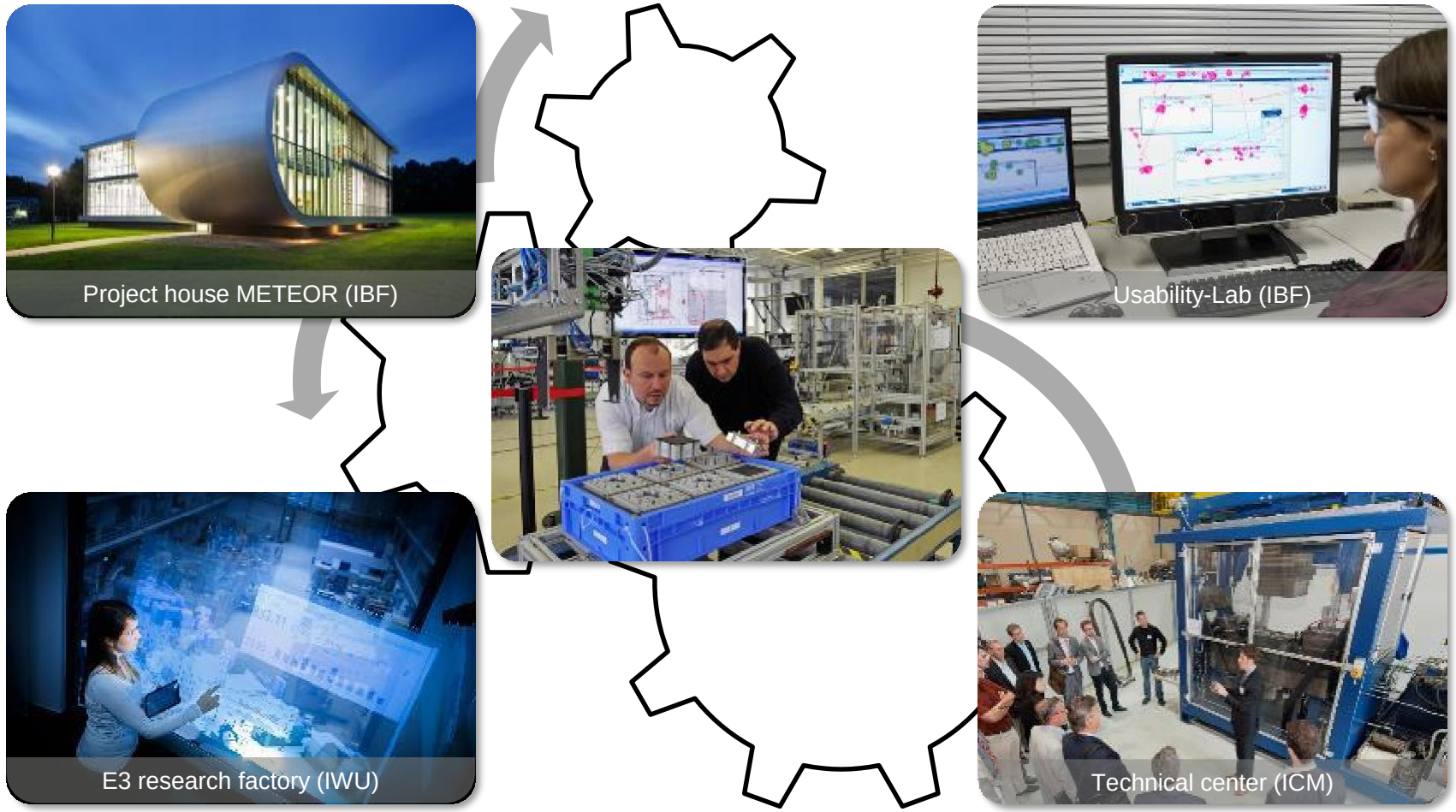
Test Environments



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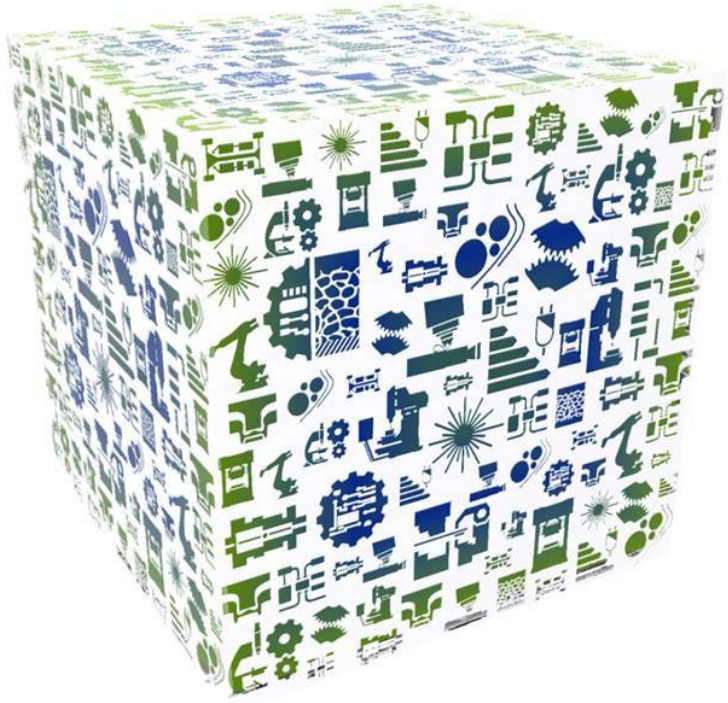
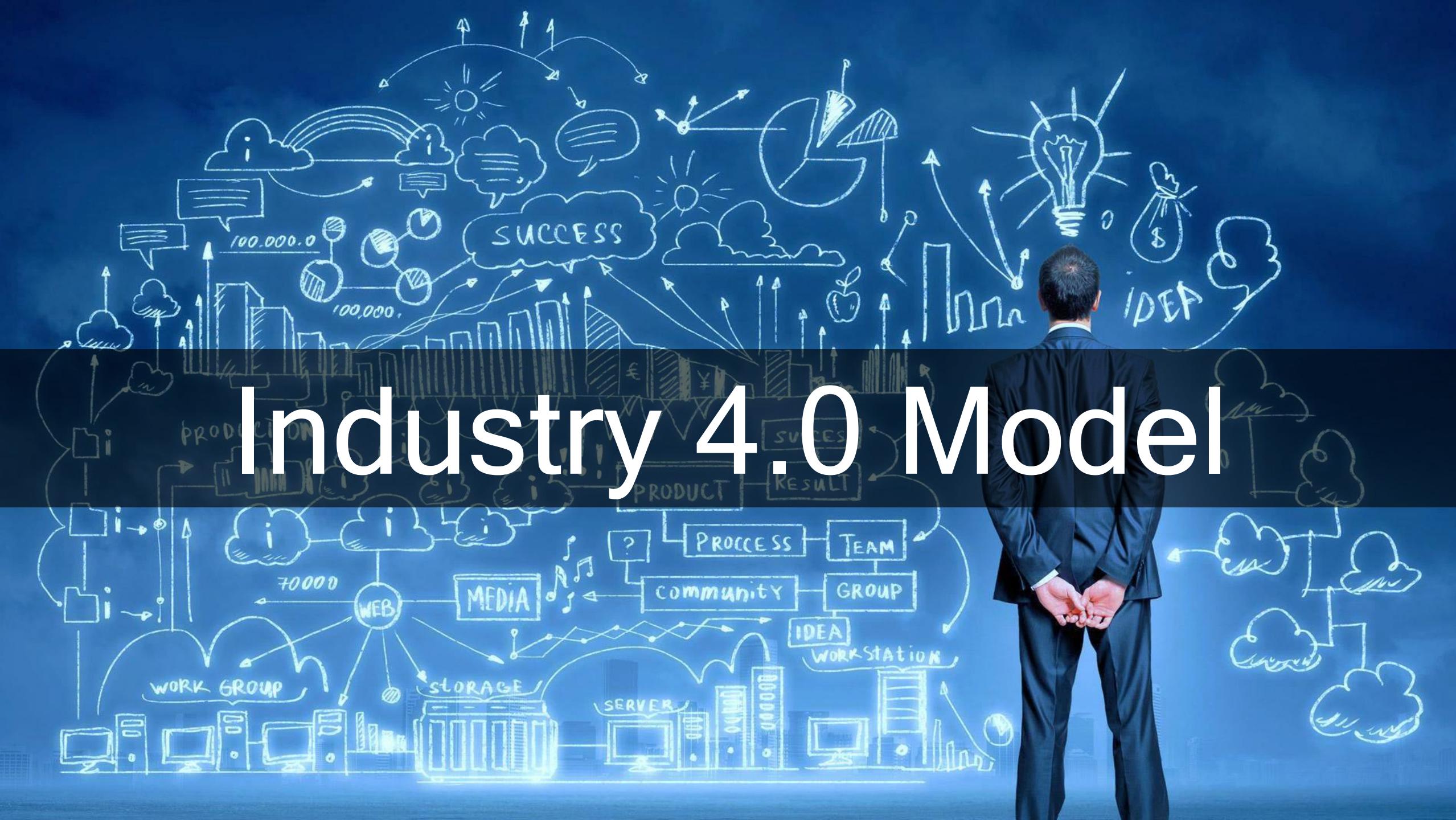


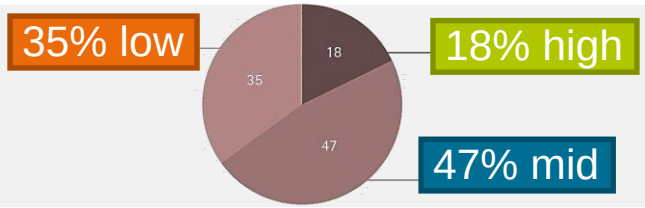


Industry 4.0 Model

Introduction to T.O.P. Model

Today`s situation

Grade of digitalization in Saxony



Unused potentials

Revenue increases

Efficiency & Costs

New Services & Business Models

Barriers

Finances

Qualification

Unknown potentials

Main goal

Cost-effective method for I4.0 qualification and Exploitation of digitization potentials

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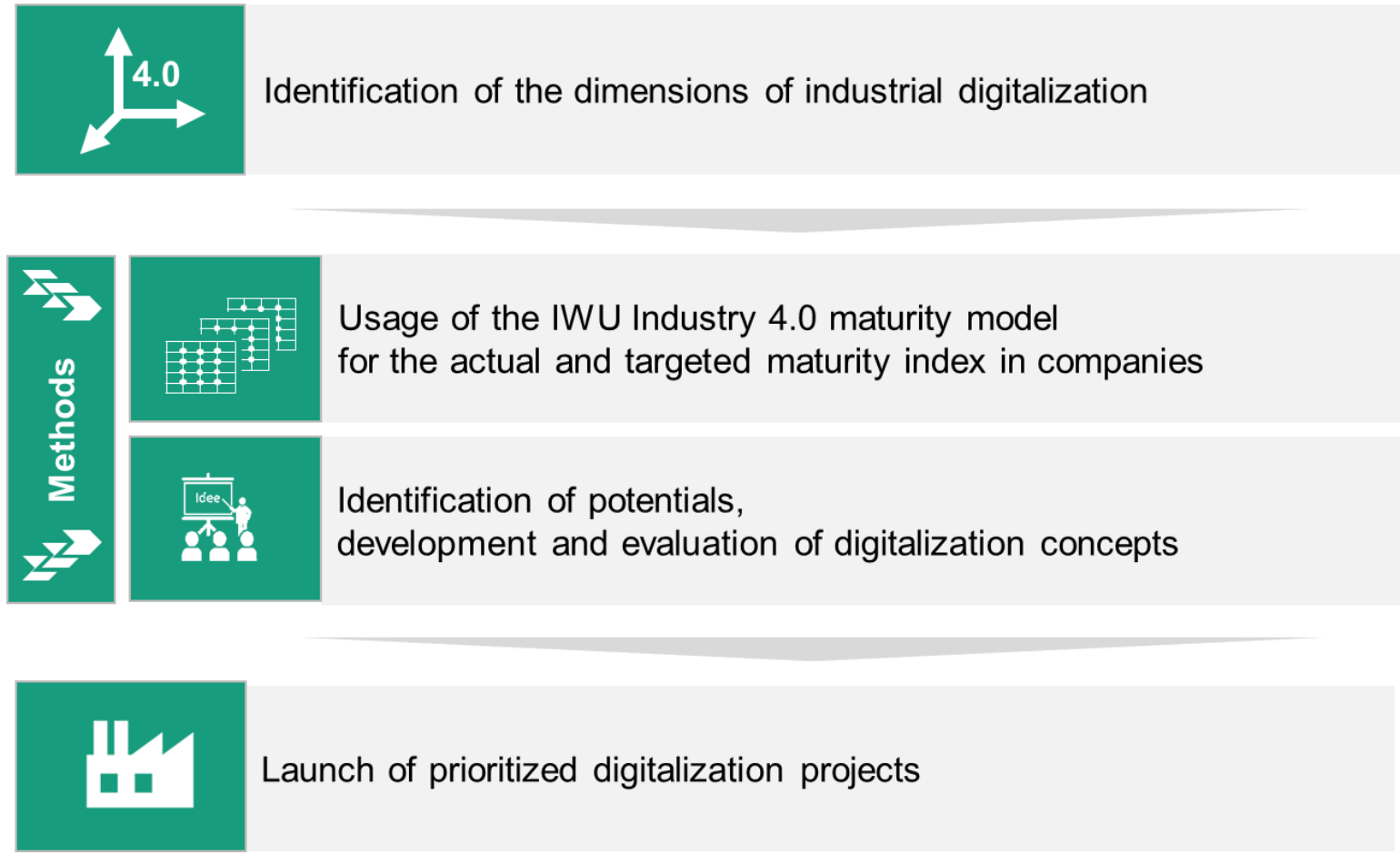
Introduction to T.O.P. Model

- Goals and procedure for the introduction of digitalization projects



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Introduction to T.O.P. Model

- Dimensions of digitalization projects – The T.O.P. model

Technology

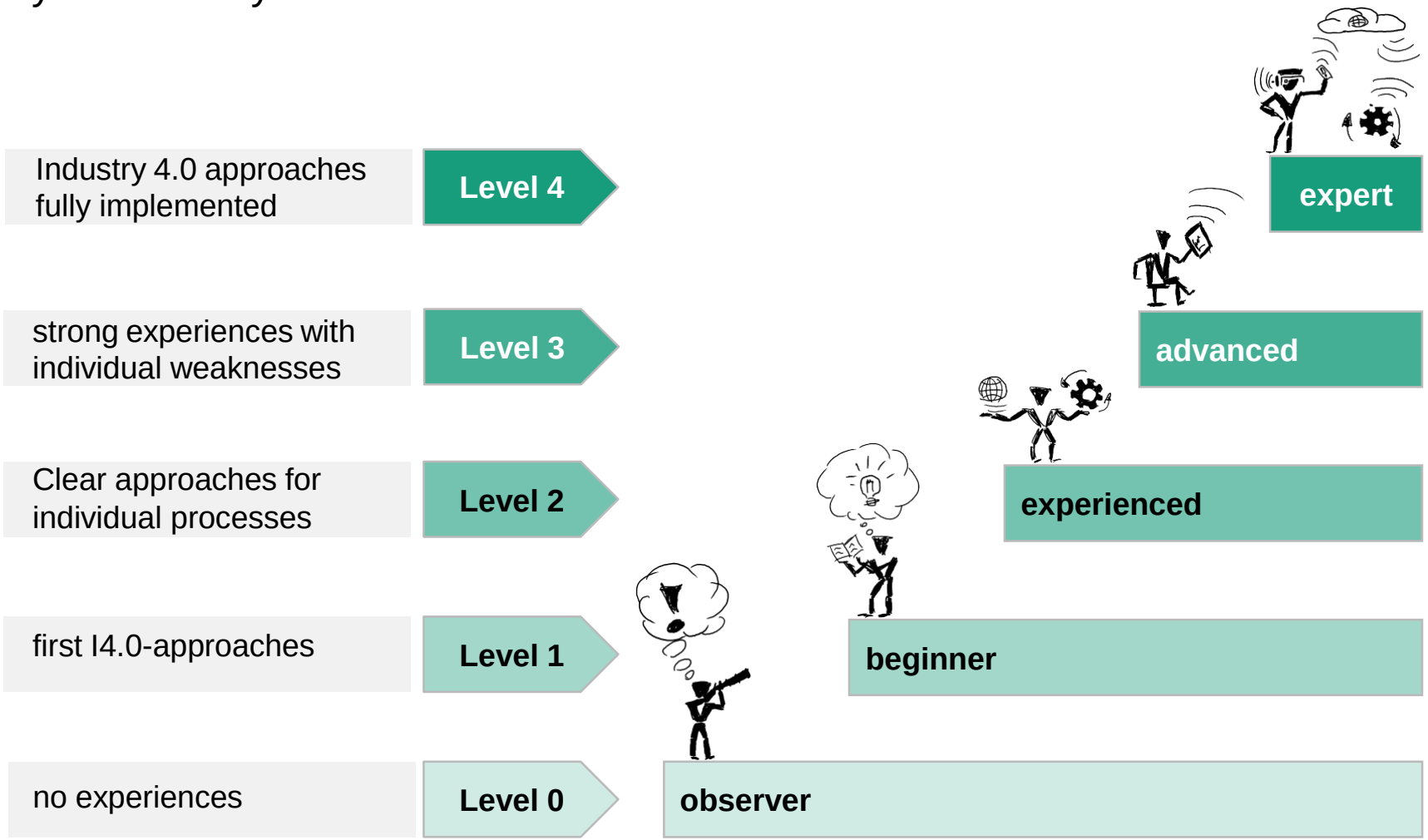
- Products
- Production
- IT & Data

People

- Leadership & employees
- Competences & further education
- Communication culture

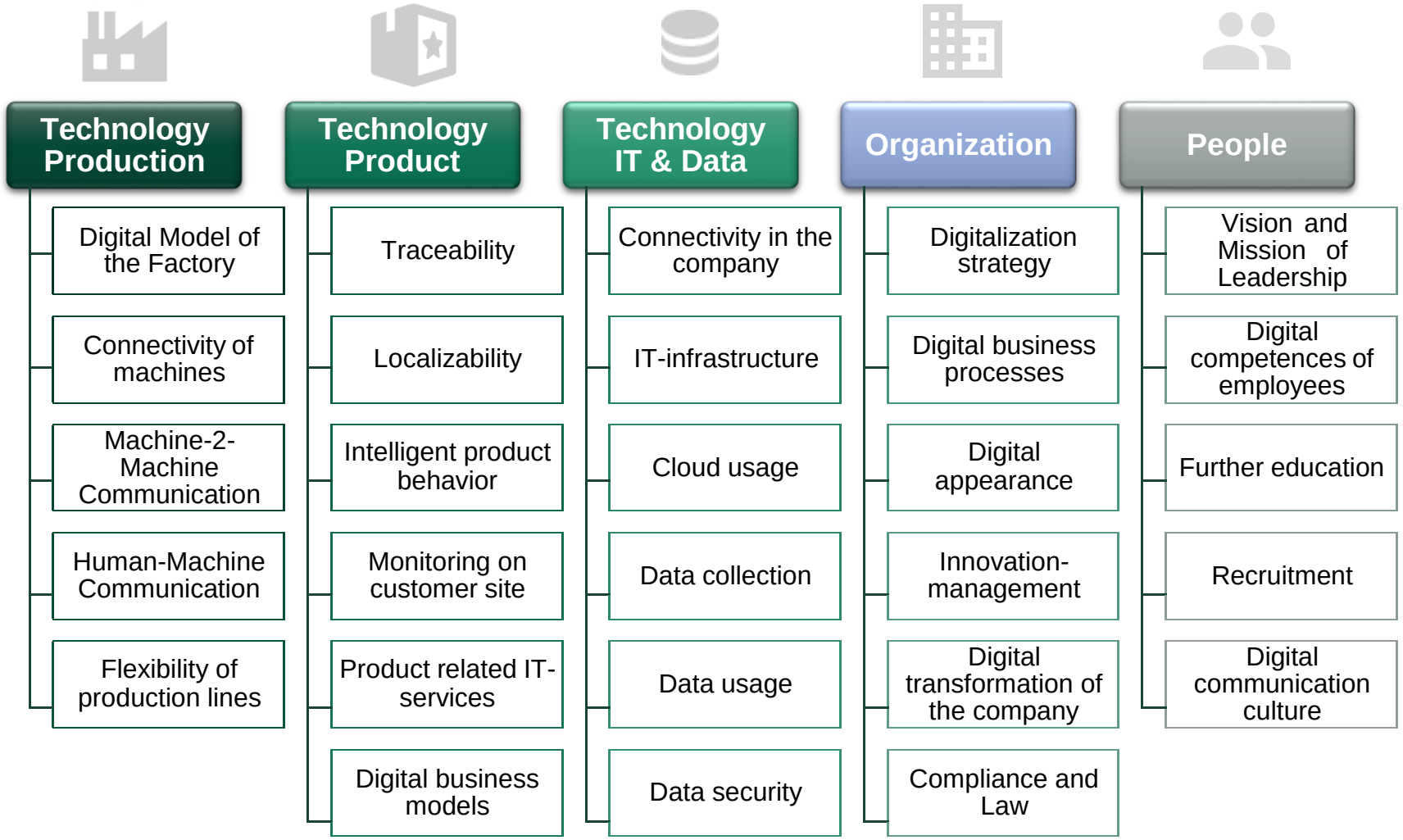
Introduction to T.O.P. Model

- IWU Industry 4.0 maturity model: the “T.O.P. model”



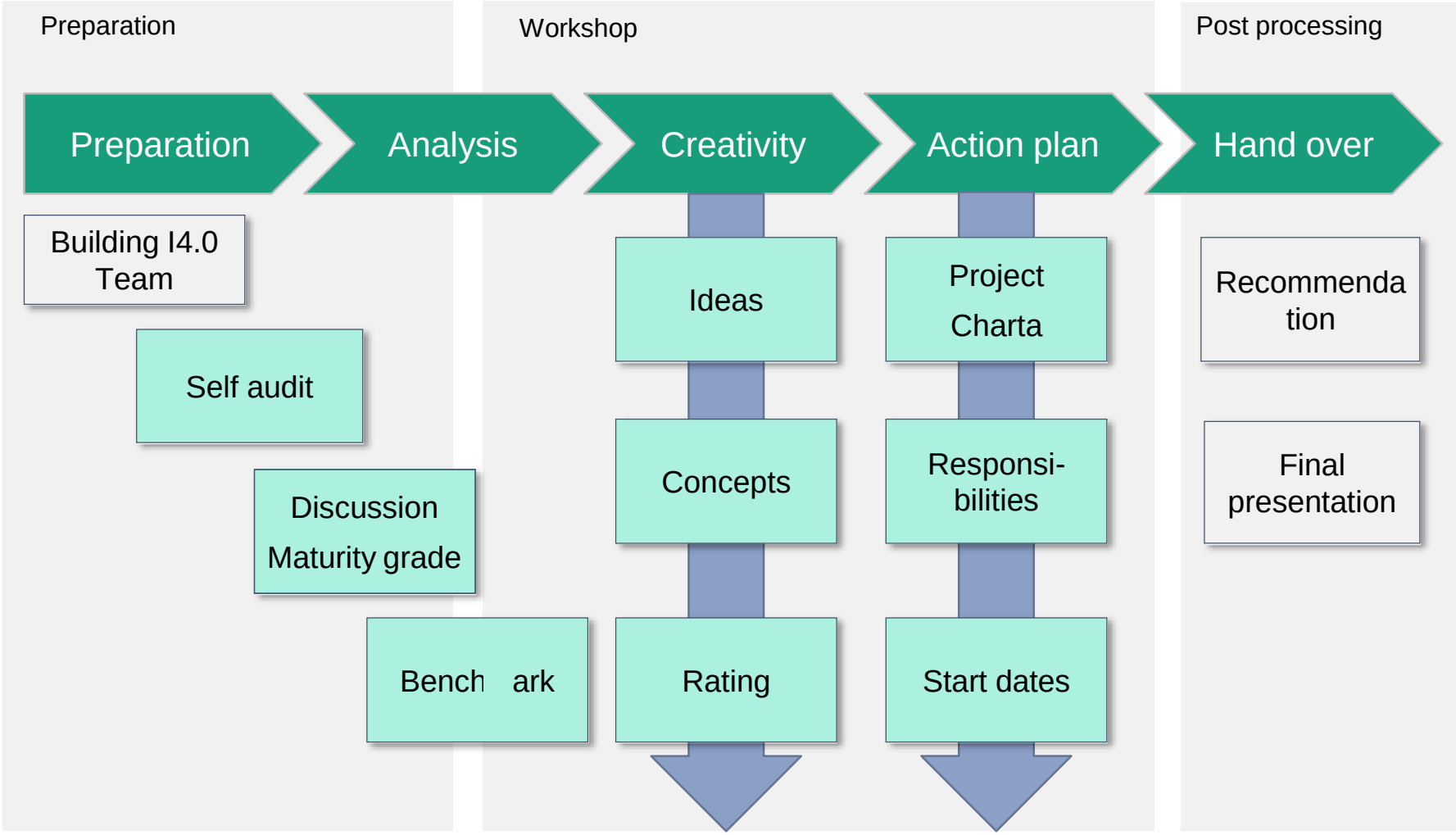
Introduction to T.O.P. Model

- IWU Industry 4.0 maturity model: the “T.O.P. model”



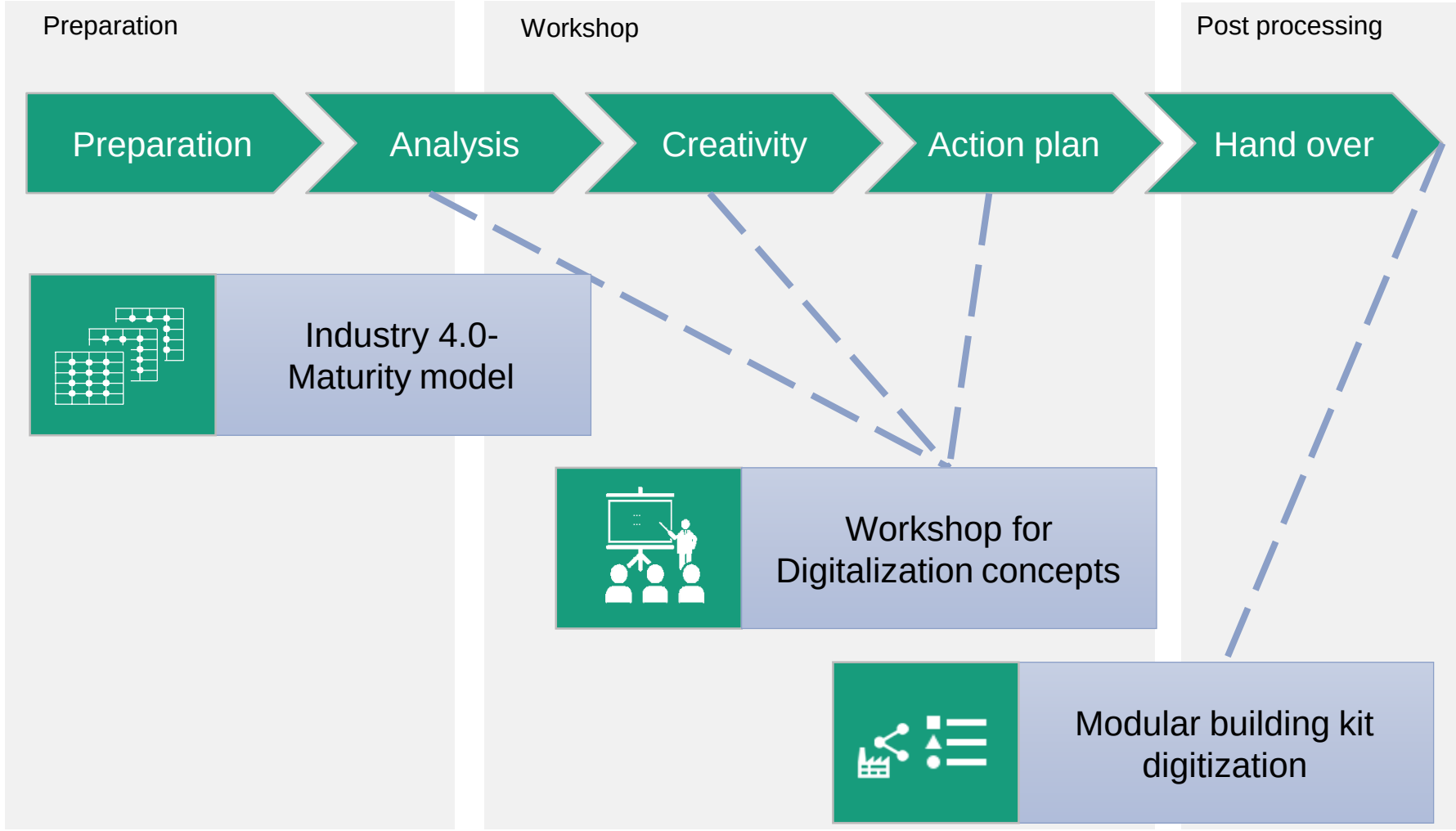
Methodology for digitalization

- The five phases of the Methodology



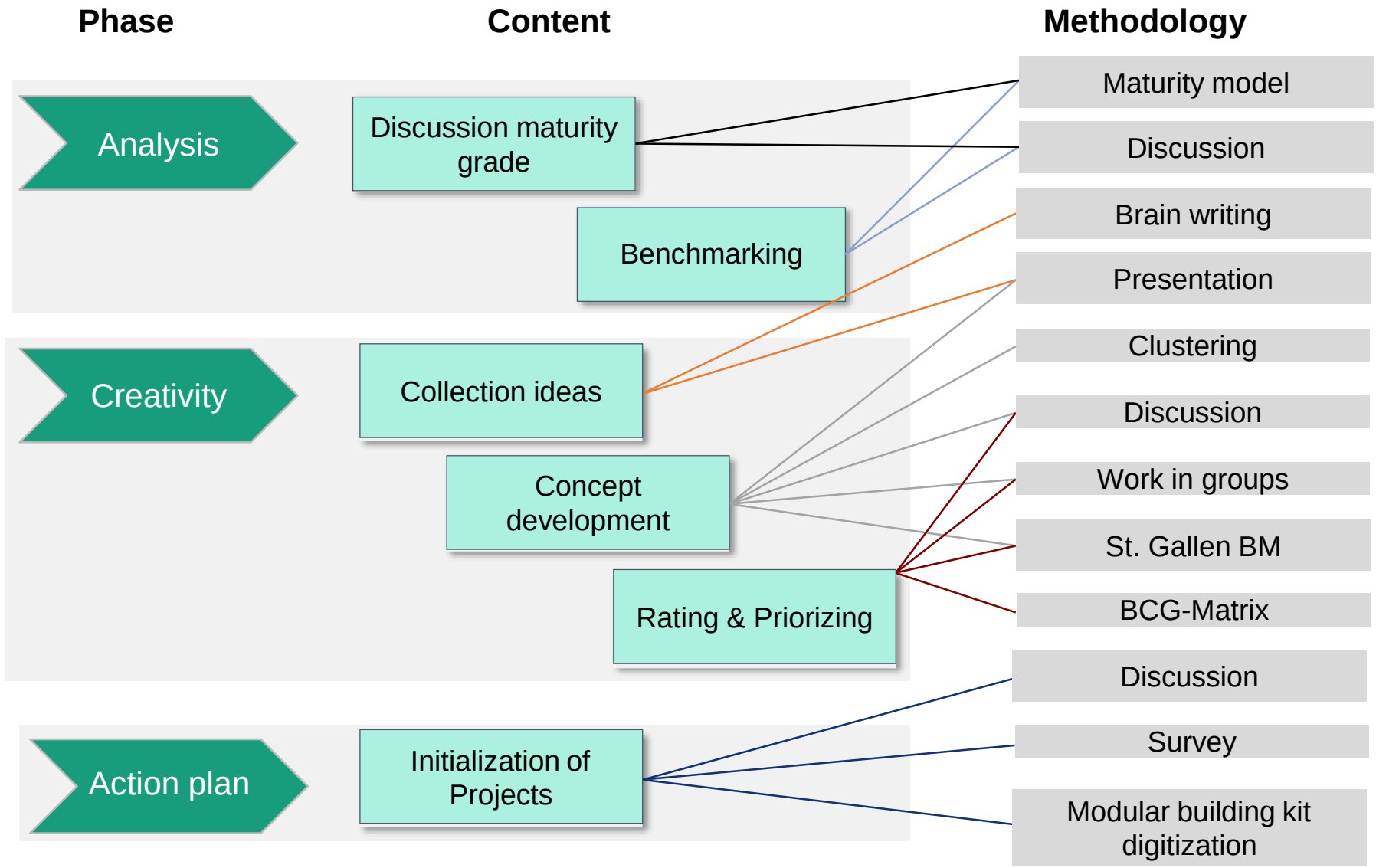
Methodology for digitalization

- The five phases of the Methodology: usage of tools



Methodology for digitalization

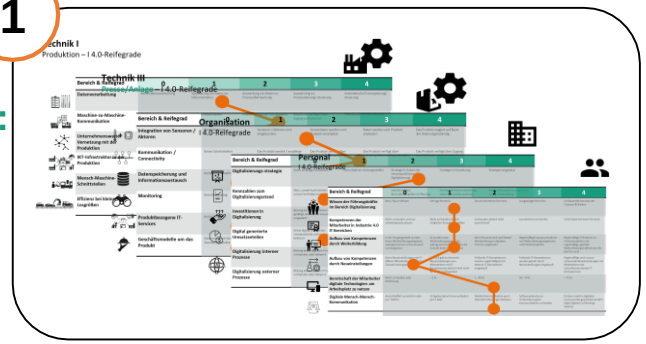
The five phases of the Methodology: Workshop



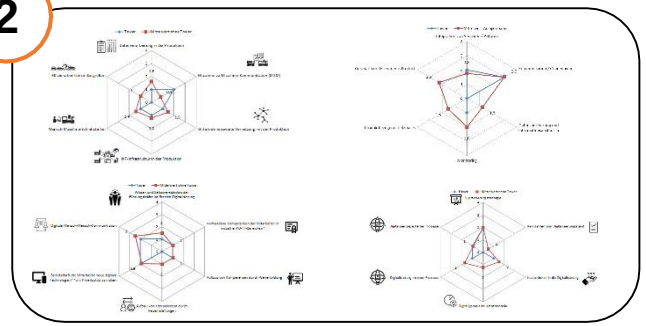
Methodology for digitalization

Link to the selfcheck:
https://betrieb-machen.de/selfcheck

1 Maturity evaluation

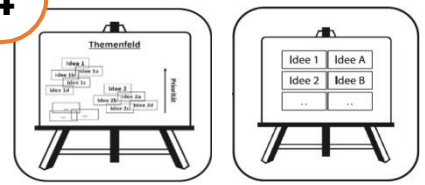


2 Comparison to other SMEs

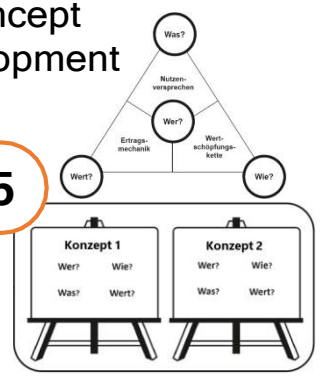


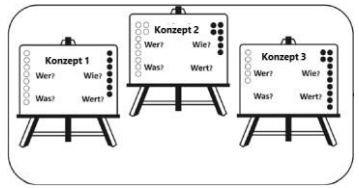
3 Idea generation in workshop

4 Clustering ideas

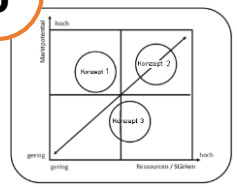


5 Concept development





6 Rating of concepts



7 Roadmap generation

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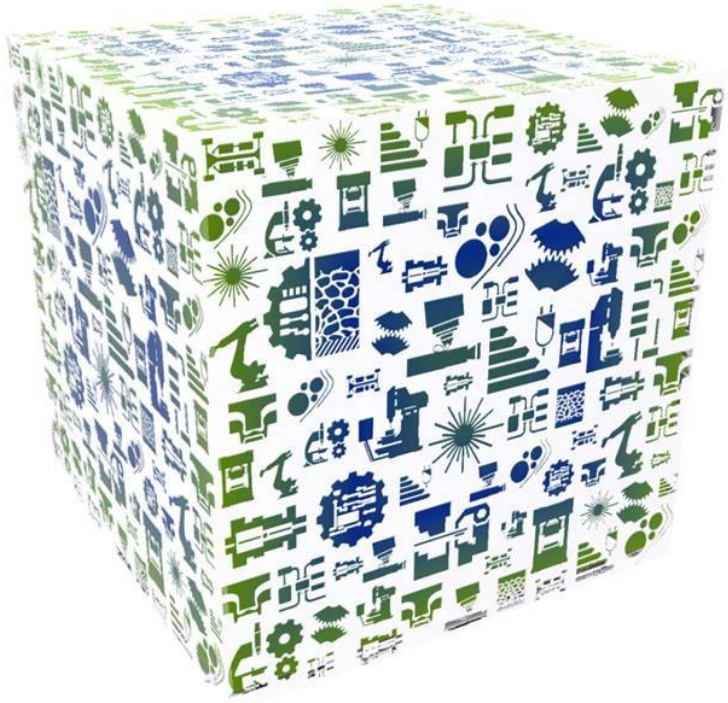
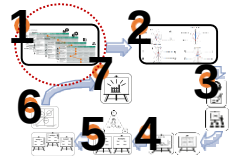


Example - Fictional Enterprises

- Mediumsized enterprise from saxony
  - Number of employees: ca. 25
  - industrial sector: manufacturing systems engineering
  - Products: manufacturing of cooling towers
  - Services: manufacturing, assembly, putting into service, maintenance, support
- Focus:
  - Organization and Technology
- Problem:
  - Lack of data transfer (internal & external)

Dimensions of T.O.P. Model



- Technology Production : explanations of each category and index

actual target

Category & index	0	1	2	3	4
Data usage	Data-based decisions by employees	Human processing of data for higher quality information	Automatic machine processing of data for decision proposals	Automatic machine processing of data and rule-based implementation of system improvements	Machine learning-based processing of data for partially or fully autonomous process control
Machine-2-Machine Communication	No communication	Via fieldbus interfaces	Via Industrial Ethernet interfaces	Machines have access to the Internet	Web services (M2M-Software)
Connectivity in the company	No networking between departments	Exchange of information via mail / telecommunications	Cross-departmental linked data servers	Uniform data formats and rules for data exchange	Cross-departmental, fully networked IT solutions
IT-infrastructure	File-based storage, excelfiles	Data servers in the production	ERP/MES systems, without interfaces	Extensively networked ERP/MES systems	Use of further modular software applications (PLM, CRM, PPS, etc.) as a supplement to ERP / MES
Human-Machine-Communication	No exchange of information between man and machine	Use of local display devices	Central / decentralized production monitoring / control	Use of mobile display devices	Augmented & virtual assisted reality
Flexibility of production lines	Rigid means of production	Some production means are flexibly adjustable via parameters	All production means are flexibly adjustable	The production is fully flexible and component driven	Component driven, fully flexible production with possibility of batch size 1

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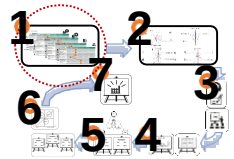
Dimensions of T.O.P. Model



- Technology Product: explanations of each category and index

actual target

Category & index	0	1	2	3	4
Integration of sensors / actuators	No use	Sensors / actuators are integrated	Sensor data is processed by the product	Data is analyzed by the product	The product reacts independently on the basis of the data
Data storage and exchange of information	No functionality	Possibility of unambiguous identification	Product has passive data storage	Product with data storage for autonomous information exchange	Data and information exchange as an integral part
Intelligent product behavior	No interfaces	Sensor technology to detect the state of the product and environment	Products can communicate using I/O signals	Products can parameterize themselves independently	Products can make independent decisions & generate learning effects from them
Monitoring on customer site	No monitoring	Failure detection	Detection of the operating status for diagnosis	Prediction of own functionality	Independent control measures
Product related IT-services	No services	IT-Services via online portal	Service execution directly from the product	Independent execution of services	Full integration into IT service infrastructure
Digital business models	Profits from selling standard products	General advice, e.g. via telephone & online portal	Additional sales of IT services (SaaS)	Different operator models are offered, which are defined when the contract is concluded	Sale of product functions that can be switched on and off at any time during the product lifetime

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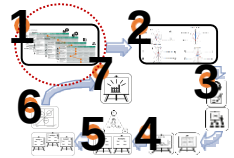
Dimensions of T.O.P. Model



- Organization: explanations of each category and index

actual target

Category & index	0	1	2	3	4
Digitalization strategy	No strategy available	Pilot initiatives have been launched	Strategy in progress with digitalization manager	Strategy in implementation or already implemented	Digital transformation is lived as a strategy and is constantly supplemented in the sense of CIP
Digital business processes	The processes are only visualized analogously	Some processes are mapped digitally	The core processes are digitized	Most processes are digitized	The entire process landscape is digitized
Digital processes (internal)	The processes are only visualized analogously	Some processes are mapped digitally	The core processes are digitized	Most processes are digitized	The entire process landscape is digitized
Investing in digitalization	No investments made so far and will continue unplanned in the future	No investments made so far but planned	1 - 5% of sales in the past financial year	6 - 10% of sales in the past financial year	> 10% of sales in the past financial year
Innovation management	No active management in this area	Innovation management based on analog tools	Innovation management based on digital tools	Automated reconfiguration of parts of the business model	Algorithm based development of the business model
Compliance and Law	Haven't dealt with it yet	Risks and legal requirements are known	There are isolated regulations and safeguards in the company	There is an internal compliance policy that is followed	Use of a compliance management system certified according to ISO 19600

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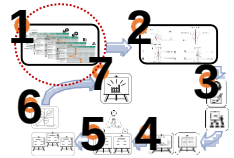
Dimensions of T.O.P. Model



- People: explanations of each category and index

actual a

Category & index	0	1	2	3	4
Vision and Mission of Leadership	No level of knowledge known	Executives are marginally concerned with Industry 4.0 (e.g. visits to trade fairs)	Executives are planning isolated Industry 4.0 measures	Executives plan holistic Industry 4.0 measures	Executives have an Industry 4.0 vision that they communicate clearly and implement projects for
Digital competences of employees	Not available and only time-consuming to set up	IT-savvy employees in the company	A few employees with IT expertise are available	IT expertise available, but not all relevant areas covered	Broad team with IT expertise in relevant areas
Further education	No training opportunities in the past and none planed	Staff are allowed to take part in external training on their own initiative	There are regular internal & external training courses, which are promoted by the management group	Collaboration with online training services (Udemy, Coursera)	Offer for medium- to long-term further education and training of employees
Employees willingness to use digital technologies in the workplace**	Not present or rejection	Low (-1%)	Ordinary (1 - 49%)	High (50 - 74%)	Very high (> 75%)
Digital communication culture	Only in person or by phone	Local communication	Mobile communication	Communication via mobile & multifunctional (mail, appointments, PM) software services	Exchange of information and knowledge among employees via group and project platforms

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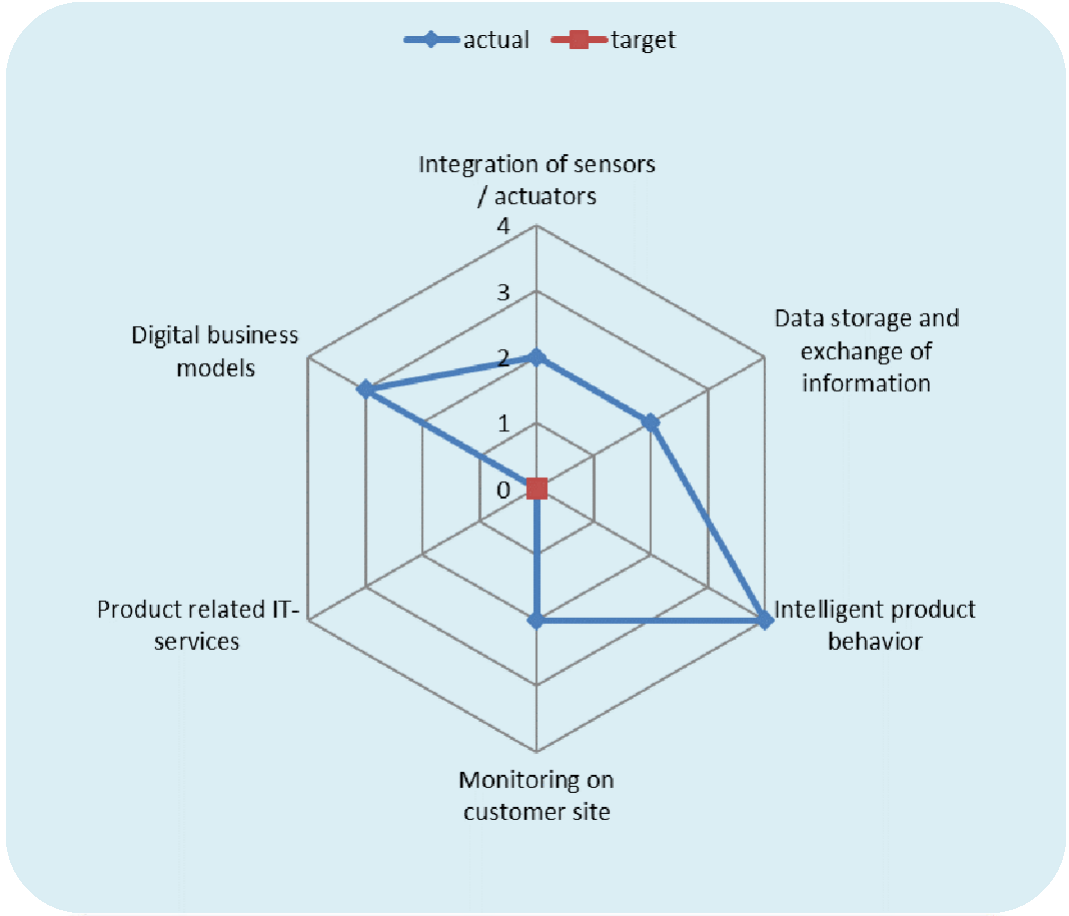
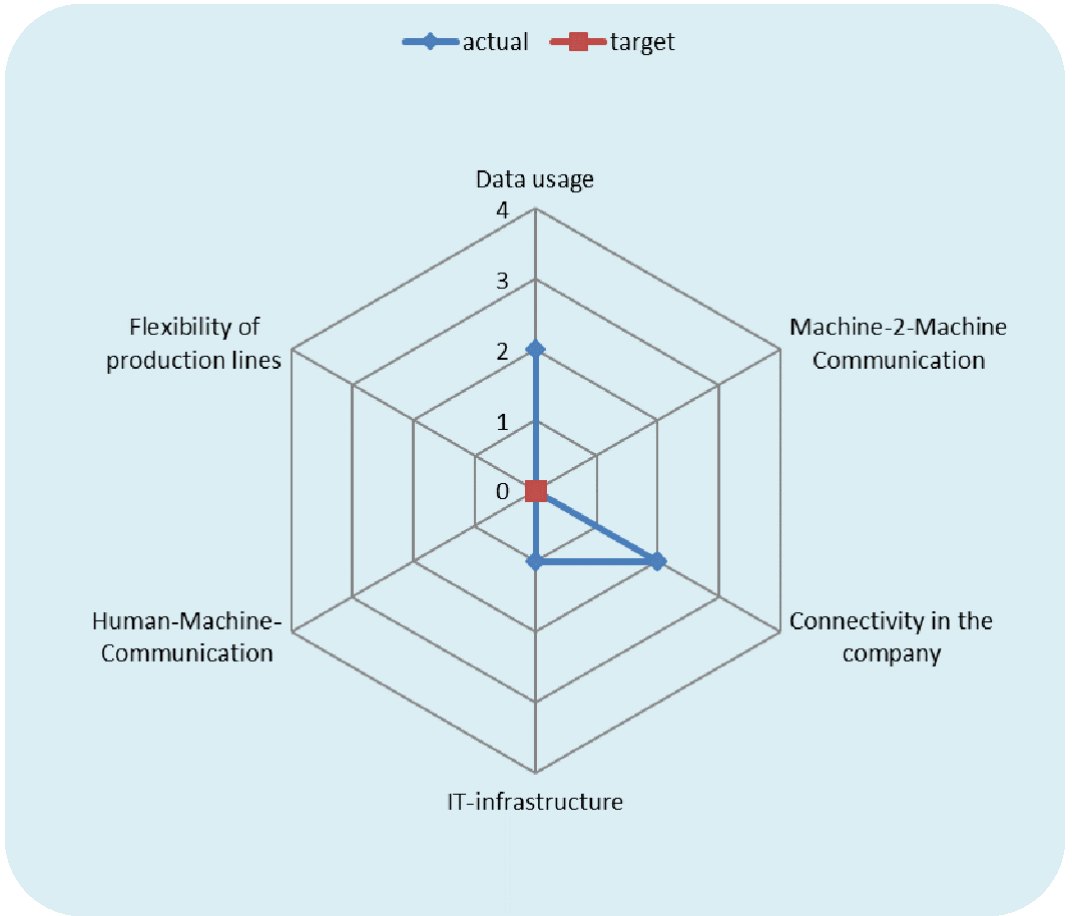
Benchmark – Technology (Production, Product)

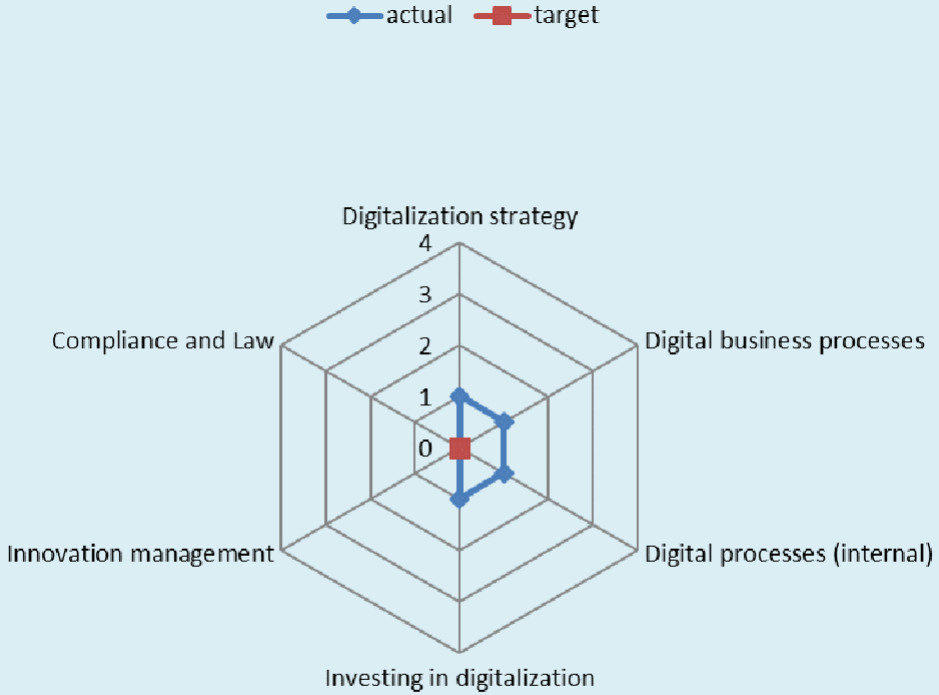
- Potential analysis through benchmarking

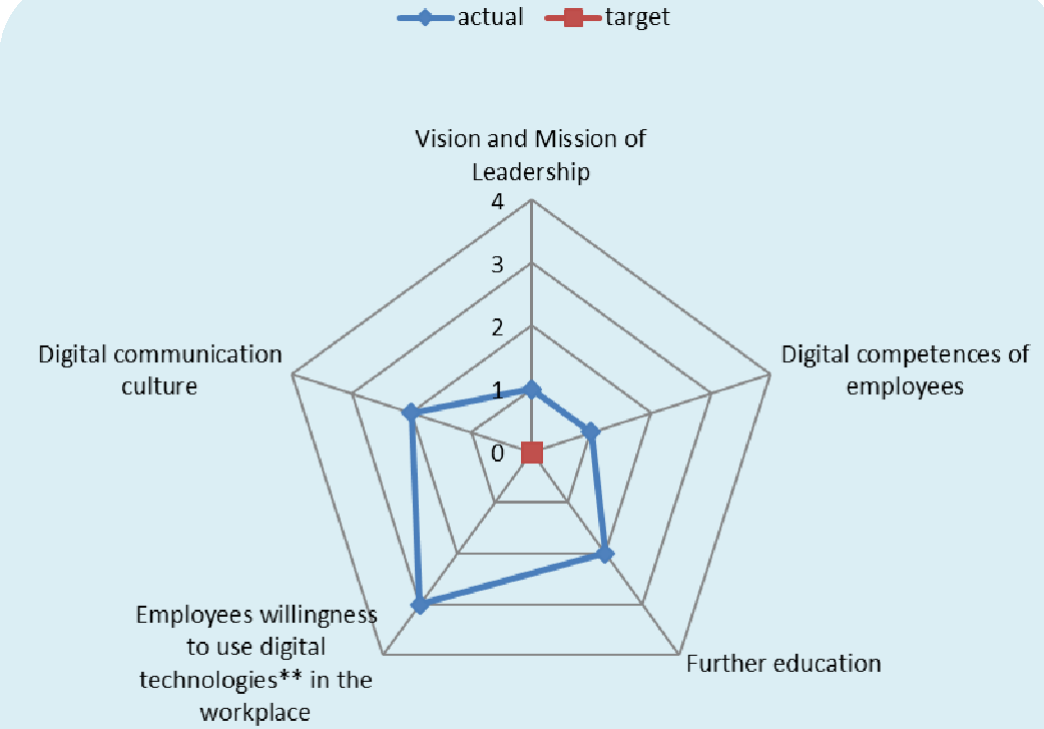




Benchmark - organization and people

- Potential analysis through benchmarking





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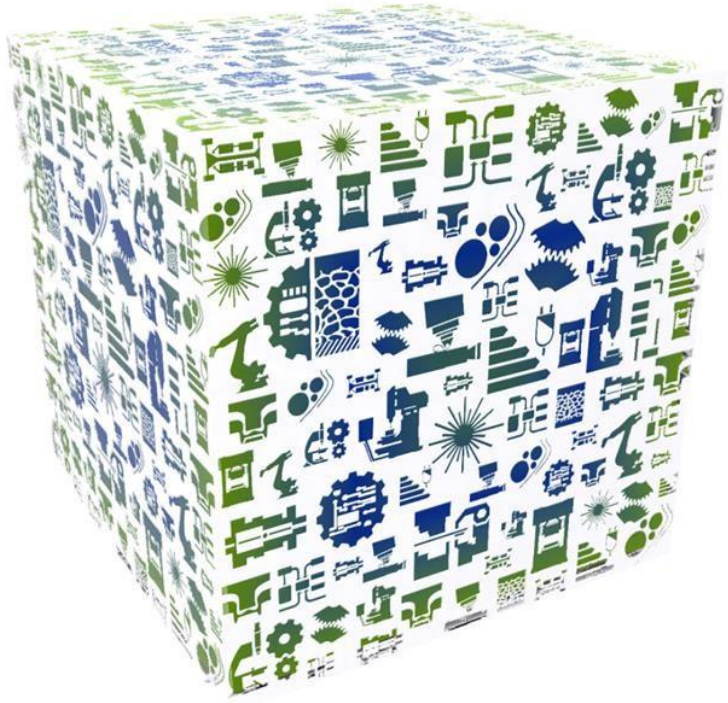
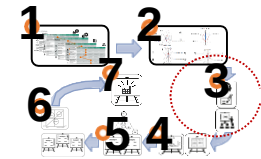
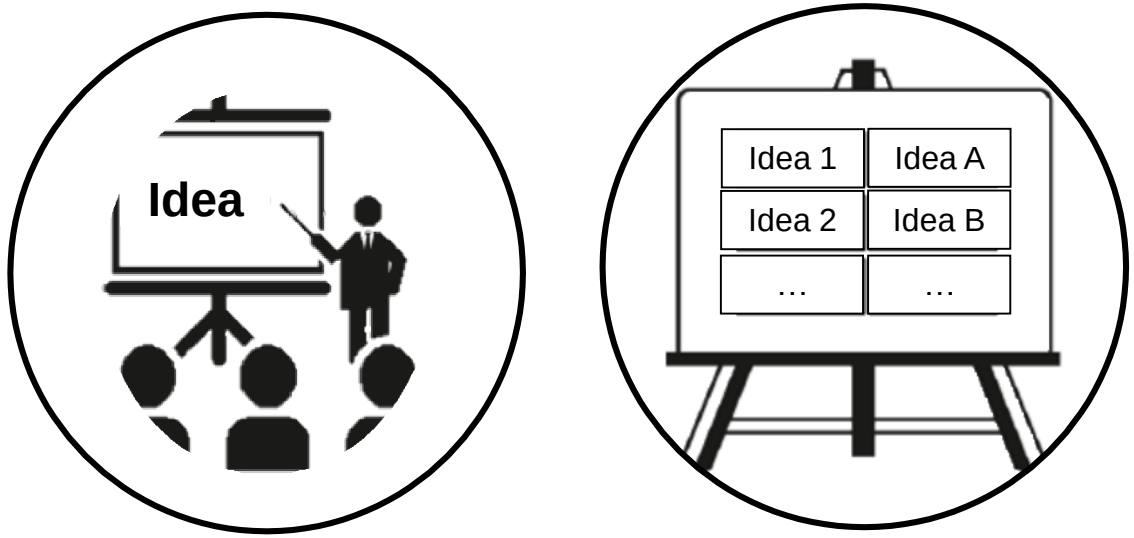



From ideas to concepts

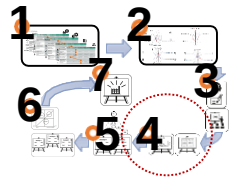
Creativity





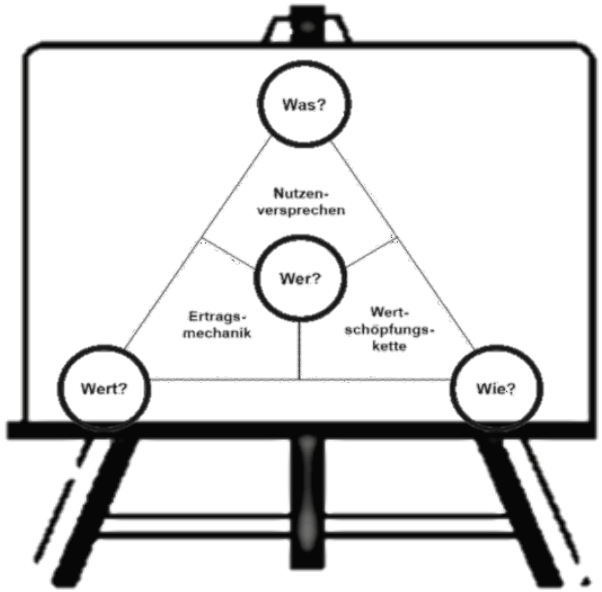
- Normaly 60 minutes time slot for:
  - Presenting and discussion of previously developed ideas in Excel
  - Classification of the ideas in the maturity model
    - (Inquiries allowed)

Creativity



- Business model concept, best practice & working groups

Business model concept

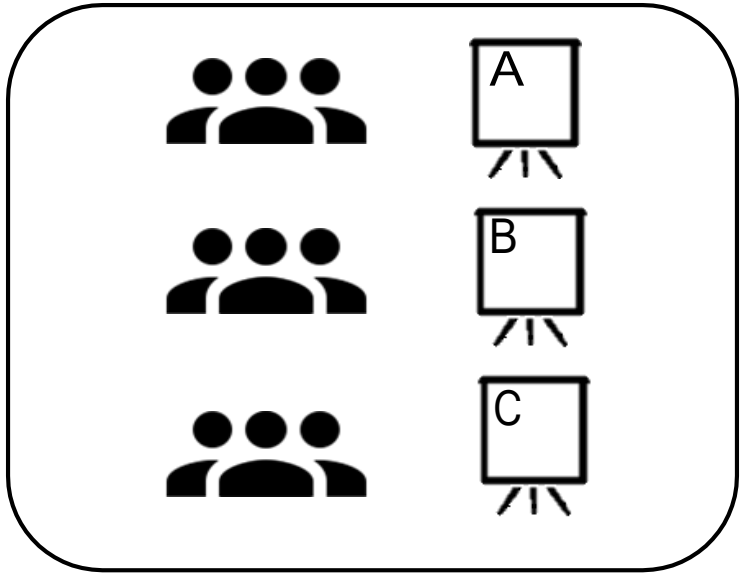


Project concepts according to St. Gallen BM-Concept

Examples

ca. 30 minutes

Subject-specific groups



Working groups are formed on the selected topics

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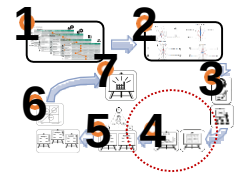
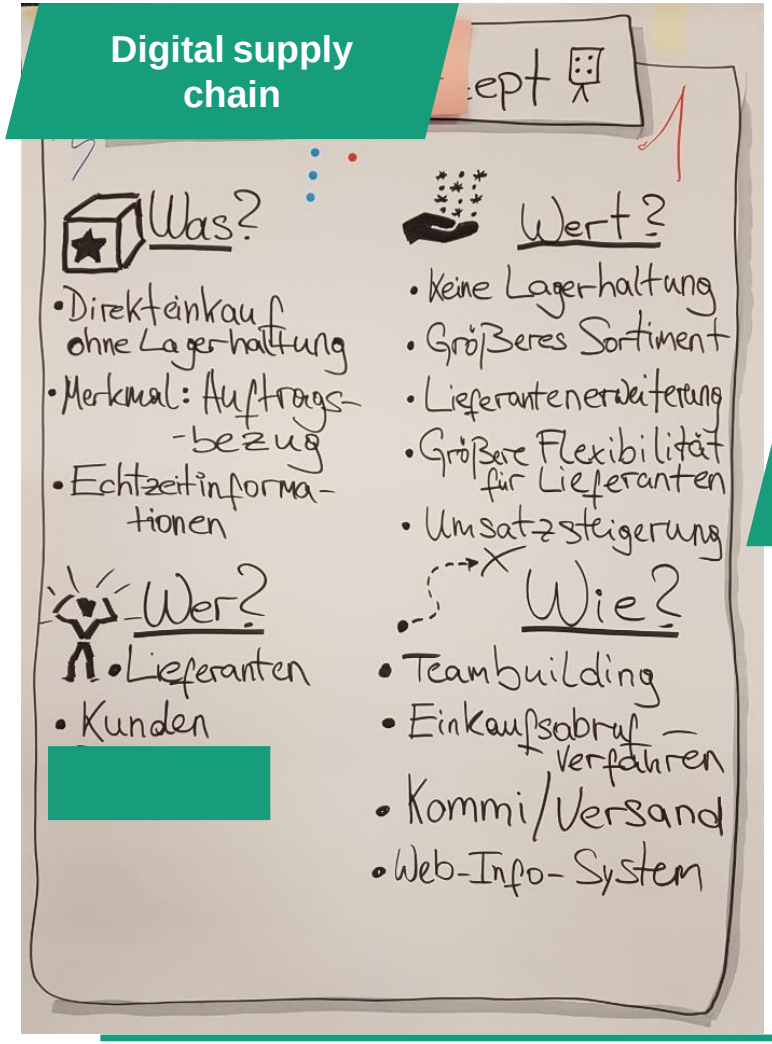
Best Practice Examples

Best practice

- Examples of concepts from other workshops

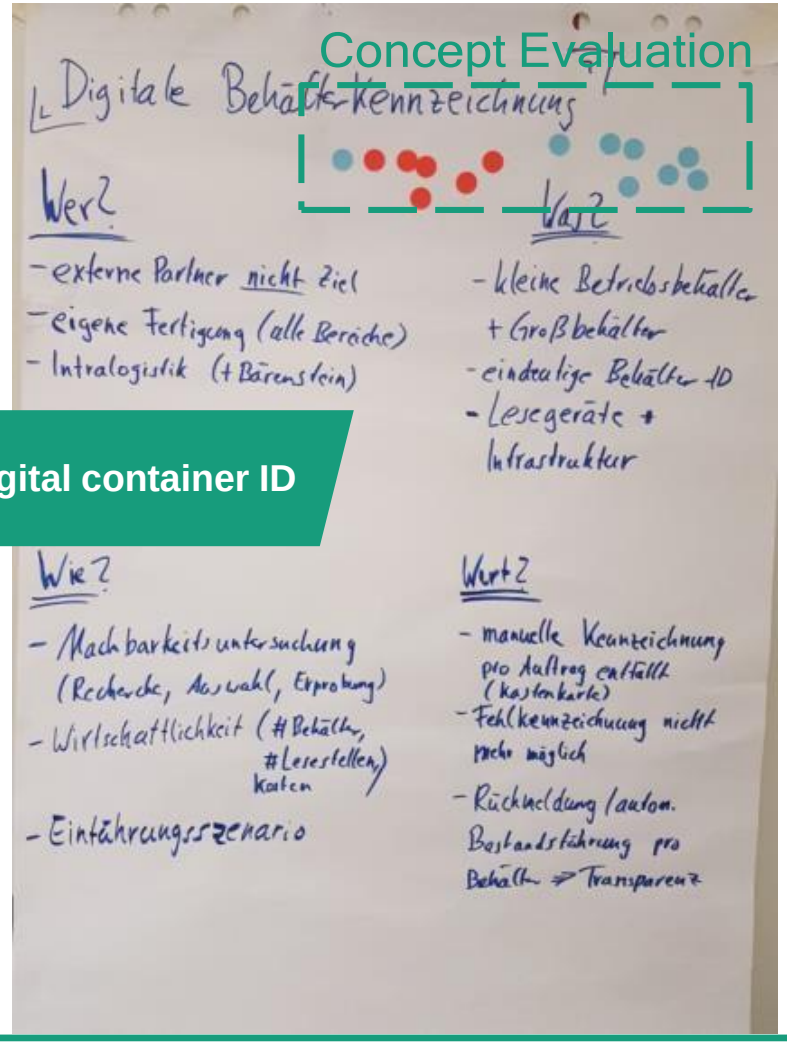


Digital supply chain



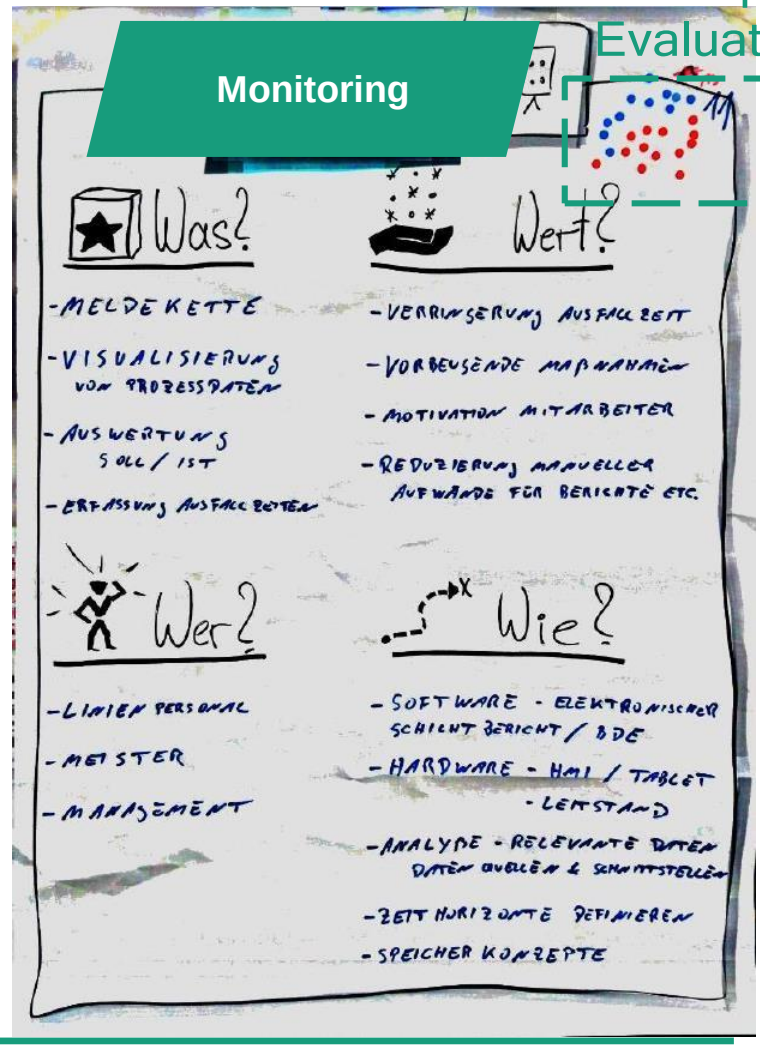
Concept Evaluation

Digital container ID



Concept Evaluation

Monitoring



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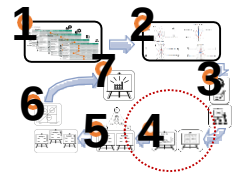
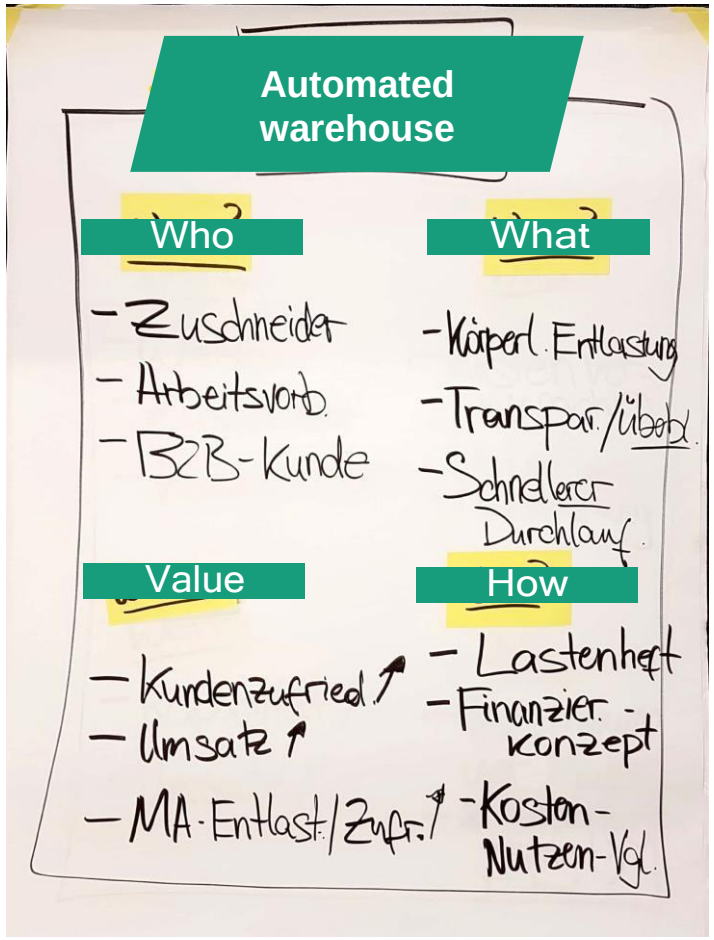
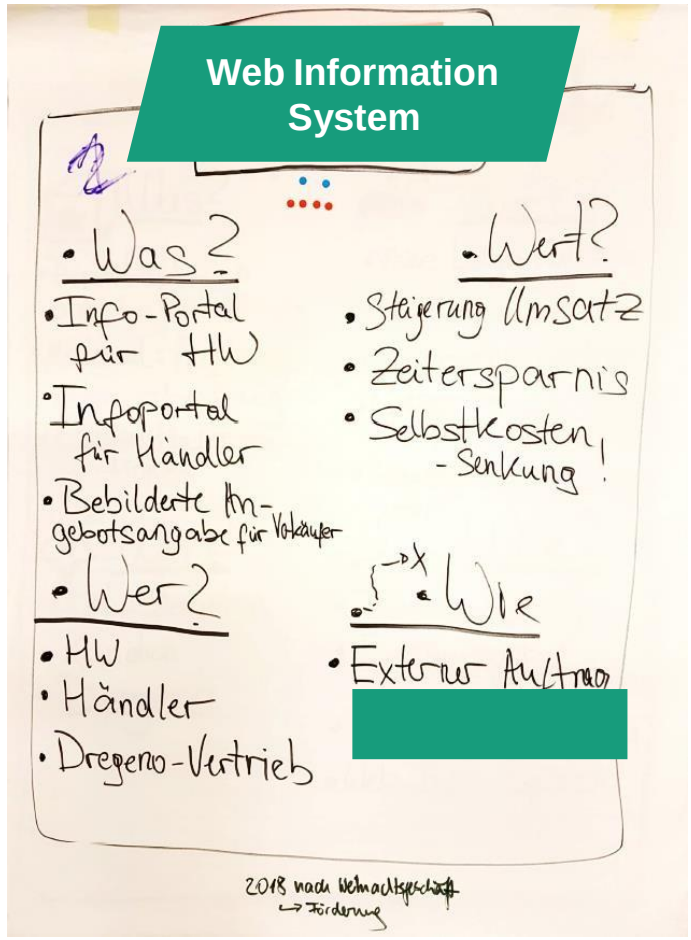
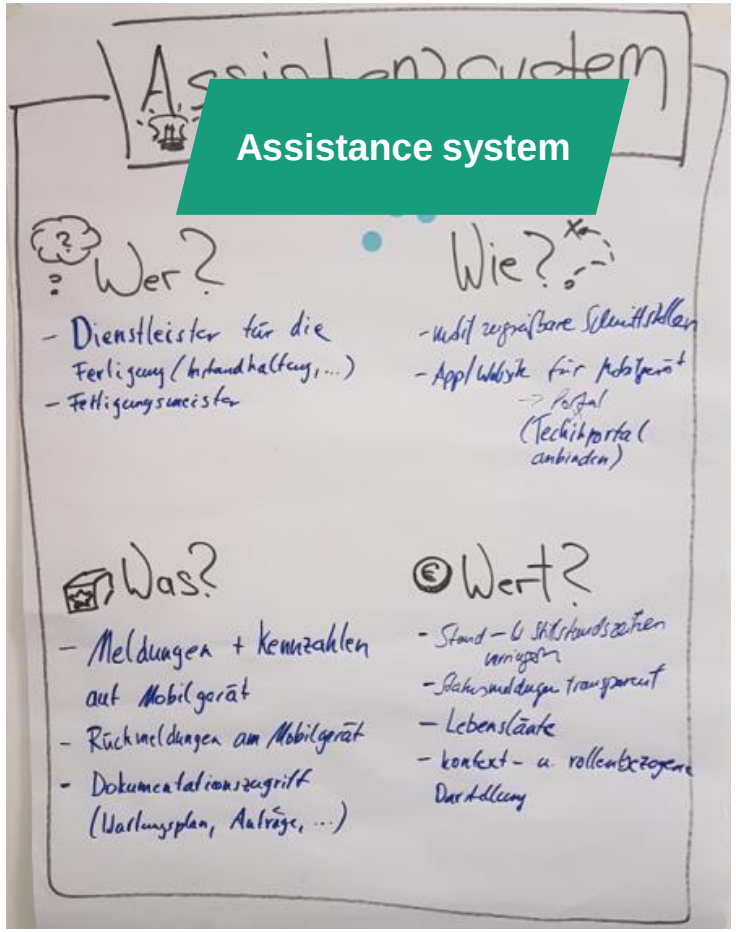
Best practice



- Examples of concepts from other workshops

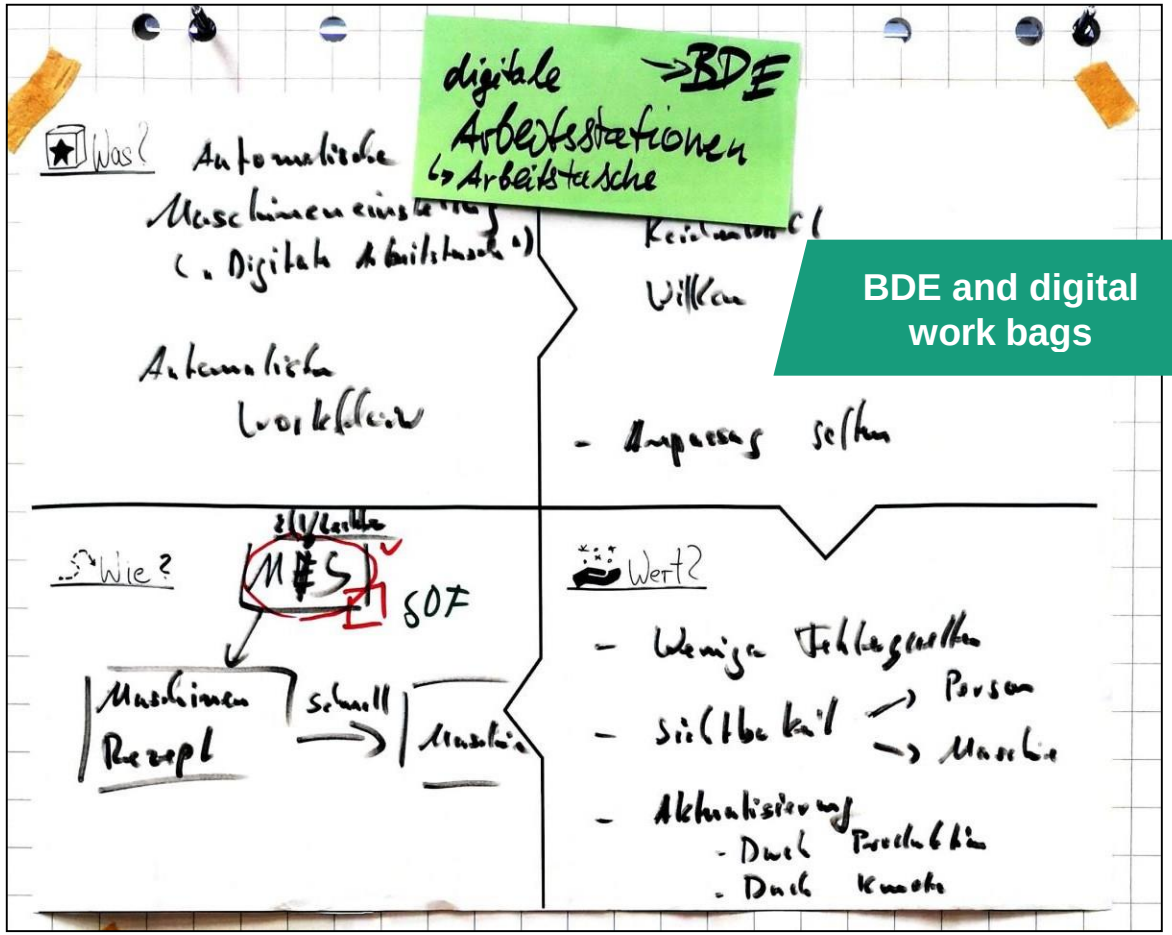




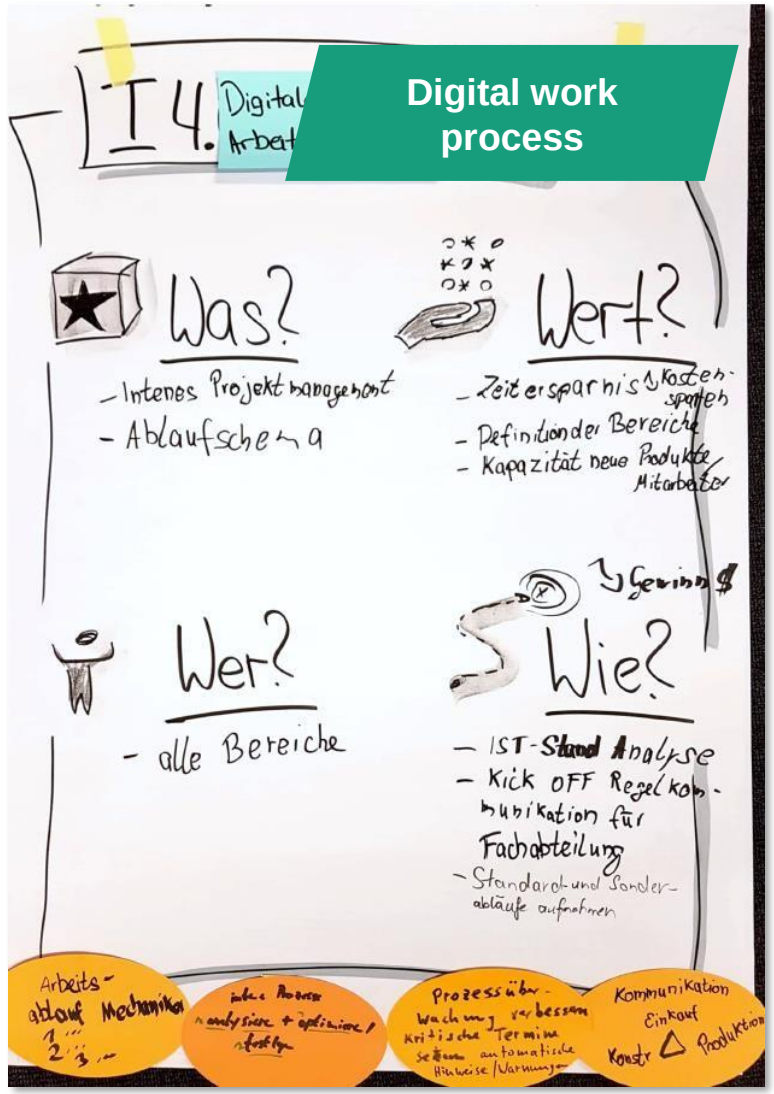


Best practice

- Examples of concepts from other workshops



BDE and digital work bags



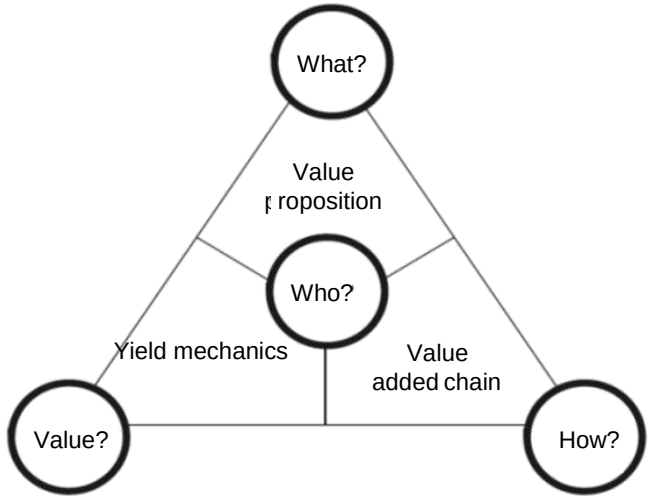
Digital work process


Developing concepts

Productivity

- Develop and present digitalization concepts

Develop



Further development of the four dimensions

1. **What?**

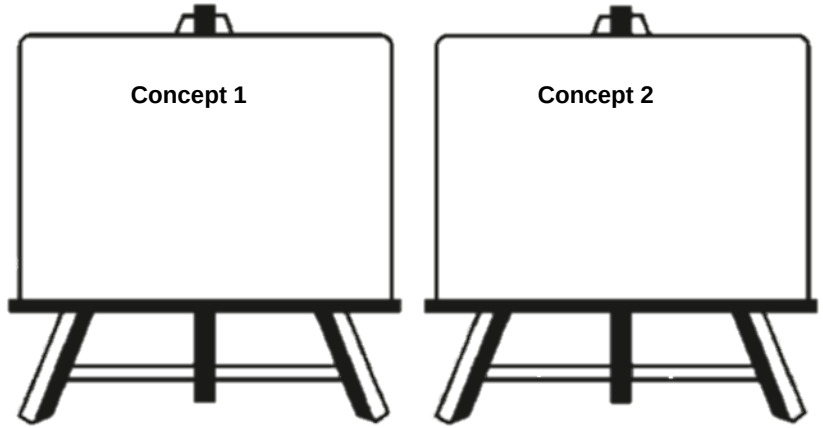
   What do we offer our customers/ employees?

2. **Who?**

   Who are our target customers? - Consumer / Employee?

ca. 60 min

Present



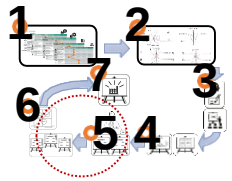
3. **Value?** Presentation and discussion of the concepts

   How is value achieved & how high is it estimated?

4. **How?**

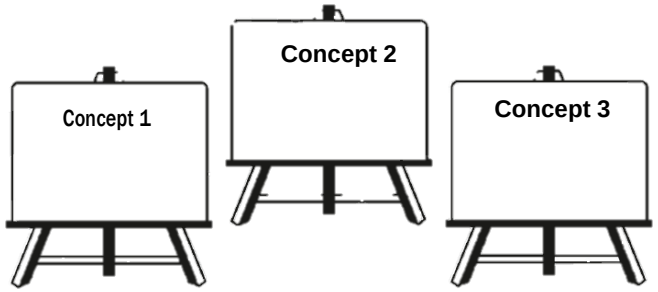
   How do we make the service?

Evaluation



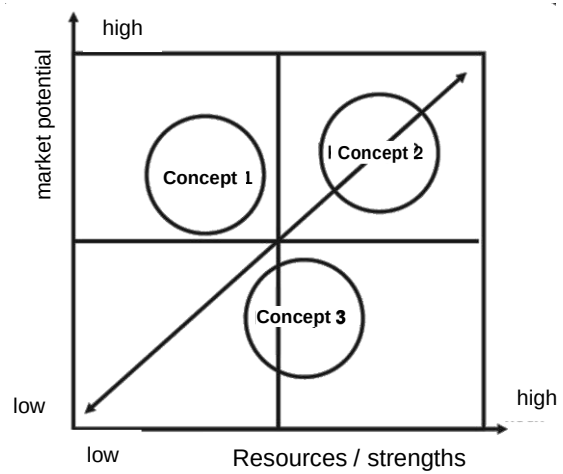
- Evaluate concepts based on their potential for success and feasibility

Evaluate & prioritize



Two points per participant for
Market potential and resources / strengths

ca. 30 min



Potential Feasibility Matrix

- Evaluation of all concepts
- Determining which idea (s) should be translated into concrete implementation
- Responsibilities

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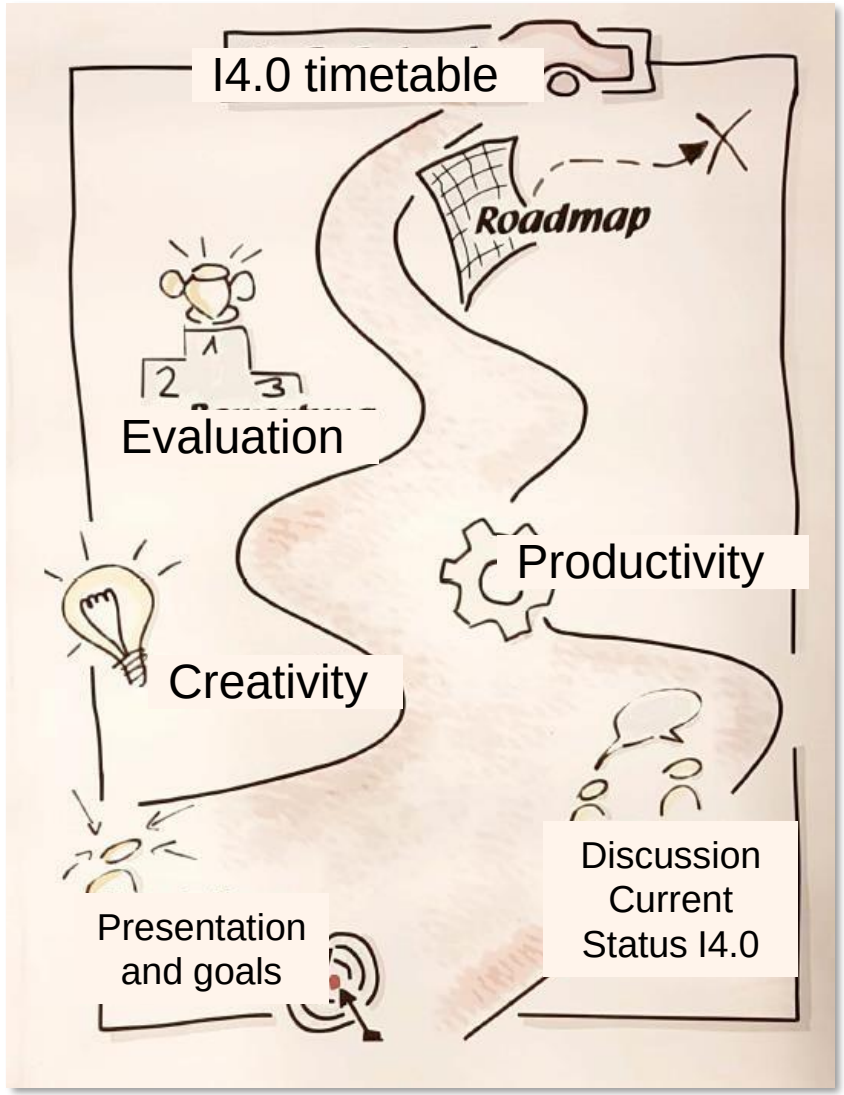
Roadmap

- Goals & next steps
  - Next steps will be agreed on within the workshop

Link to the selfcheck: https://betrieb-machen.de/selfcheck



Agenda

1| Welcome and introduction

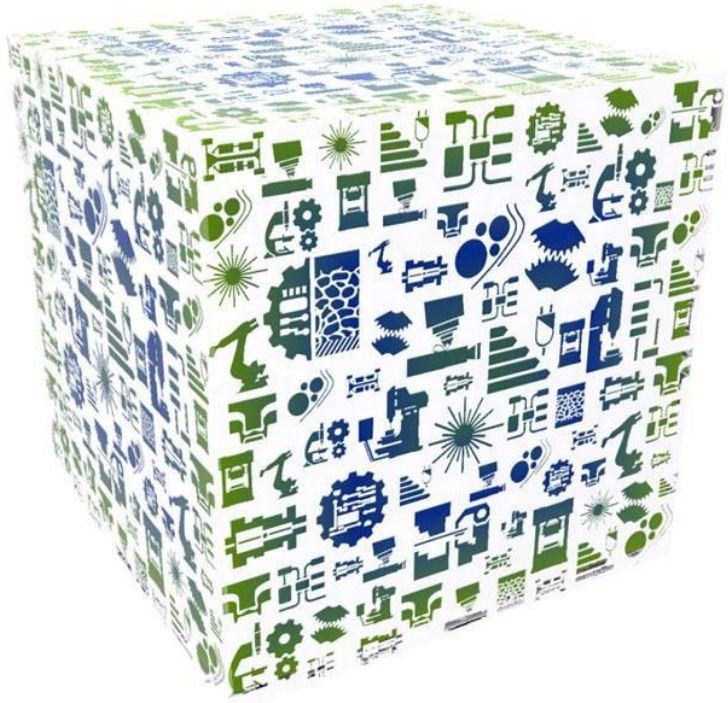
2| Classification and objectives of the workshop

3| Current Status I4.0 of an example company

4| Conceptual Work: Ideas – Concepts

5| IIoT Experiences

6| Networking



IIoT Experiences

Modular toolkit digitalization

Industrial IoT

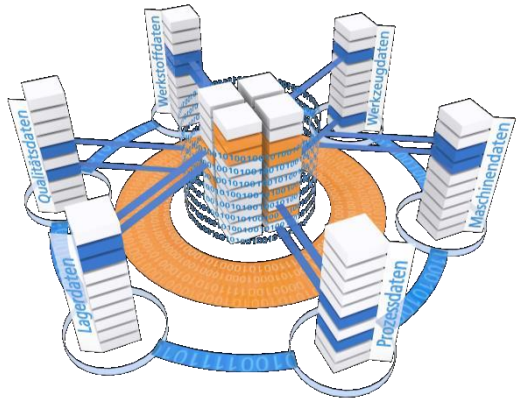
Smart Systems

- Adapters for existing machines
- Linkage of process chains

Smart objects

- Auto-ID: identification and tracking
- Real-time localization
- digital product memory

Linked Factory



- Digital models
- Machine and process data
- Modular interfaces

Smart Production

Visualization and interaction

- Mobile and portable devices
- Virtual and augmented reality
- Assistance systems and programs

Analytics and data science

- Big data methods
- Visual analysis
- Machine learning

Production IT and services

VFK - Secure decentralized cloud

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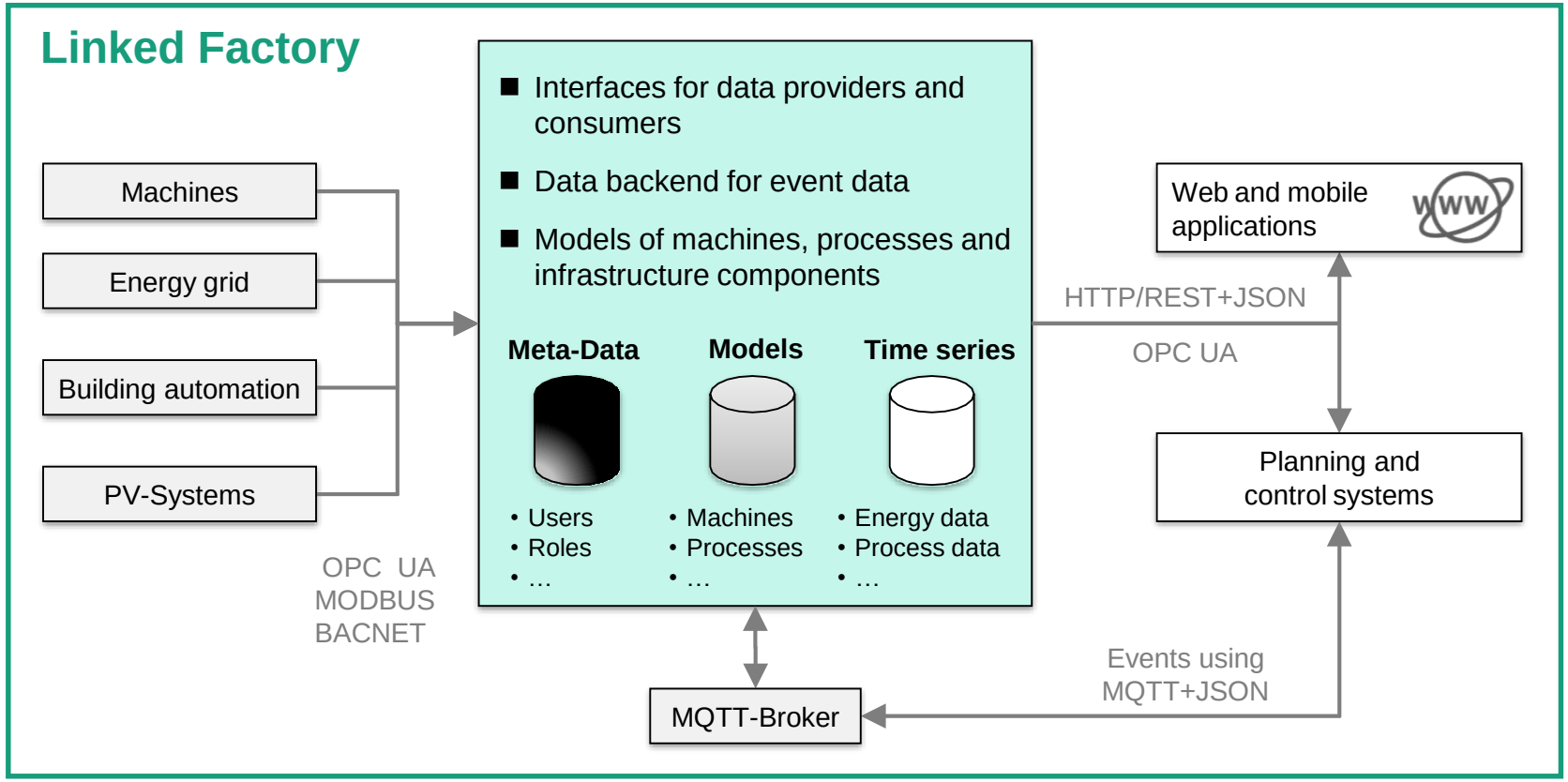
Data architectures for industrial production

- Linking of data from Excel, MES and other sources
- Design of uniform APIs (Micro Services)
- Cloud- and Edge-Computing-Architectures
- Meta data management



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IIoT Experiences

- Intelligent product display

Product display in specialist shops

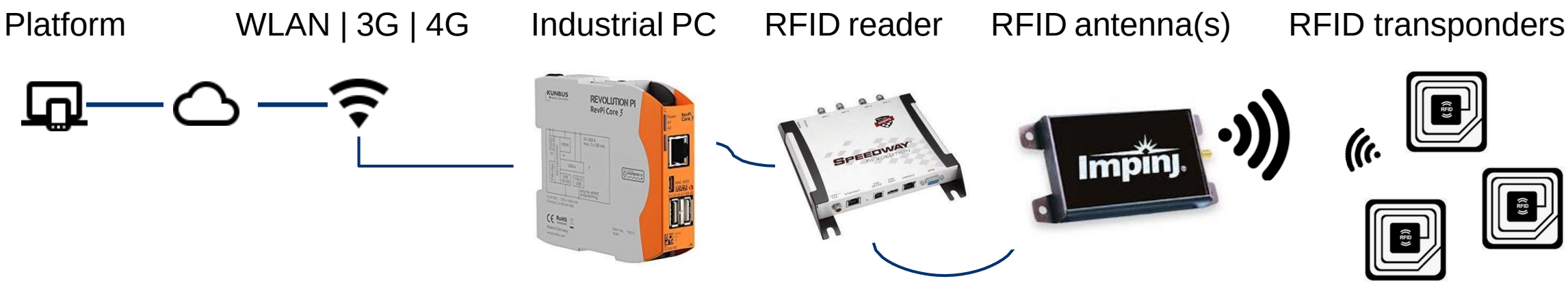
Inventory data in the supplier's warehouse

IIoT Experiences

- Intelligent product display

  The aim of the project was to pilot an overall concept for self-sufficient product displays.

- Overall system
  - Platform independent edge and cloud software
  - zero configuration on site
  - Standard RFID hardware 868 MHz
  - Internet connection required (WLAN / 3G / 4G)

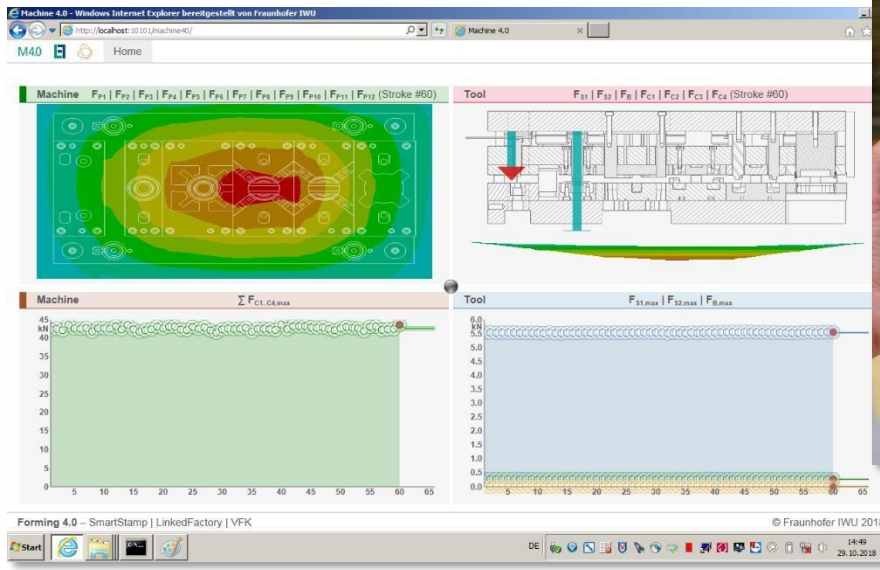


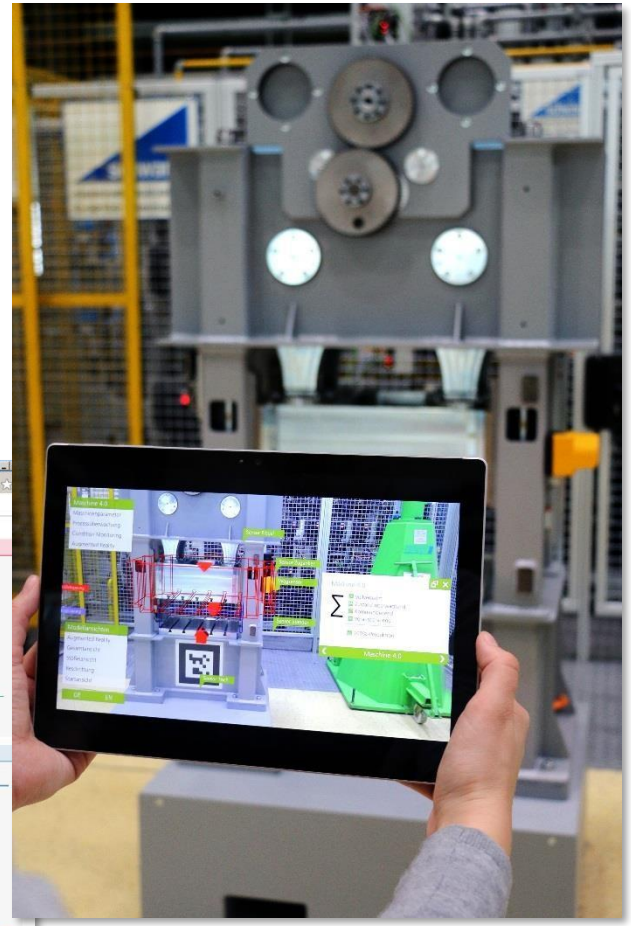
IIoT Experiences

- Transparent forming press
  - Holistic processes

1. Acquire data: Integrated sensors in press table, tool, frame
2. Process data: storage in a central database
3. Output data: Enrichment of 3D models with real data

- Data usage for:
  - Equipment condition monitoring
  - Retrospective process evaluation
  - Analyze time series data
  - Wear monitoring





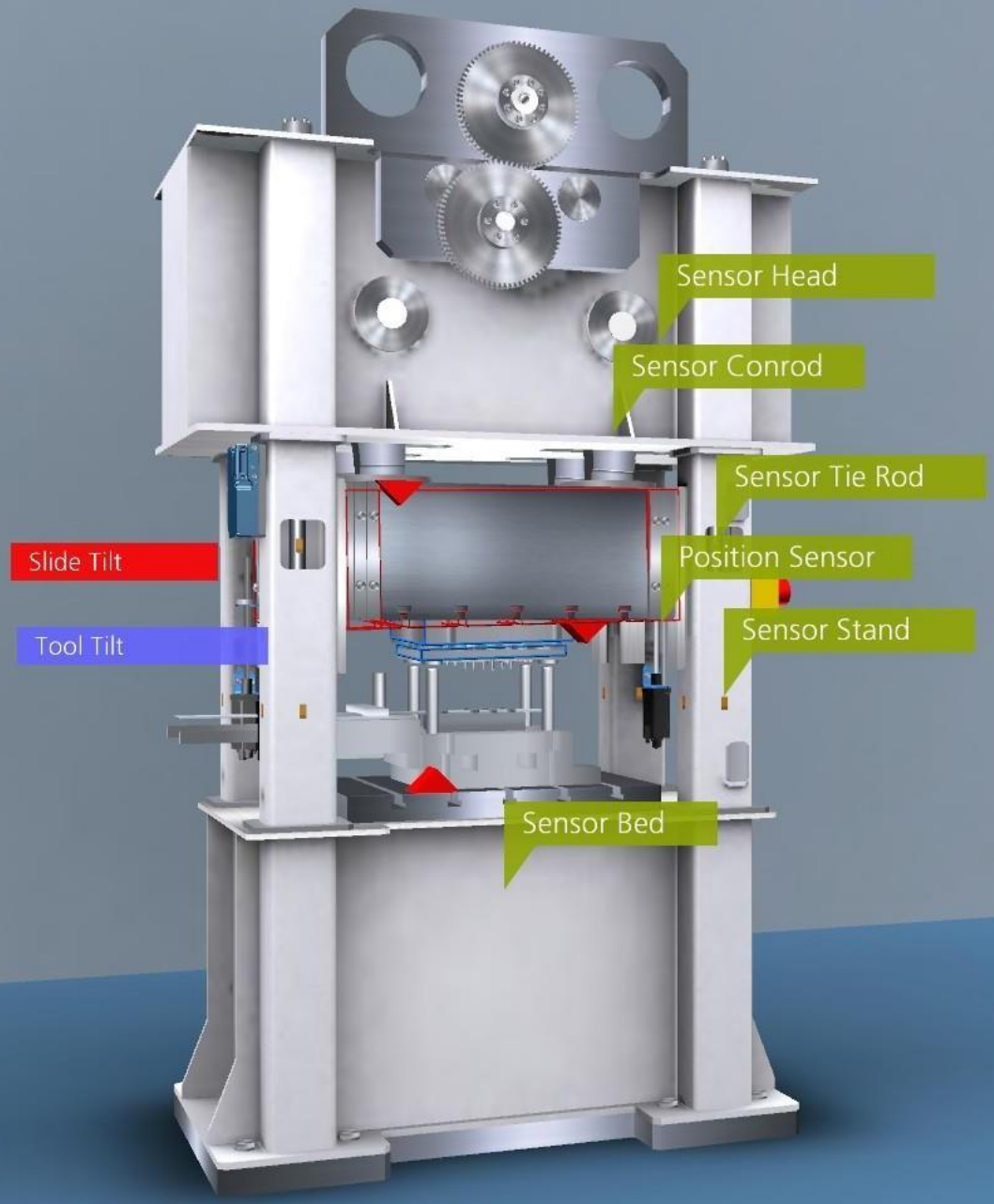
Machine 4.0

- Machine Parameter
- Process Monitoring
- Condition Monitoring
- Augmented Reality

Model Views

- Augmented Reality
- Total View
- Stamp View
- Labeling
- Housing

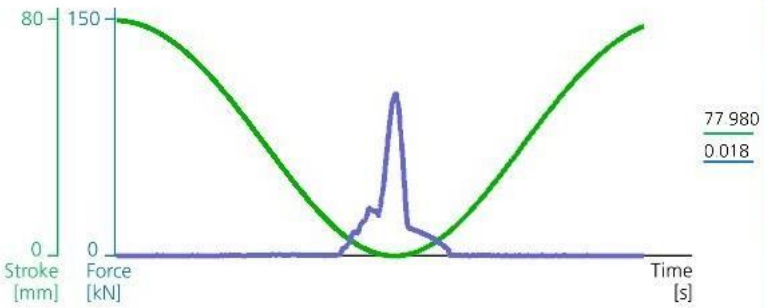
DE EN



Slide Shift [mm]		Force [kN]	
Pos. Sensor 1:	-0.004	Stand 1:	0.132
Pos. Sensor 2:	-0.052	Stand 2:	0.002
Pos. Sensor 3:	0.026	Stand 3:	-0.016
Pos. Sensor 4:	-0.036	Stand 4:	-0.100

Stroke Rate [1/min]		Force [kN]	
Current:	6.000	Tool 1:	-0.453
		Tool 2:	-1.091

Condition Monitoring

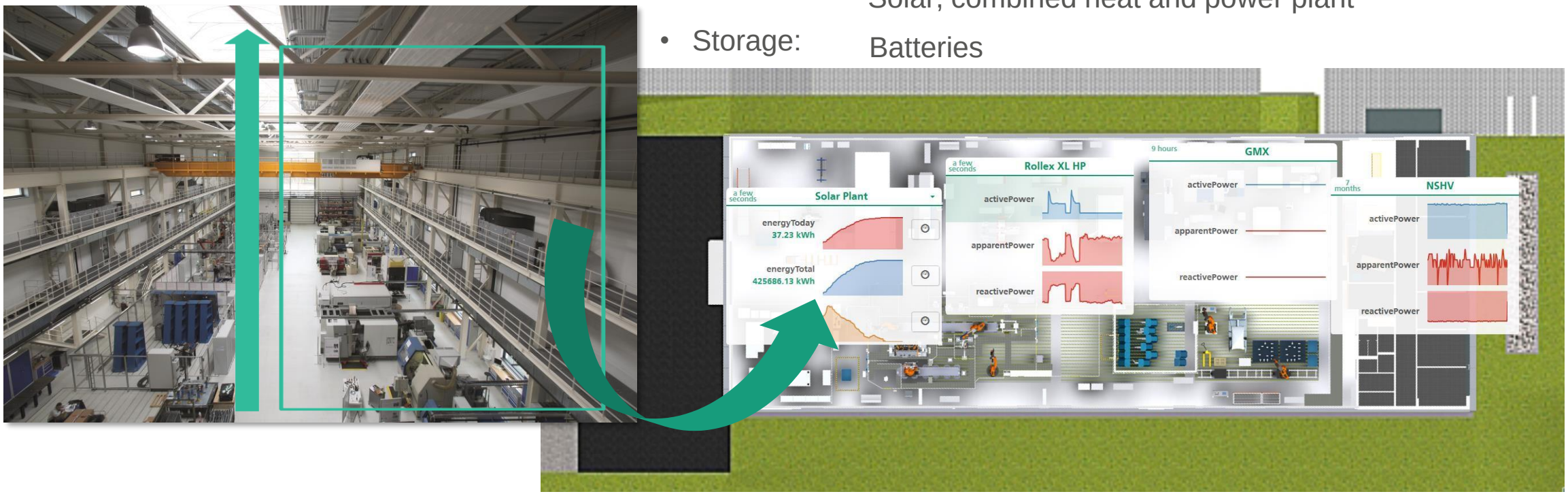


Process Monitoring

IIoT Experiences

- E3 research factory
  - Energy balance of a manufacturing system

- Consumer: machinery and equipment
  Electricity, pneumatics, hot and cold water, building services
- Producer: Solar, combined heat and power plant
- Storage: Batteries



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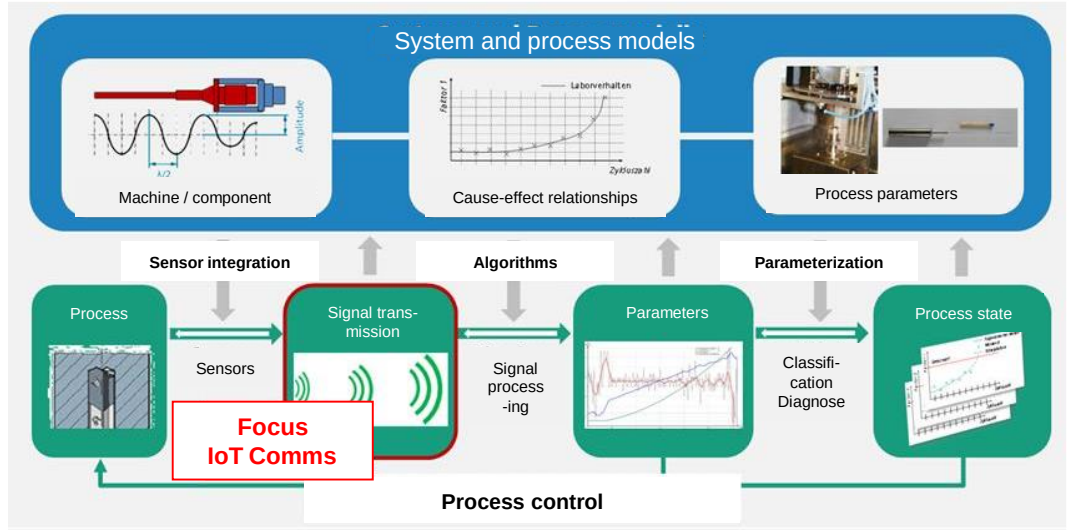
CCIT – Fraunhofer Cluster of Excellence Cognitive Internet Technologies

- The CCIT develops cognitive internet technologies for industry

- The demonstrator:
  - Use Case: Process monitoring in machining
  - Functional integration of actuators, sensors, data processing and communication in **one modular component**
  - **Secure, low-latent, real-time capable** and **wireless** data transmission
  - Overarching goal: **Active tool for process control**



Any questions?

Thank you for your attention

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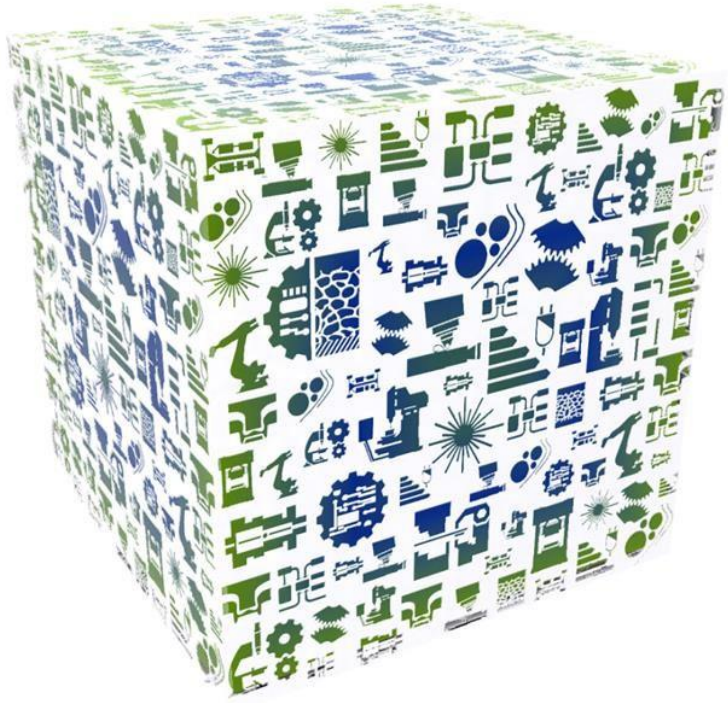

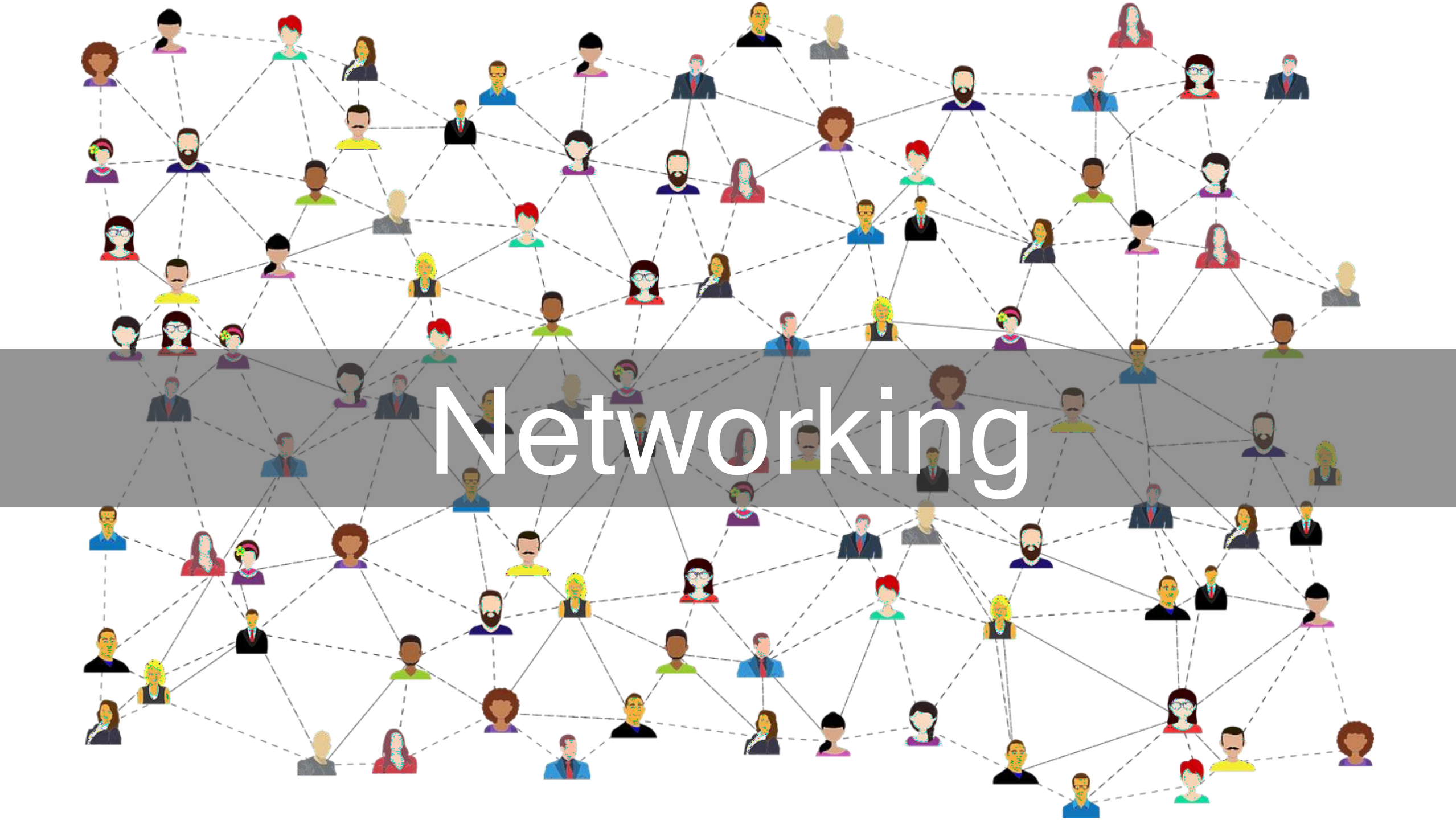
Networking

References (images)

List of References

Icons for Produkct & Production: Anderl, R. (2015): Leitfaden Industrie 4.0. Orientierungshilfe zur Einführung in den Mittelstand, Frankfurt am Main: VDMA-Verl.

Icons8: https://icons8.com/, last checked 18.05.2020

TOP-Icons: https://material.io/icons/, last checked 17.07.2017

Product-Icon: Created by Gregor Cresnar – Noun Project, last checked 17.07.2017

Factory-Icon: Created by Amelia Wattenberger – Noun Project, last checked 17.07.2017

Remaining Icons: Noun Project – Vicon Designs, Alvaro Bueno, Maxim Kulikov, Joe Artcon, Ralf Schmitzer, Alena Artemova, Gregor Cresnar, Oliviu Stoian, Arafat Udin, Royyan Wiljaya, Josh Sorosky, zuletzt geprüft am 17.07.2017

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