SUPPORTING SME IN TAKING UP INDUSTRIE 4.0 AND DIGITALIZATION SOLUTIONS

Christian Blobner, Prague, May 30, 2018

Univ.-Prof. Dr.-Ing. Michael Schenk

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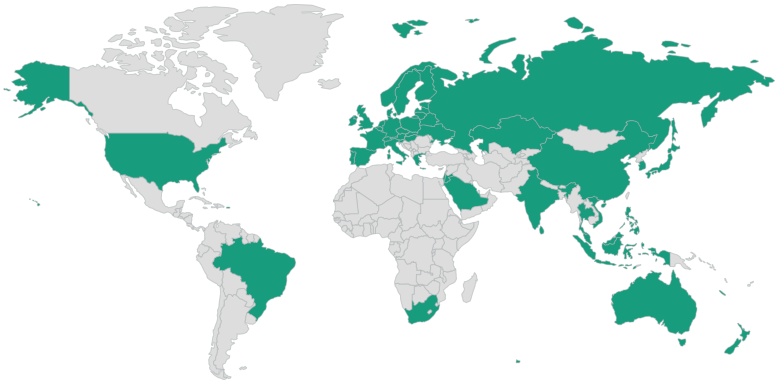
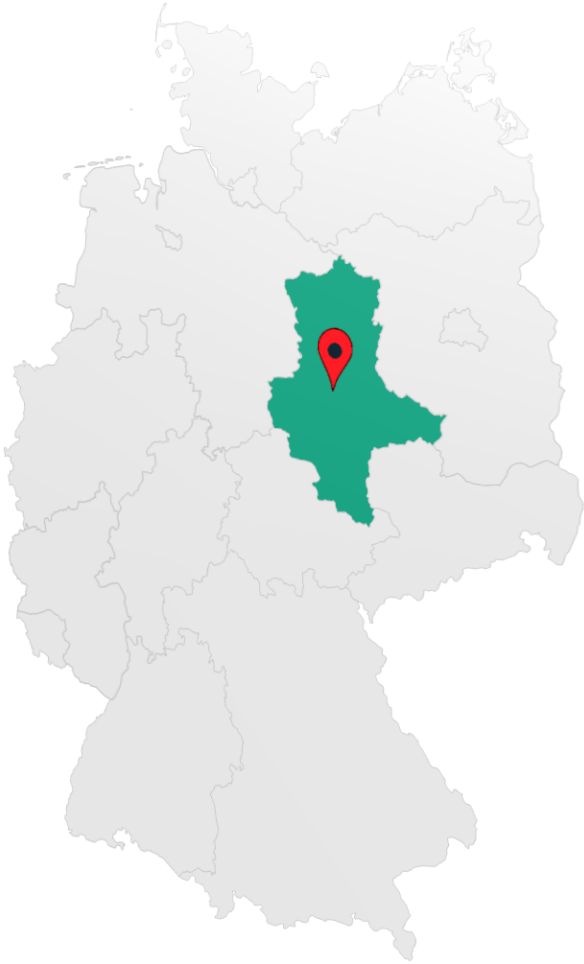
Your Technology Partner for Applied Research in Saxony-Anhalt

- 188 employees
- Research budget €19.6 million
- Operates two research buildings incl. various laboratories
- Project office in Bangkok, Thailand
- Active on six continents

- Institute Director: Prof. Michael Schenk





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Fraunhofer IFF as Technology Partner

Providing a systems' perspective on the factory

Business Units

- Virtual Engineering
- Convergent Infrastructures
- Logistics and Factory Systems
- Material Handling Engineering and Systems
- Measurement and Testing Technologies
- Biosystems Engineering
- Robotic Systems

Fields of Research

- Smart Work Systems 
- Resource Efficient Production and Logistics 
- Convergent Supply Infra-structures 

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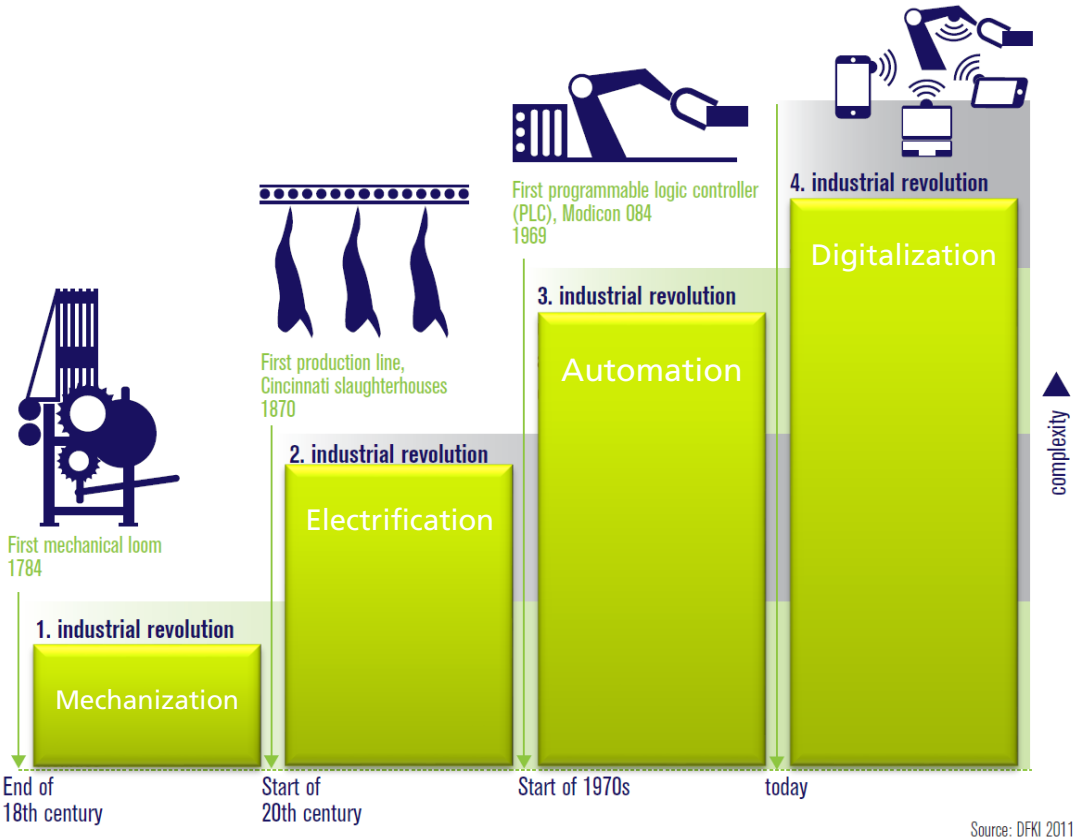
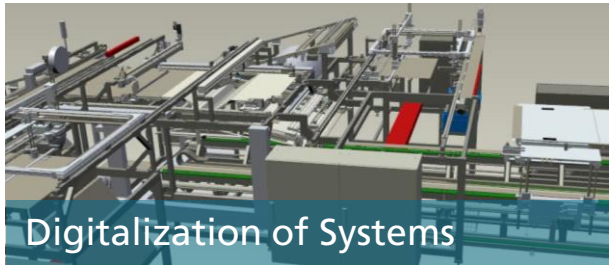
Industrie 4.0 realization at the Fraunhofer IFF

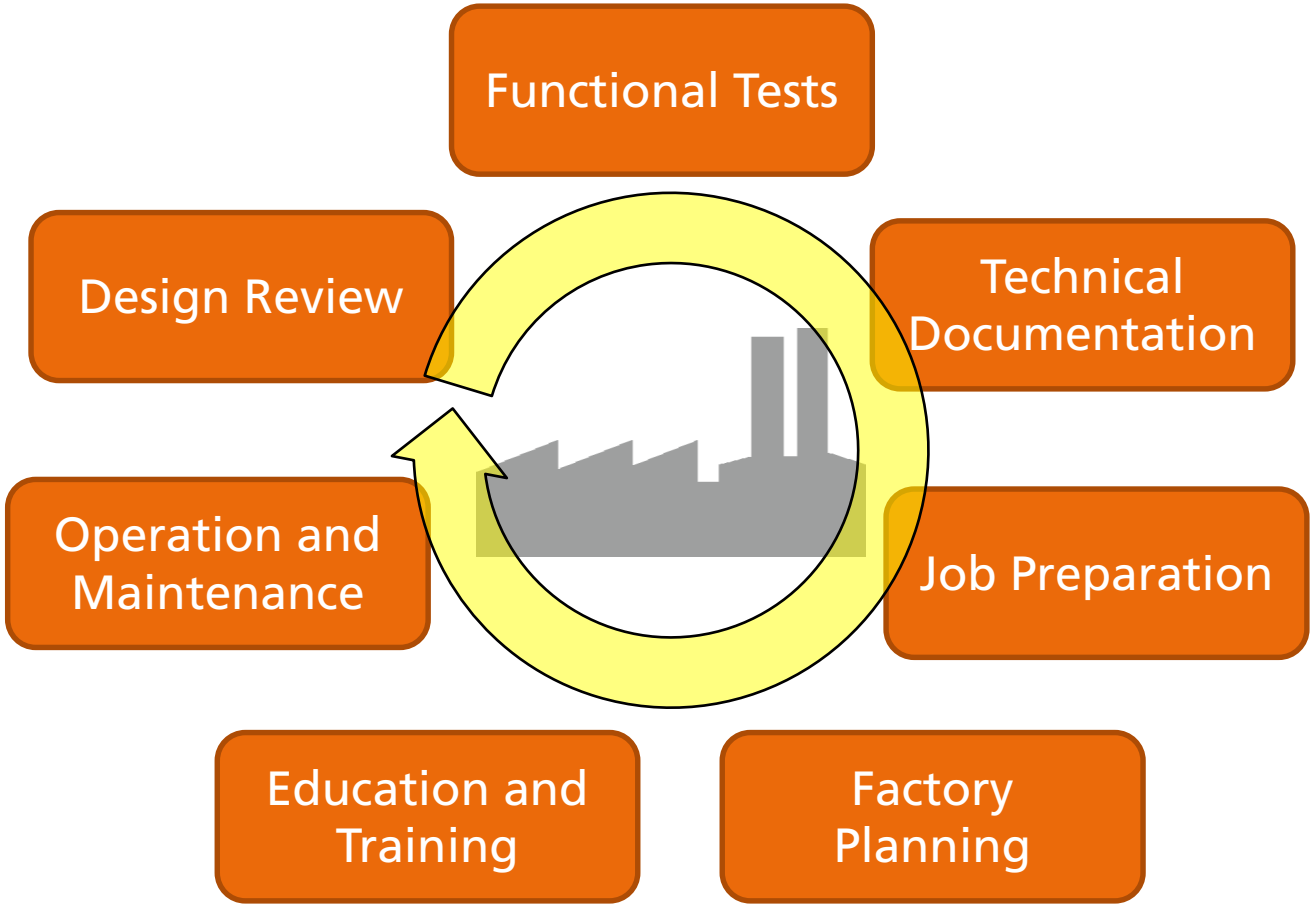
Digital Technologies as Enablers of Industrie 4.0





Source: acatech 2013,
http://www.acatech.de/fileadmin/user_upload/Baumstruktur_nach_Website/Acatech/root/de/Material_fuer_Sonderseiten/Industrie_4.0/Final_report__Industrie_4.0_accessible.pdf

Digital Technologies as Enablers of Industrie 4.0
Digital Engineering and Operation



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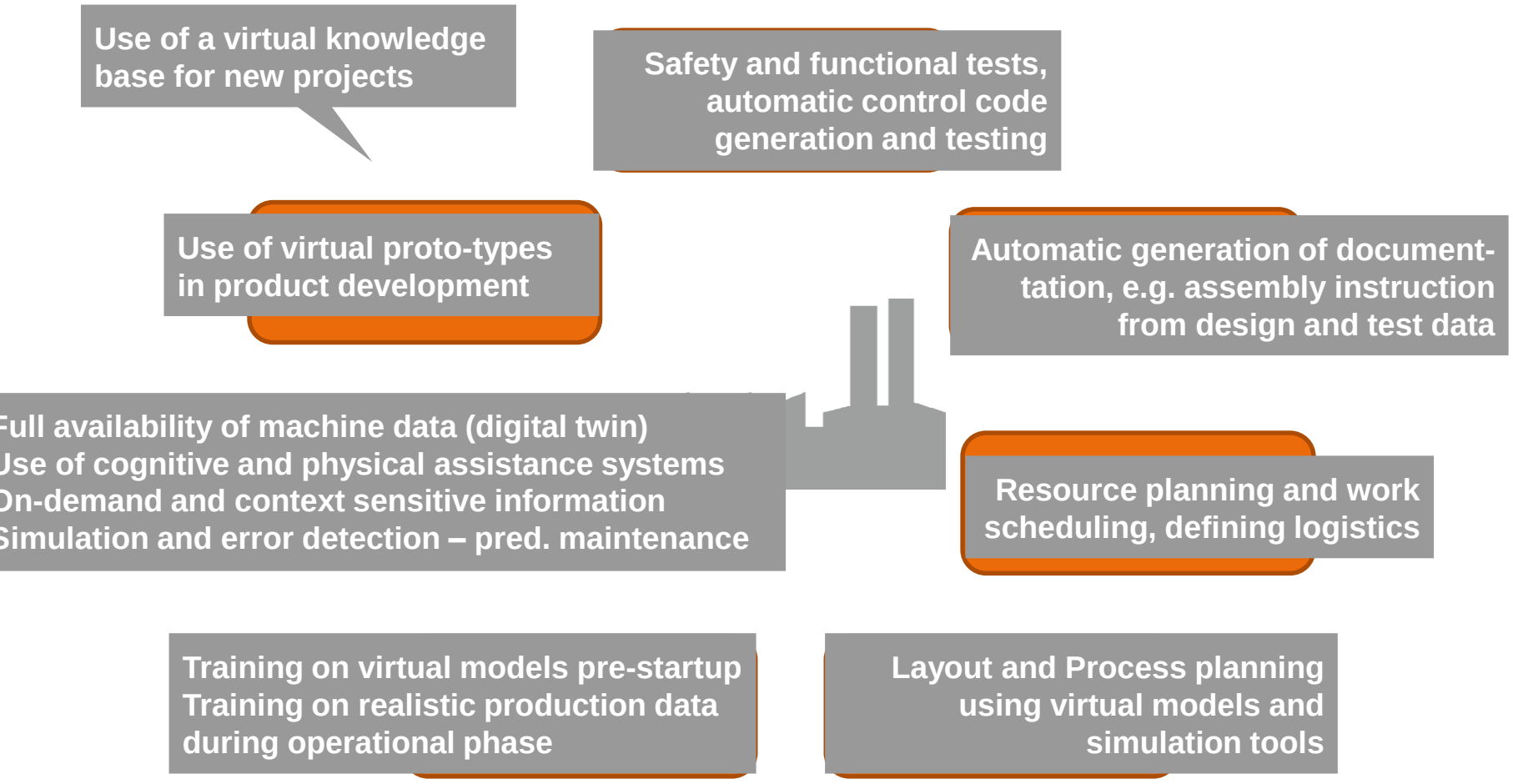
Digital Technologies as Enablers of Industrie 4.0
Digital Engineering and Operation



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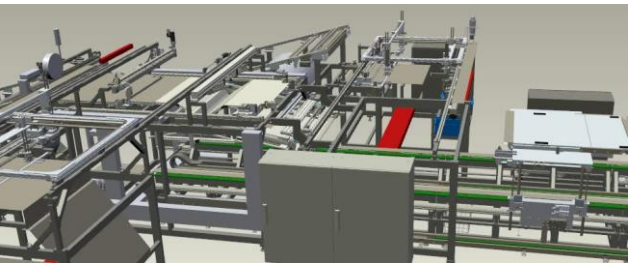
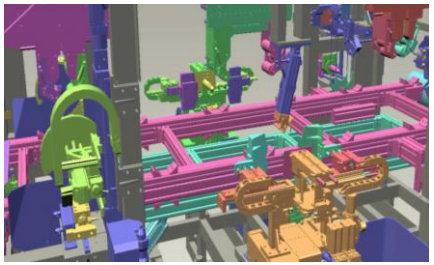
Virtual technologies as enablers of Industrie 4.0

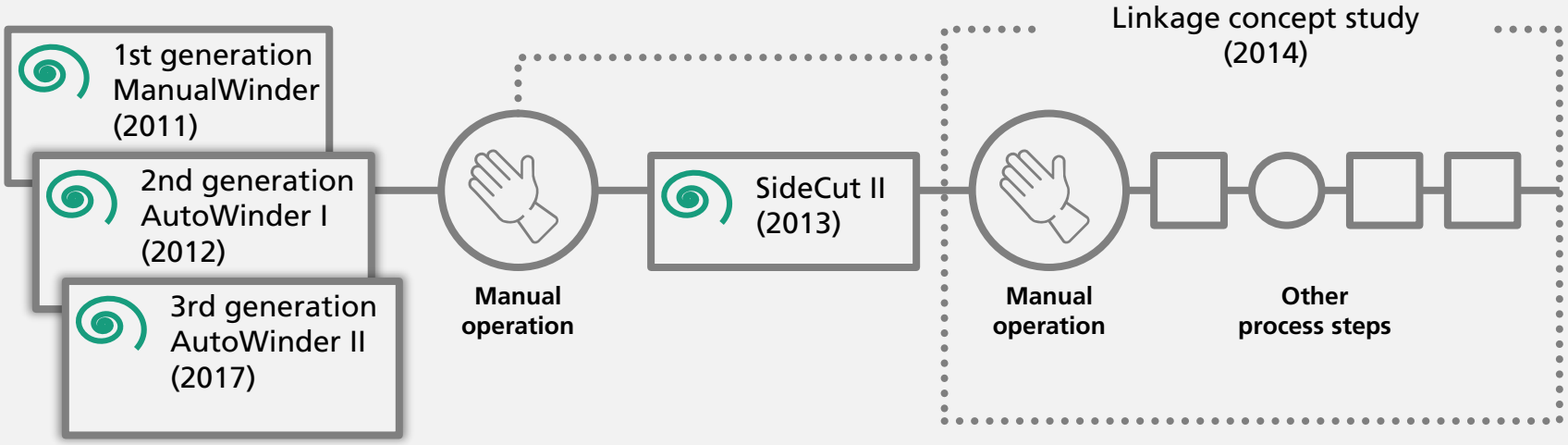
Integrated and Parallel Product and Manufacturing System Design for LANXESS AG





- Use of virtual models to plan, develop and prototype the manufacturing system for innovative water filters in parallel to the product development process

Planning and development of several (semi) automated manufacturing systems
Goal: Fully automated production facility (2020)



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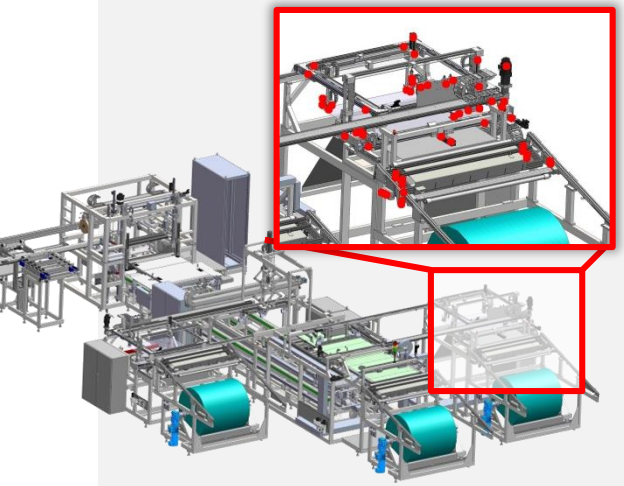
Virtual technologies as enablers of Industrie 4.0

Integrated and Parallel Product and Manufacturing System Design for LANXESS AG

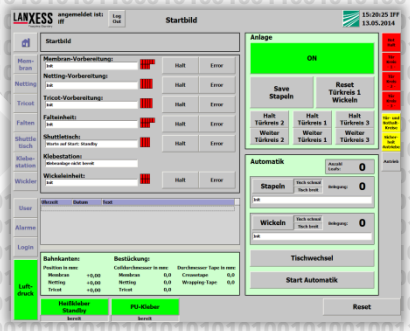
Complexity



AutoWinder 1 consisting of a total of thirteen modules

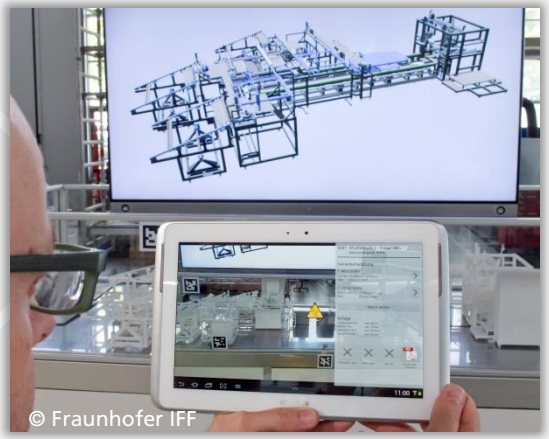
- 10,000 components
- 800 sensors
- 150 pneumatic actuators
- 30 electric drives

Digital Engineering and Operation



- Constant analysis: Analysis of nominal and actual data from the virtual and the real system

Benefits



Functioning Digital Twin:

- Error codes including solution strategies
- Maintenance data
- Supporting operational assistance system

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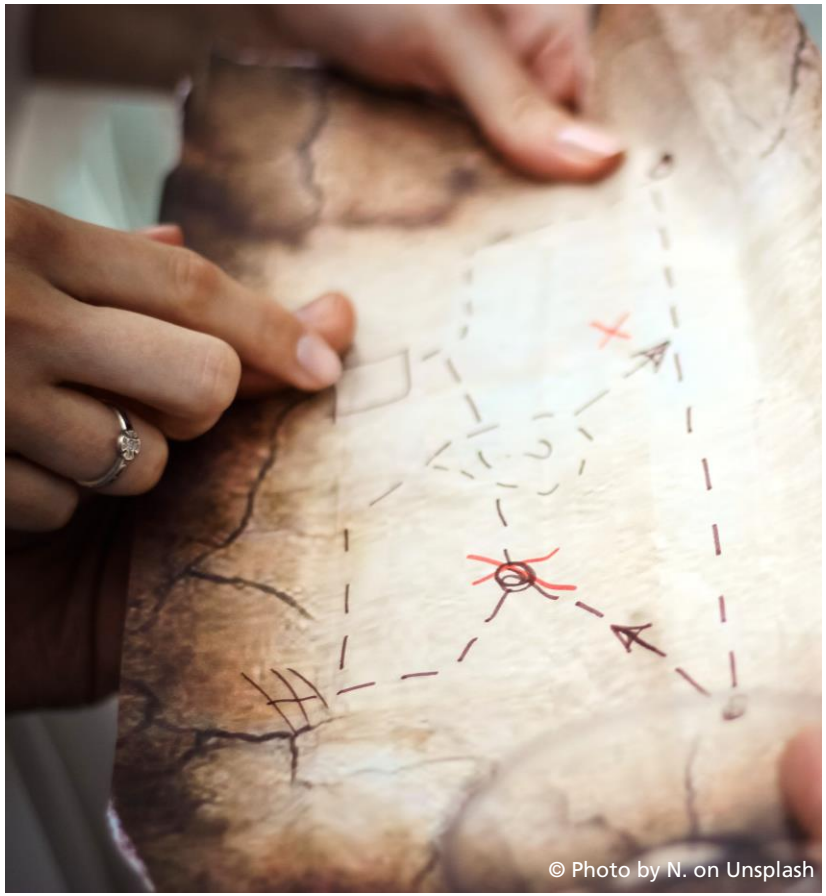
SME and their perspectives on Industrie 4.0
Where do I start?

Prototypical mindset of an SME owner:

- Everybody talks about I4.0, I *need* to do *something*.
- There are a lot of *buzz words* on I.4, which I do not understand – IoT, Industrial Internet, Platforms, Cloud, Machine Learning, AI, HRC…
- On the last trade fair someone showed me an "I4.0-Plug". Do I need *that* and that's enough then?
- Can I be *disruptive*?

What does Industrie 4.0 mean specifically for my company?



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Competition abound
Disruption vs. Evolution

Disruption is easy!

- If you start from scratch and/or do not have any physical assets.
  - E.g. companies like Airbnb, Netflix, Amazon, Uber

Disruption is hard!

- If you have physical and financial assets, investment cycles, customers, supply chains, employees, relevant IP, distribution networks.
- In short if you are an established company as any generic SME
- Big automotive companies will for the foreseeable future stick to their main business models of selling cars based on combustion engines as this is where their core competence and valuable IP lies
  - However, they are testing the waters in data driven business models around providing mobility as a service to customers through apps and car sharing schemes in parallel to their established operations

Competition abound
Rethinking traditional business models

- Rolls-Royce – from selling aircraft engines to selling aircraft mobility as a service
  - Airplane manufacturers do not buy a piece of equipment but operation time of an engine
- Rolls-Royce is able to exploit full life-time data to enhance reliability
  - Real-world use data for ongoing product development processes
  - Actual status of engine for condition-based and predictive maintenance
- New set of incentives for manufacturer and user of engine through service contracts
  - Focus on longevity and reliability

Competition abound

Disrupt the Disrupter – Advantages of Manufacturing Companies

You need to know from where you start to know which direction to take to accomplish your objectives.

- Companies have implicit and/or domain knowledge
- Processes have been established over time
- Communication and data exchange tried and tested
- Appropriate technology mix
- Qualification and experience of staff
- There is a certain way to do business, i.e. corporate and innovation culture

Companies exhibit a specific process- and technology *capability maturity*, which informs the path towards Industrie 4.0 implementation.

This cannot easily replicated by outside competitors

https://twitter.com/elonmusk/status/984882630947753984?lang=en

Approaching SME on Digitalization
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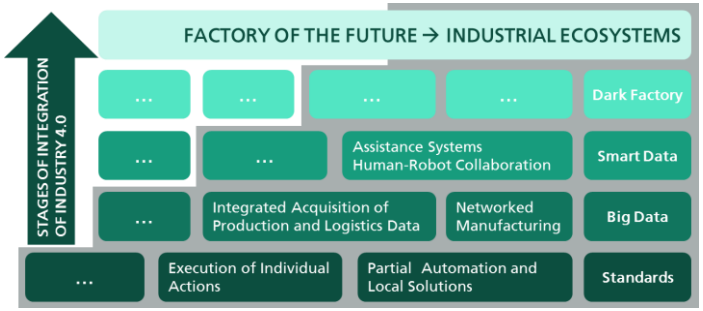
Source: © Fraunhofer IFF



Source: © Fraunhofer IFF

- Providing companies with a realistic maturity assessment within the Industrie 4.0 paradigm
  - Process mapping and visualization;
  - Classification of the company regarding the maturity to absorb new technology and/or processes;
  - Estimation of potential efficiencies and “ROI”;
- Roadmap development for evolutionary transition and exploitation of digitalization benefits
  - Derivation of short-, medium- and long-term measures for implementation;
  - Supporting the necessary technology assessment and selection
  - Implementation support
- Implemented for SME, and large OEM in Germany, Spain, Thailand, China and Kazakhstan

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Depicting a company's capability to absorb technology

5	Autonomous supply chain from customer to customer	Networked automated production and logistics systems	Industrial ecosystems
4	Interconnected product structure, process structure and infrastructure	Highly automated subsystems, self-learning control algorithms	Dark factory (fully automated)
3	Linked product and process data	Digital factories, new HMI, assistance systems, human-robot collaboration	Smart factory (smart data)
2	Integrated acquisition of production, quality and logistics data	Documentation, basis for analysis, digital modelling, low cost automation	Transparent factory (big data)
1	Single actions	Semi-automation and local solutions	Local efficiency

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A Standardized Approach for Customized Results

1	Target focusing workshop and awareness of the company	
2	Expert interviews for the analysis of material and information flows	
3	Company classification with regard to the degree of maturity "Industrie 4.0"	
4	Action derivation and assessment of the applications	
5	Link the prioritized actions to a roadmap	

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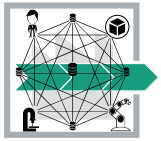
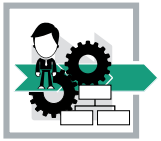
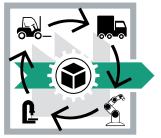
A Standardized Approach for Customized Results

	Actual competences (examples)									
	Marketing / Presale / Selling	Order / Dispatch Center	Procurement	Production / Plant control	Maintenance	Quality / Lab	After Sales / Customer Service	Payment	Human Resource	IT Service / Data Integration
 Qualification of Employees										
 Data collection and processing										
 Assistance systems										
 Networking and Integration										
 Decentralization and Service orientation										
 Self-organization and autonomy										

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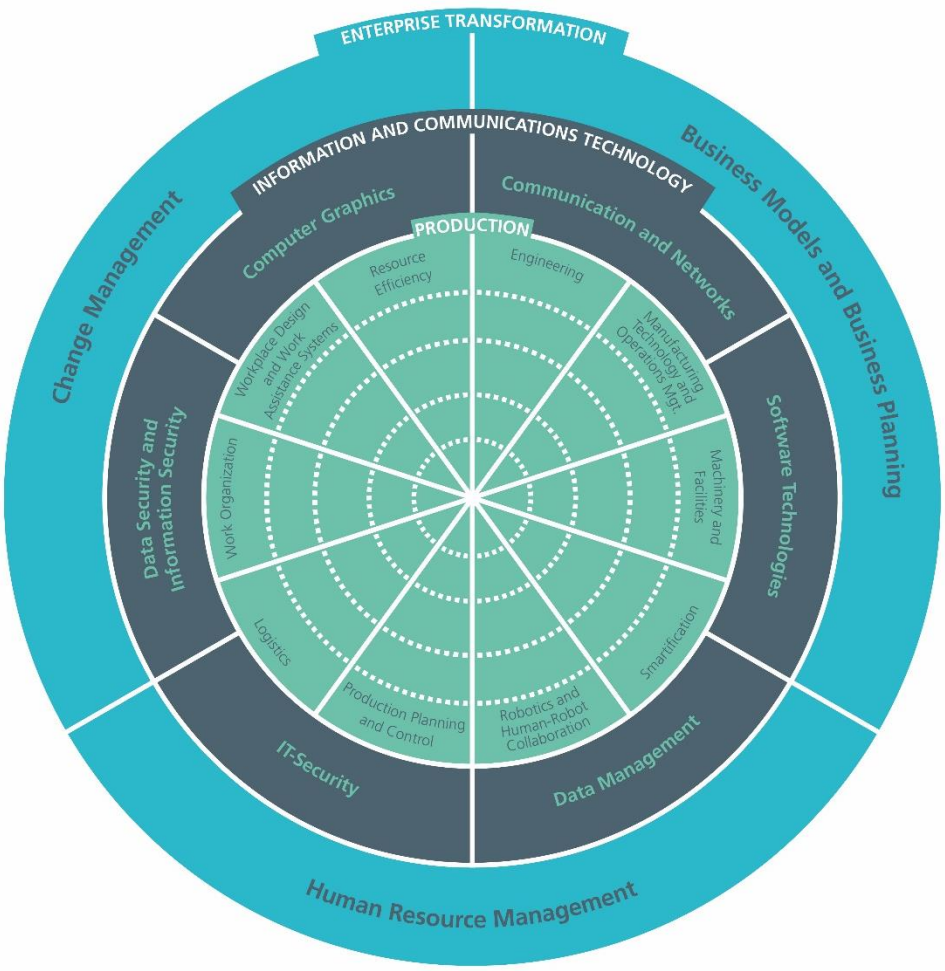
A Standardized Approach for Customized Results



Fraunhofer Layer Model of Industrie 4.0 Value Creation

LAYERS:

- ENTERPRISE TRANSFORMATION
- INFORMATION AND COMMUNICATIONS TECHNOLOGY
- PRODUCTION

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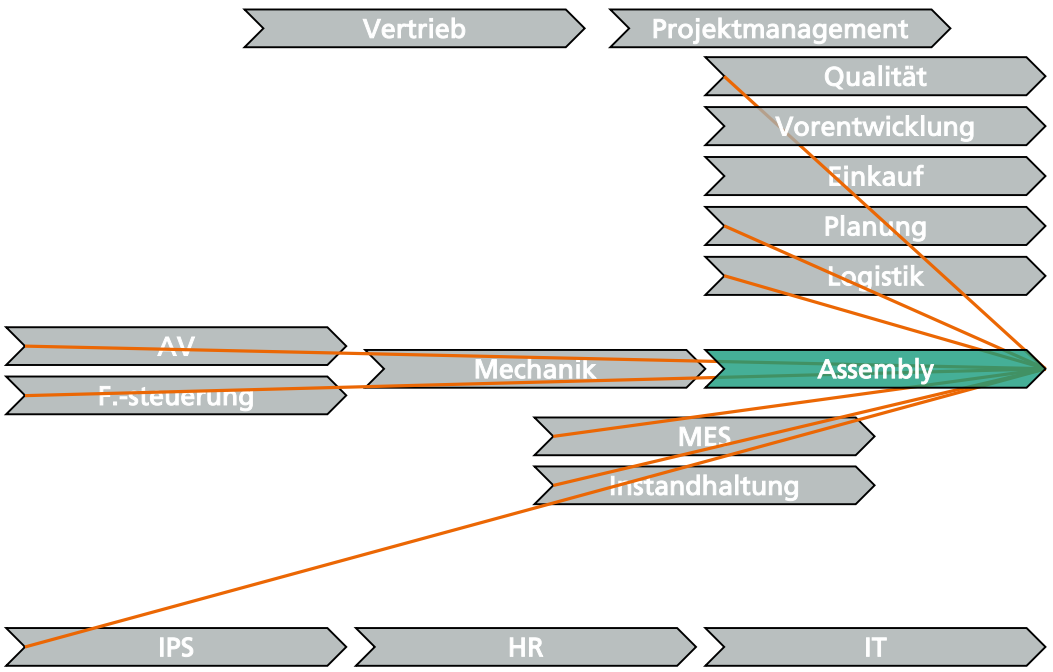
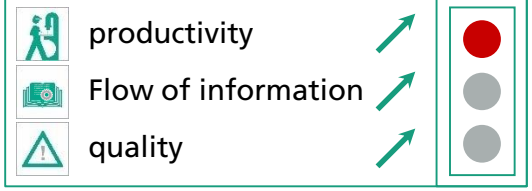
Company Overview – Example



Description

- Individual parts already have DMC for automatic identification and data transfer
- The automatic part identification of the machine and the loading of the associated program are partly performed
- No synchronization of the clock times of the different areas
- Manual data entry (error source PDF)
- Capacitive overload: leaves little room for optimization
- High machine downtimes

Potential rating



communication — by staff — by System

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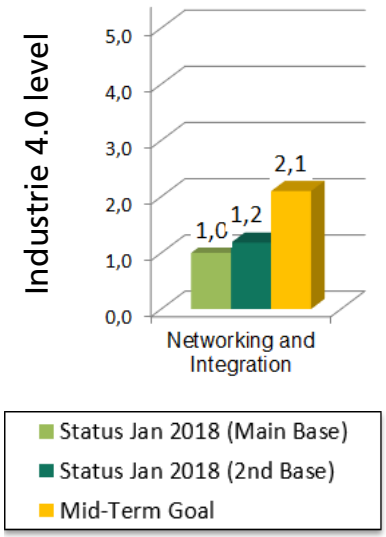
Assessment – Status – Goals – Example

Central Question for I4.0 Principle:

How are machines, units, IT systems, data and information interconnected and integrated inside and outside the company?

Status and Target



topic for proposal

Status

- Many separate IT systems are in use for individual tasks
- Lack of networking of IT systems with machines in production ☆
- Exchange of data between the system requires much manual work ☆
- A centralized data management system exists with the PDM, but with little control for completeness ☆
- Lack of transparency between the processes along the value chain prevents shortening of turnaround time for customer projects ☆

Mid-Term goal (proposal)

- All major IT-Systems are connected (SAP, MES, PLM, CRM, SRM) granting **transparency**
- **Key Information** is exchanged automatically between different systems
- Linked data of requirements, construction, production, quality and service is supplied to **authorized** users through a single interface
- A role based system of **data security** minimizes the risk of data theft

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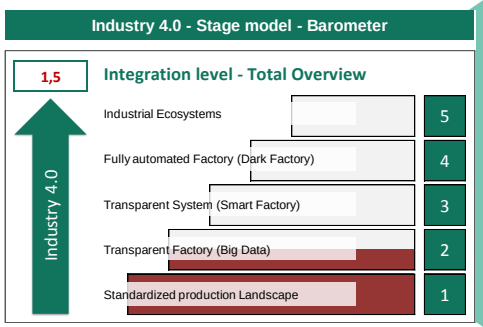
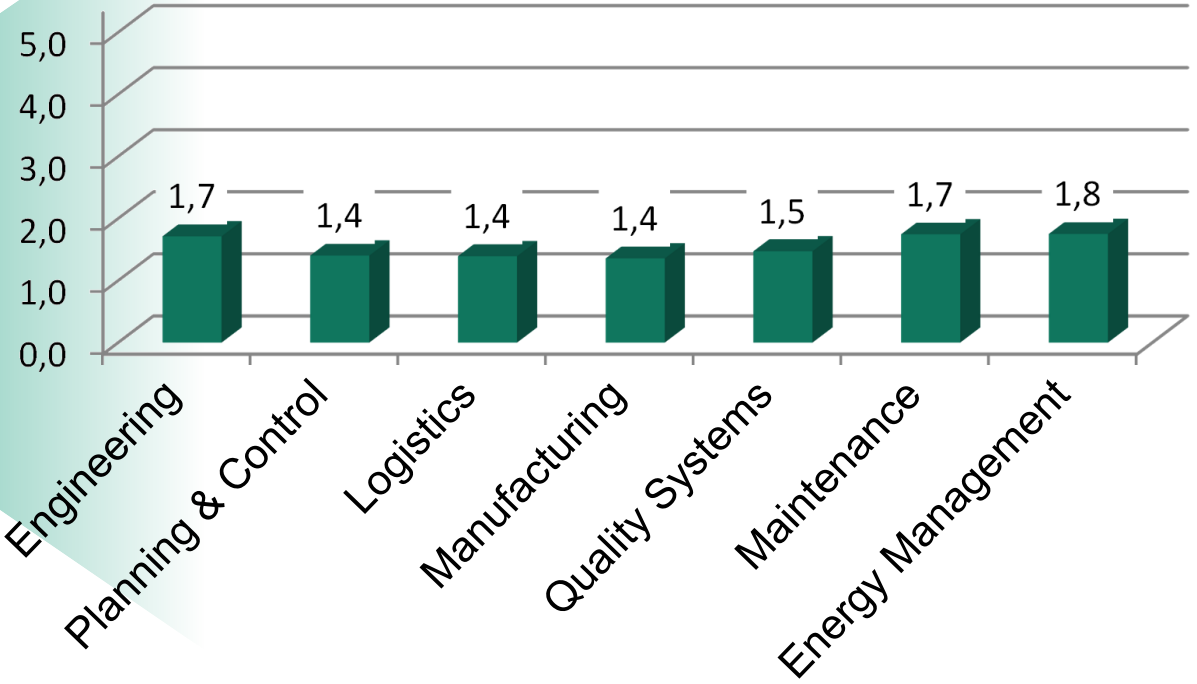
Evaluation Results by Subject Area – Example





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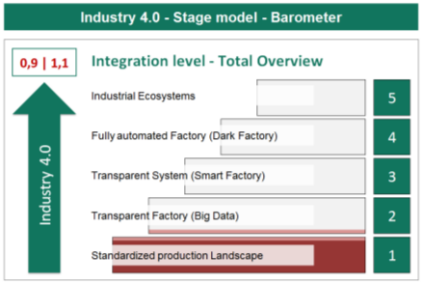
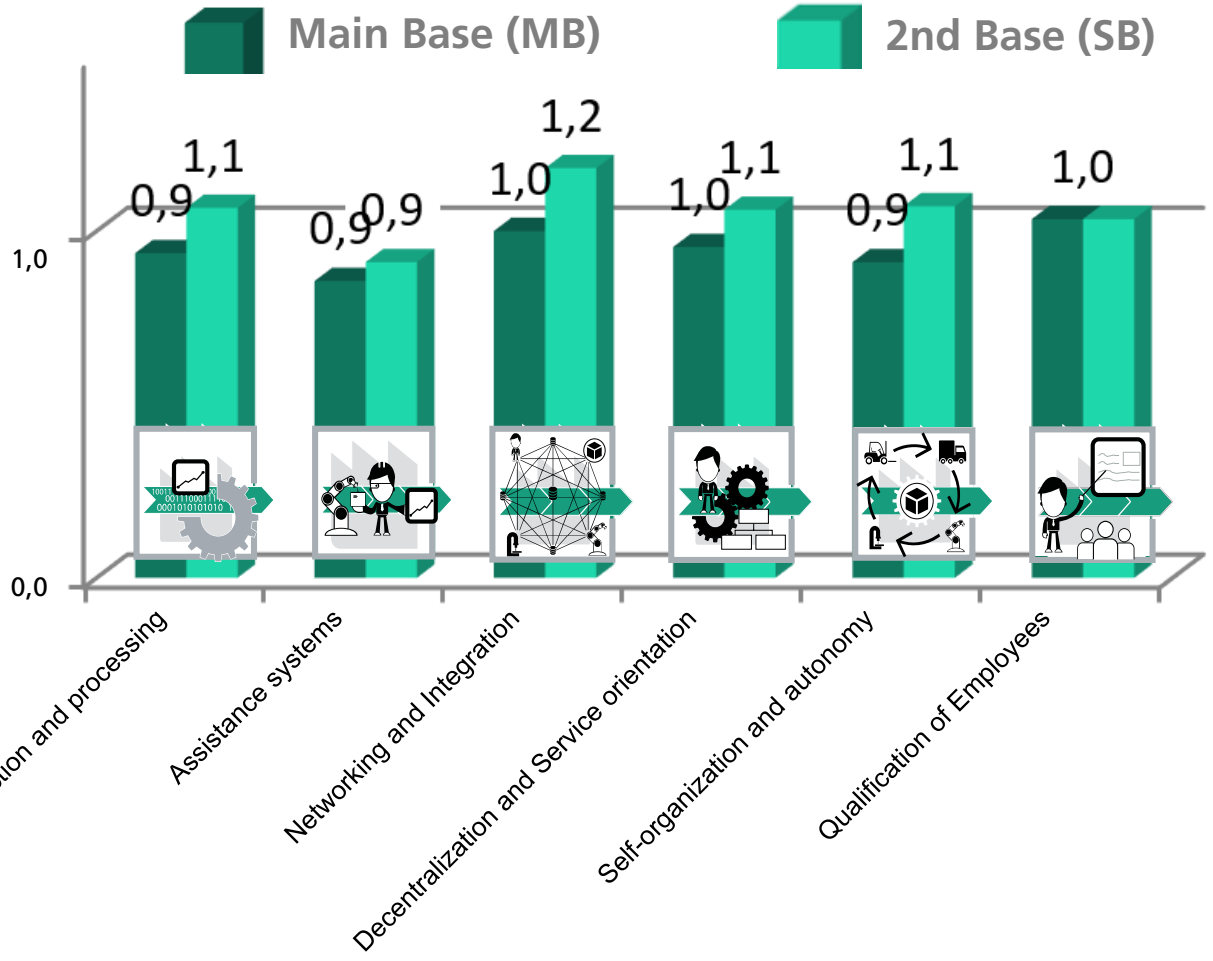
Evaluation Results – Example





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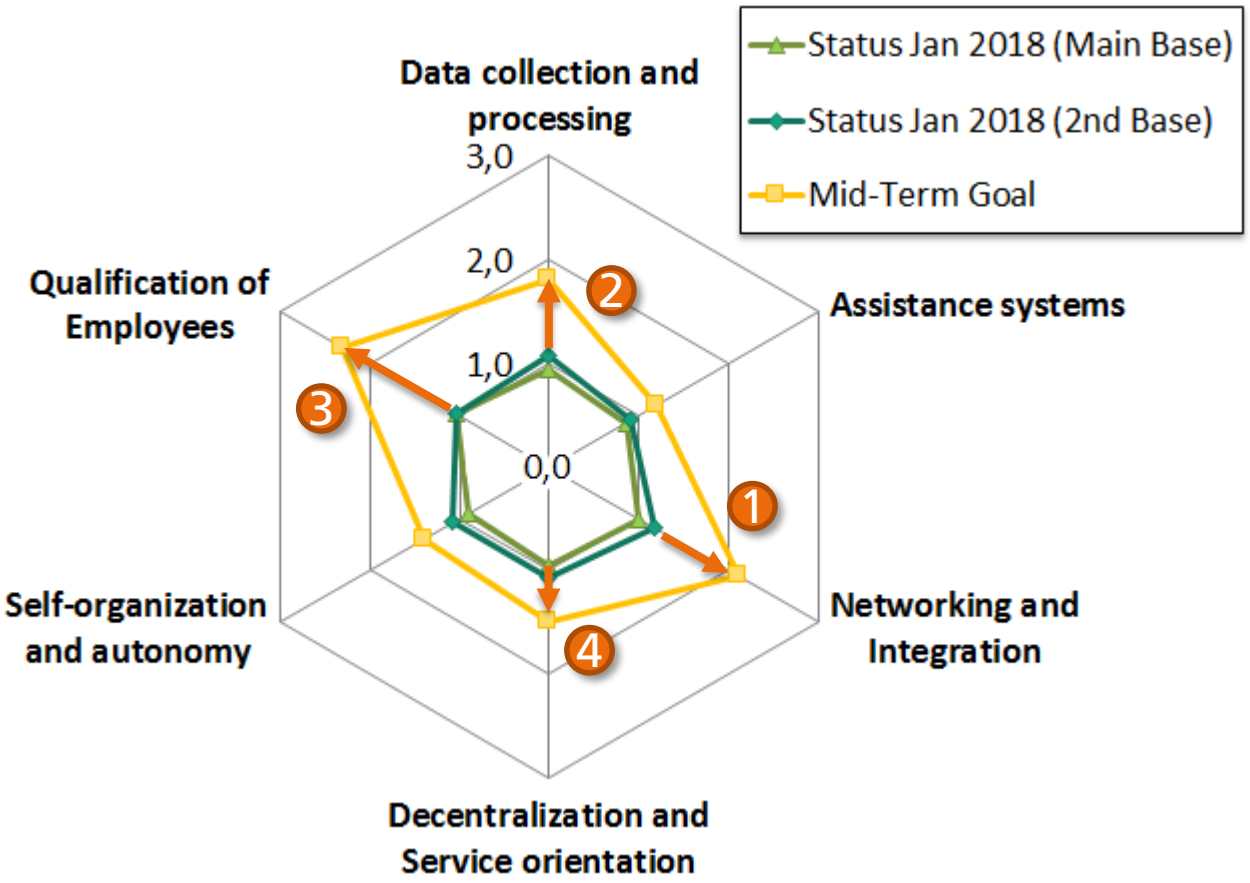
Status and proposed Mid-Term Goal – Example

1. Network digital information systems
2. Complement data and use it
3. Knowledge Management and E-Learning
4. More focus on internal customers
5. Enabling processes and technologies



Not in I4.0 focus – but still important

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Identification of Priority Projects – Example

Project Proposal

- Concept for mobile systems in production
  - Computer resources and reliant Wifi (low latency)
  - Concept for Safety and Security
  - Standardized data management, Networking (time stamped)
- Flexible use of mobile devices on site
- Define and implement first use cases (pilots) for the new system's design

Responsible	IT
involved	MES, Planning

Basis for the implementation of I 4.0

Networking ↗
Service ↗

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Identification of Priority Projects – Example

Project Proposal

- The goal is the realization of a transparent flow structure from the goods receipt to the dispatch - continuous plant development
- Methodical preparation by
  - Layout-based recording of plant structures
  - Illustration of the processes and visualization of the material flows e.g. through Sankey diagrams
- Participatory planning with all areas (for example with the help of planning table)
- Synchronizing of individual manufacturing areas (material flow)

Responsible	planning
involved	plant Manager, area manager

River-oriented plant design

productivity	↗
transports	↘
stocks	↘

digital image

↓

simulation

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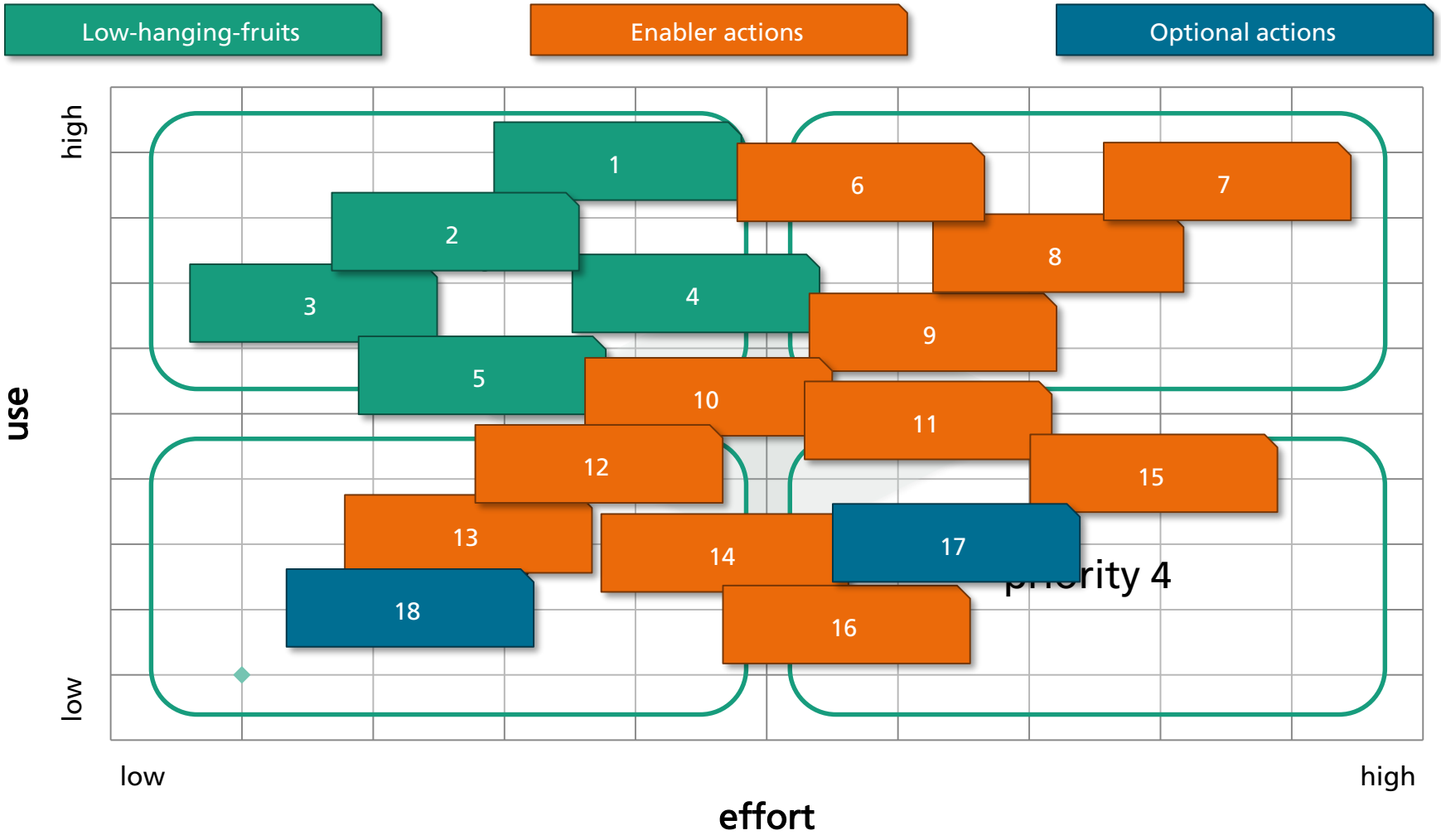
Assessment and Prioritization of Project Proposals - Example



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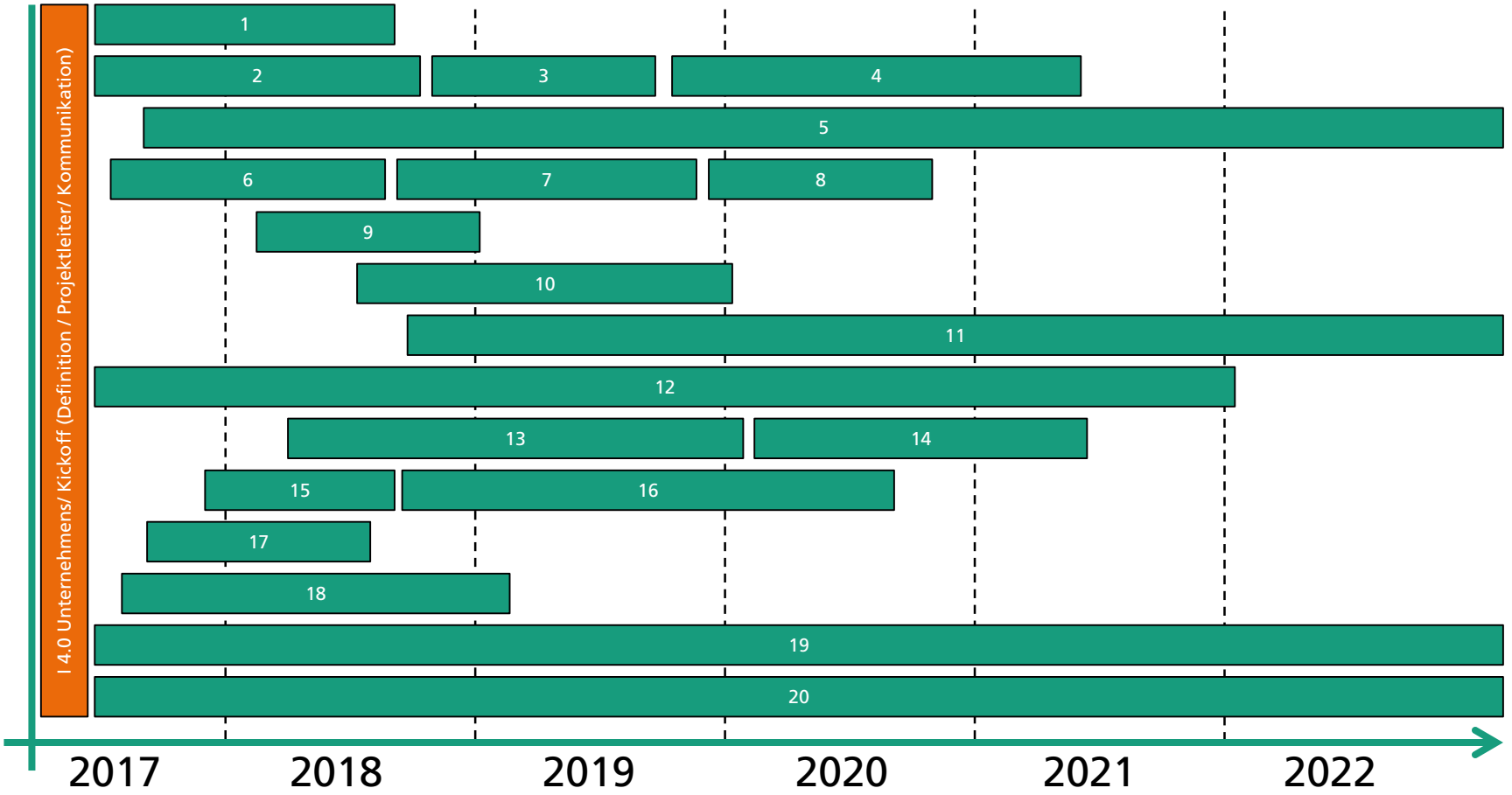
Roadmap Recommendations - Example



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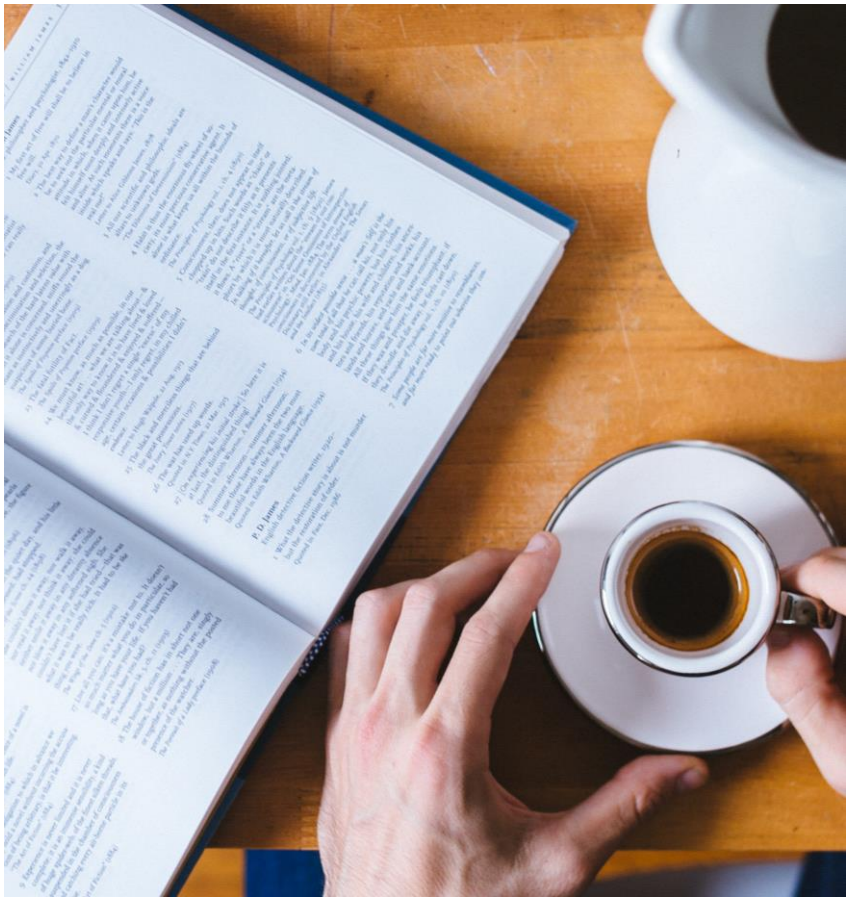
General Recommendations for Implementation

- Don’t follow the calculations for return on invests - Industrie 4.0 affects the entire company
- Implement a sustainable transformation and change management – Involve all employees
- Constantly question you own business model by e.g. using the business model canvas or the 55 pattern
- Build up you own IT competence for programming customized applications
- Follow the rules of user interface design to provide good service to your employees



The VDTC of the Fraunhofer IFF
European DIH and Competence Center for SME

- VDTC officially recognized as a Digital Innovation Hub (DIH)
- DIH as one-stop-shops for companies, especially SME, to improve their competitiveness through digitalization
- VDTC as a central actor in a network of regional stakeholders to promote and support digitalization in Saxony-Anhalt and beyond
- Fraunhofer IFF is part of two national competence centers to promote digitalization and Industrie 4.0 among SME (one regional focus, one thematic focus on construction industry)

European Commission **Digital Innovation Hubs**

Mittelstand 4.0 Kompetenzzentrum Magdeburg

Mittelstand 4.0 Kompetenzzentrum Planen und Bauen

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