How to Start with Industry 4.0 in SMEs

Practical Roadmap for Industry 4.0
Introduction in SME

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Chambre de Commerce, Luxembourg

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Portfolio

IPL - Institute for Production and Logistics Systems

Global orientation
- Worldwide projects
- Located in the Greater Region of FR, LU, DE

Production & logistics
- Greenfield-/Brownfield-concepts
- Development and transformation of production systems

Strategy consulting
- Industry 4.0 Roadmapping
- Supply chain organisation
- Design of material flow

Qualification, coaching and training
- Lean Six Sigma
- Company and supplier development

European Research and Development
- Academic research methodology
- Development of innovative methods for practical application

Management and organisation
- Project management
- Interims-management & service

Worldwide projects
Located in the Greater Region of FR, LU, DE
Agenda

Content of Presentation

- Introduction
  - Strategic need for Industry 4.0 in the SME sector
  - Introductory examples
- Methodology for creating an individual Roadmap Industry 4.0
  - Phase 1: Company analysis
  - Phase 2: Identify opportunities
  - Phase 3: Select and evaluate opportunities
  - Phase 4: Create and realize Roadmap
- Summary
**Strategic Need for Industry 4.0**

**Enablers, Opportunities and Risks**

<table>
<thead>
<tr>
<th>Enablers</th>
<th>Opportunities</th>
<th>Barriers / Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Digitalization („Big Data“)</strong></td>
<td>Efficient production</td>
<td>▪ Delay due to unclear cost-benefit ratio</td>
</tr>
<tr>
<td>▪ Increasing availability of data about</td>
<td>▪ Vertical/horiz. integration</td>
<td>▪ Deficits prevent implementation: lack of technology</td>
</tr>
<tr>
<td>customer, product and production</td>
<td>▪ Supply Chain transparency</td>
<td>and knowledge, rigid organizational structures,</td>
</tr>
<tr>
<td></td>
<td>▪ Process automation</td>
<td>poor master data, etc.</td>
</tr>
<tr>
<td></td>
<td>▪ Flexibility and agility</td>
<td>▪ Culture of preservation and lack of courage</td>
</tr>
<tr>
<td><strong>2. Connectivity and communication (ICT)</strong></td>
<td>New business / products</td>
<td>grants competition time-critical advantages</td>
</tr>
<tr>
<td>▪ Internet of Things (IoT)</td>
<td>▪ New services</td>
<td></td>
</tr>
<tr>
<td>▪ Real-time communication</td>
<td>▪ Mass customization</td>
<td></td>
</tr>
<tr>
<td>▪ Permanent availability of broadband</td>
<td>▪ New types of cooperation</td>
<td></td>
</tr>
<tr>
<td>connections for large data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Disruptive technologies/software</strong></td>
<td>Vertical/horiz. integration</td>
<td></td>
</tr>
<tr>
<td>▪ Cyber Physical Systems: lightweight</td>
<td>▪ Supply Chain transparency</td>
<td></td>
</tr>
<tr>
<td>robots, Automated guided vehicles, drones,</td>
<td>▪ Process automation</td>
<td></td>
</tr>
<tr>
<td>3D printing, VR / AR, mobile devices, pick-</td>
<td>▪ Flexibility and agility</td>
<td></td>
</tr>
<tr>
<td>by-tech, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Business Analytics, AI, Blockchain</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A clever combination of enablers in own company leads to new opportunities.
Indicative Opportunities of Industry 4.0

Value Drivers for Potentials according to McKinsey

- **Value drivers**
  - Productivity increase by 3-5%\(^5\)
  - 30-50% reduction of total machine downtime\(^2\)
  - 45-55% increase of productivity in technical professions through automation of knowledge work\(^4\)
  - 10-40% reduction of maintenance costs\(^1\)
  - 20-50% reduction in time to market\(^1\)
  - Forecasting accuracy increased to 85+%\(^3\)
  - Costs for quality reduced by 10-20%\(^6\)
  - Costs for inventory holding decreased by 20-50%\(^3\)

1. Cf. McKinsey Global Institute: Big data: The next frontier for innovation, competition, and productivity
2. McKinsey analysis
3. McKinsey analysis
5. See, for example, ABB case study

A New View on Waste

„Digital Waste“ by Unused Information according to McKinsey

Information leakages cause digital inefficiencies

Indicative Barriers for Industry 4.0 Introduction

Challenges for a Successful Implementation of Industry 4.0

- Unclear cost-benefit-ratio, unclear investments: 46%
- Unsufficient qualification of workforce: 30%
- Missing standards, norms and certificates: 26%
- Unclear legal situation concerning ownership of...
- Low maturity of required technologies: 22%
- Issues with data security: 20%
- Low priority / commitment from executive...
- Slow expansion of basic technologies (broadband): 19%
- Unsufficient network/storage capabilities: 18%
- Low maturity of required technologies: 13%
- Unsufficient qualification of workforce: 6%

Source: PWC (2014), Study with n=235 companies from Germany, 5 business sectors
Facts about Industry 4.0 in SMEs
Status introduction and implementation of Industry 4.0 in Germany

Do you plan specific investments in Industry 4.0 applications?
- Yes, we plan introduction: 43%
- No, Industry 4.0 is out of question for us: 53%
- No, we don't see need for action, currently: 4%


Is your company using Industry 4.0 applications?
- Yes: 44%
- Nein: 56%

Current use of Industry 4.0-applications. Result of questionnaire – Industry 4.0 in SME, n=297.

Source: Study and thesis of University Ansbach (2017) with n=333 companies from different business sectors in Germany
Facts about Industry 4.0 in SMEs

Application

In which areas of the company could you imagine using Industry 4.0 applications?

- Production: 96%
- Logistics: 89%
- Purchasing: 40%
- Sales: 38%
- R&D: 36%
- Marketing: 24%
- Others: 10%

Application of Industry 4.0
Result of questionnaire – Industry 4.0 in SME, n=293, multiple answers possible.

Source: Study and thesis of University Ansbach (2017) with n=333 companies from different business sectors in Germany
Facts about Industry 4.0 in SMEs

Potential Benefits

Which of the following opportunities by Industry 4.0 do you consider realistic?

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Does apply</th>
<th>Does rather apply</th>
<th>Does rather not apply</th>
<th>Does not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase level of automation</td>
<td>61%</td>
<td>32%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>53%</td>
<td>40%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Improved MES</td>
<td>36%</td>
<td>53%</td>
<td>9%</td>
<td>2%</td>
</tr>
<tr>
<td>Flexible production</td>
<td>41%</td>
<td>44%</td>
<td>12%</td>
<td>3%</td>
</tr>
<tr>
<td>Resource efficiency</td>
<td>36%</td>
<td>45%</td>
<td>17%</td>
<td>2%</td>
</tr>
<tr>
<td>New business services</td>
<td>36%</td>
<td>44%</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>Relief for employees</td>
<td>25%</td>
<td>47%</td>
<td>23%</td>
<td>5%</td>
</tr>
<tr>
<td>Customized production</td>
<td>24%</td>
<td>43%</td>
<td>26%</td>
<td>7%</td>
</tr>
<tr>
<td>Development of new business</td>
<td>26%</td>
<td>38%</td>
<td>28%</td>
<td>8%</td>
</tr>
<tr>
<td>Overwhelming of employees</td>
<td>7%</td>
<td>43%</td>
<td>39%</td>
<td>11%</td>
</tr>
<tr>
<td>Increase motivation of workforce</td>
<td>6%</td>
<td>41%</td>
<td>48%</td>
<td>5%</td>
</tr>
<tr>
<td>Shorten time-to-market</td>
<td>9%</td>
<td>29%</td>
<td>52%</td>
<td>10%</td>
</tr>
<tr>
<td>Foster Work-Life Balance</td>
<td>9%</td>
<td>25%</td>
<td>53%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Source: Study and thesis of University Ansbach (2017) with n=333 companies from different business sectors in Germany
Industry 4.0 in Marketing & Sales

Introductory Example for Marketing 4.0 in the Apparel Industry

„BigData Monitor“
- Comprehensive analysis of sales data for high variety fashion products
- Increase expertise of responsible employees
- Development of a data model for early warnings in customer demand
- Model provides probability of success of a new product before market entry
- Eases decision making in product development
- Reduction in number of variants
Industry 4.0 in Production

Introductory Example for Craftsmanship 4.0

Observational studies and situational analysis for construction sites

Sensoren

- **Google glass**
  - Accelerometer
  - Gyroscope
  - Magnetometer
  - Linear acceleration
  - Rotation vector

- **Smart Watch**
  - Accelerometer
  - Gyroscope
  - Magnetometer
  - Air pressure
  - Linear acceleration
  - Rotation vector

Source: with kind approval of Business-KompetenzZentrums (eBZ) Kaiserslautern
Industry 4.0 in Production
Introductory Example for Maintenance 4.0

Machine condition monitoring at AGFA Peißenberg and maintenance via Internet 24/7

„Mobile ControlApp“
- Get machine information
- Make program changes
- Integrated camera transmits video from production process live to iPad
- Online monitoring from "outside"

Individual Company Roadmap for Industry 4.0

Approach, Phases and Instruments

Meetings with steering-committee to align results

1. Company Analysis
   - Pre-structured Interviews
     - Organisation and tasks
     - Infrastructure with input/output
     - Core processes and communication
     - Typical deviations
     - Strength/Weaknesses
     - Strategic fields of actions

2. Identify opportunities
   - Quick-Check I 4.0
     - (Form, examples)
     - Business Model Canvas
     - Design Thinking Workshop

3. Choose and evaluate opportunities
   - Catalogue for evaluation
     - (Workshop with key questions)
     - Benefit-feasibility-matrix
     - Check of pre-requisites human, technology, organisation
     - (Workshop with key questions)
     - Investment calculations
     - Evaluation of non-monetary benefits
     - (Workshop with Extended Performance Analysis)

4. Establish and realize roadmap
   - Roadmapping I 4.0
     - Project plans for stepwise introduction
     - Operational support of implementation

Source: AK4.0 model, Seiter M. et al. (2016), modified
Phase 1: Company Analysis

Pre-structured Interviews Interviews Map the Current State of the Company

A) Organization and tasks
- Organisation, R&R
- Tasks and focus of departments
- Qualification of employees

B) Infrastructure and I/O
- Important resources (machines, licenses, etc.)
- Input and outputs from relevant departments

C) Core processes and comm.
- Important processes/products in/from departments
- Communication structures

D) Defects and deviations
- Typical issues and deviations in different departments
- Issues between departments as well as customers/suppliers

E) Strength/Weaknesses
- Strength/weaknesses of departments, products, company
- Strength/weaknesses to customers or with suppliers

F) Strategic fields of action
- Strategic change requests
- Future market potential
- Different view points from employees and executives
Phase 2: Identify Opportunities

Quick-Check I4.0 for Production

Six application levels with five technological and sequential development stages support brainstorming of ideas.
Quick-Check Production: Data processing
Example: Inventory Management

<table>
<thead>
<tr>
<th>No processing of data</th>
<th>Storage of data for documentation</th>
<th>Analysing data for process monitoring</th>
<th>Evaluation for process planning / control</th>
<th>Automatic process planning / control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual disposition (order point) for C-parts in traditional containers</td>
<td>Documentation of replenishment; manual ordering process</td>
<td>Data Analytics with data based inventory reduction</td>
<td>Know-how automation for inventory planning (Cognitive Computing)</td>
<td>iBin: automized inventory detection and trigger for purchase orders</td>
</tr>
</tbody>
</table>

Human
Manual process
Technology: Traditional
Organisation: Skilled labor required

Human: Manual process
Technology: traditional
Organisation: Standardized work

SAP Deutschland SE & Co. KG
Human: Competency in data
Technology: ERP & Software
Organisation: Consistent Master data

SAP Deutschland SE & Co. KG
Human: Acceptance by worker
Technology: Data Analytics Tool
Organisation: Clarified legal basis

Würth Industrie Service GmbH & Co. KG
Human: Only for escalation
Technology: RFID, optical camera, ERP
Organisation: Skilled labor, consistency

Source: for picture references see end of presentations
Phase 2: Identify Opportunities

Quick-Check I4.0 for Product / Business Model

Six application levels are also available for new products or business models, each with five consecutive development stages for brainstorming.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Integration of sensors/actuators</td>
</tr>
<tr>
<td>2</td>
<td>Communication/Connectivity</td>
</tr>
<tr>
<td>3</td>
<td>Functionalities for data storage and information exchange</td>
</tr>
<tr>
<td>4</td>
<td>Monitoring</td>
</tr>
<tr>
<td>5</td>
<td>Product related IT-services</td>
</tr>
<tr>
<td>6</td>
<td>Business models around the product</td>
</tr>
</tbody>
</table>

Source: VDMA (2016), modified
### Quick-Check Product: Monitoring

**Example: Product Safety in Transportation**

<table>
<thead>
<tr>
<th>No monitoring by the product</th>
<th>Detection of failures</th>
<th>Recording of operating condition for diagnostic</th>
<th>Prognosis of its own functional condition</th>
<th>Independently adopted control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive security with warning, sturdy packaging, bubble wrap</td>
<td>Tilting indicator for transport control</td>
<td>DropTagEVENT: Low-cost tool for condition monitoring</td>
<td>Packaging provides prognosis about functionality of goods</td>
<td>Packaging with self-correction in case of environmental issues</td>
</tr>
</tbody>
</table>

1) **Enviro Pack GmbH**
   - Human: Manual process
   - Technology: Proper packaging
   - Organisation: Skilled labor required

2) **TransPack-Krumbach GmbH**
   - Human: Manual process
   - Technology: Tags
   - Organisation: Control of tags

3) **Cambridge Consultants Ltd & Inc**
   - Human: Act based on data
   - Technology: Sensor, App, Server
   - Organisation: Consistent Master data

4) **DB Schenker Security Guard**
   - Human: Escalation only
   - Technology: Sensors, Software
   - Organisation: Reliable data/limits

**Source:** for picture references see end of presentations
Phase 3: Choose and Evaluate Opportunities

Evaluation Catalogue and Benefit-Feasibility-Matrix

Key questions support a factual assessment of cost-effectiveness and feasibility of the planned measures

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Source: Seiter M. et al. (2016)
Phase 3: Choose and Evaluate Opportunities

Derive and Evaluate Necessary Pre-requisites for Industry 4.0 Transformation

<table>
<thead>
<tr>
<th>Level</th>
<th>Production/Product</th>
<th>Human</th>
<th>Technology</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>• Competence in dealing with physical thing, e.g. Operation of machines</td>
<td>• Functional product, e.g. Pump</td>
<td>• Targeted business organization, e.g. lean production</td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>• Competence in data analysis</td>
<td>• Actuating</td>
<td>• Data consistency</td>
<td></td>
</tr>
<tr>
<td>Sensor and Actuator</td>
<td>• Competence in sensor technology</td>
<td>• Identifiers (Barcode, RFID etc.)</td>
<td>• Clearly clarified legal basis regarding automated data usage</td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>• Generalists with a holistic understanding of complex systems</td>
<td>• Connection of production facilities</td>
<td>• Acceptance in the added value network</td>
<td></td>
</tr>
<tr>
<td>Connectivity</td>
<td>• Competence in data protection</td>
<td>• Broadband network internal/external Cloud Server</td>
<td>• Acceptance by the customer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Competence in data security</td>
<td>• Fieldbus</td>
<td>• Data consistency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Competence in network technology</td>
<td>• Internet interface to attachments</td>
<td>• Clearly clarified legal basis (data use in automated data exchange, on the internet regarding the ownership of data)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cross-employee IT competencies</td>
<td>• IT security system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• networking of systems</td>
<td>• Local data storage (e.g. SD Card)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td>• Establishment of the job profile “Data Scientist”</td>
<td>• Algorithms for data analysis</td>
<td>• Clearly clarified legal basis regarding personal data</td>
<td></td>
</tr>
<tr>
<td>Analytics</td>
<td>• Extended competence in data protection</td>
<td>• Datawarehouse</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Extended competence in data security</td>
<td>• Data interface between machine and database</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Competence in data analysis</td>
<td>• Suitable analytics software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 5</td>
<td>• Extended competence in algorithms</td>
<td>• Remote Module</td>
<td>• Acceptance by the customer</td>
<td></td>
</tr>
<tr>
<td>Digital solution</td>
<td>• Extended competence in data analysis</td>
<td></td>
<td>• Suitable software</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generalists with a holistic understanding of complex systems</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Workshop with key questions will reveal required measures and additional investments to create **pre-requisites** in terms of

- Human
- Technology
- Organization

Source: Seiter M. et al. (2016)
Phase 3: Choose and Evaluate Opportunities
Monetary and Non-monetary Benefit Effects

Monetary benefit effects
- Low personnel costs due to networked machines
- Low costs through Predictive Maintenance
- Lower inventory costs through optimized utilization
- Lower cost, higher revenue etc.

Non-monetary, direct quantifiable benefit effects
- Optimized employee utilization through the use of efficient machines
- Lower number of errors due to early error analysis
- High adherence to schedule through efficient planning
- Optimized lead times / utilization etc.

Non-monetary, quality benefit effects
- Employee satisfaction through attractive workplace design
- Cooperations through joint IT platforms
- Transparency due to high data availability
- Customer satisfaction, transparency

⇒ Better transparency in cost-benefit ratio through consideration of non-monetary benefit effects

Source: Seiter M. et al. (2016)
Phase 3: Choose and evaluate Opportunities

Financial Evaluation of Non-monetary Benefits

### Monetary benefits

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Actual</th>
<th>Desired</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue increase in T€ per year</td>
<td>750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost cutting in T€ pro Jahr</td>
<td>5.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monetary effect in T€ per year</td>
<td>755.73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Actual</th>
<th>Desired</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue existing customers in Mio. € per year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing customers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>80</td>
<td>80.67</td>
<td>1%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>10</td>
<td>10.08</td>
<td>1%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route optimization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel cost per maintenance per day in €</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>20</td>
<td>18.74</td>
<td>-6%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated storage costs in T€ per year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>210</td>
<td>206.91</td>
<td>-1%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Redamation costs</td>
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</tr>
<tr>
<td>Calculated redamation costs in T€ per year</td>
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<td></td>
</tr>
<tr>
<td>Actual</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Non-monetary, direct quantifiable benefit effects

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Actual</th>
<th>Desired</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downtime plant in h per year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>10</td>
<td>9.6</td>
<td>-4%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of maintenances per day</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Actual</td>
<td>20</td>
<td>23.75</td>
<td>19%</td>
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<td>Desired</td>
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<tr>
<td>Delta</td>
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<tr>
<td>Warehousing</td>
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<tr>
<td>Inventory turnover rate on filter</td>
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<tr>
<td>Actual</td>
<td>3</td>
<td>3.19</td>
<td>6%</td>
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<tr>
<td>Desired</td>
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</tr>
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<td>Delta</td>
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<tr>
<td>Long-term optimization</td>
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<td>Redamation quote</td>
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</tr>
<tr>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desired</td>
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<tr>
<td>Delta</td>
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</tbody>
</table>

### Non-monetary, quality benefit effects

<table>
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<th>Benefit</th>
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<th>Desired</th>
<th>Delta</th>
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<tr>
<td>Transparency</td>
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<tr>
<td>Needed maintenances per day</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Actual</td>
<td>8</td>
<td>10</td>
<td>25%</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta</td>
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</tbody>
</table>

### Strength of effect

- **Revenue increase in T€ per year**: 20%
- **Cost cutting in T€ pro Jahr**: 1%
- **Monetary effect in T€ per year**: 20%
Phase 4: Establish and Realize Roadmap

Roadmap for stepwise introduction

A **Roadmap Industry 4.0**
- visualizes the long-term transformation strategy
- is flexible and may be continuously adapted by organizational learning
- details necessary measures into
  - manageable steps and
  - financially viable sub-projects

Source: Seiter M. et al. (2016), modified
Summary

Important Aspects of Creating and Implementing Industry 4.0 Roadmaps

- Industry 4.0 offers future opportunities through clever combination of
  - Digitization
  - Connectivity and
  - Disruptive technologies / software
- Benefits need to be individually and monetarily assessable
- Quick-Check I4.0 supports and simplifies brainstorming for ideas
- Industry 4.0 roadmap consolidates a transformation strategy
- The time factor competition plays a crucial role in competition
- Similar to Lean, Industry 4.0 will fail without strong commitment from leadership
Thank you for your attention!

Q&A
References

Used/Recommended Literature

Maturity Models

Business Model Canvas

Financing and Investment
Other References

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