acatech Industrie 4.0 Maturity Index
Development of company-specific Industrie 4.0 roadmaps
The Maturity Index is developed by renowned partners from industry and research

**Goal**
- Companies lack an established strategic framework for determining their current status regarding Industrie 4.0 and deriving measures
- The existing frameworks do not take into account the entire organization, the culture, the resources as well as the interactions between these elements

**Approach**
- Development of a maturity model to find out the fields of action with special respect to digitalization potentials and first actions
- Identifying the relevant elements based on the acatech Industrie 4.0 Maturity Index

**Result**
- The main result is a strategic framework enabling companies to identify their field of action and deriving a company specific Industrie 4.0 roadmap
Companies are currently failing with the implementation of Industrie 4.0; the developed approach deduces necessary actions and ensures investments

**Industrie 4.0** was first presented in 2011, a systematic implementation in companies has not been taken place as far as possible until today

- In companies use cases are dominant, but an **end-to-end implementation** is necessary for raising potentials
- Many companies are not aware of the **development path**

**Companies need a precise development path for a holistic implementation** of Industrie 4.0
- An Industrie 4.0 roadmap is necessary to operationalize the implementation, to **schedule the projects** and to **highlight the modifications of the organization**
- A well-structured roadmap supports **benefit-oriented development** of the company and **enables modalities** to ensure investments

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**Planned implementation of Industrie 4.0 in 2020 (State 2015)**

<table>
<thead>
<tr>
<th>Year</th>
<th>No Implementation</th>
<th>Potential Recognized</th>
<th>Partially Implemented</th>
<th>Systematically Implemented</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>15%</td>
<td>31%</td>
<td>39%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>2020</td>
<td>7%</td>
<td>14%</td>
<td>32%</td>
<td>47%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Industrie 4.0 Maturity Index**

- **Industrie 3.0**
  - What does happen? “Seeing”
  - What will happen? “Forecasting”
  - Why does it happen? “Understanding”
  - How can autonomous reaction take place? “Self-optimizing”

- **Industrie 4.0**
  - Visibility
  - Transparency
  - Predictability
  - Adaptability

**Industrie 4.0 Maturity Level Development Path**

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Companies can leverage diverse potentials on the development path to Industrie 4.0 by choosing a stepwise approach.
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**Industry 4.0 Maturity Level**

**Business Value**

1. **Industrie 3.0**
   - Computerization
   - Connectivity

2. **Industrie 4.0**
   - Visibility
   - Transparency
   - Predictability
   - Adaptability

**What does happen?**

- **“Seeing”**
  - Companies have a full transparency about their value added processes in the form a digital shadow
  - The management takes data-based decisions

**Why does it happen?**

- **“Understanding”**
  - Companies understand why events happen
  - Knowledge is discovered through recognition

**What will happen?**

- **“Forecasting”**
  - Companies know what will happen in the future
  - Decisions are made on the basis of future scenarios

**How can autonomous reaction take place?**

- **“Self-optimizing”**
  - Companies react autonomously on conditions
  - The system controls itself autonomously and is fully viable

The stepwise approach enables companies to identify long term goals for implementing Industrie 4.0
The Maturity Index analyses four different structuring forces and creates a first agenda for implementation.

From outside to inside: 6 stages describe the Industrie 4.0 Maturity Index:

1. Support by data processing systems
   Employees are relieved of repetitive activities

2. Systems are structured and connected
   IT-systems reflect the core business processes

3. Companies have digital shadows
   Data based management decisions

4. Companies understand, why things happen
   Knowledge is a result of recognition

5. Companies know, what will happen
   Decisions based on future scenarios

6. Companies react to events autonomously
   The systems are self-adjusting and operate robust
Industrie 4.0 does not only evoke a technological change in the company, but involves the entire organization.

Captured key questions within the four structuring forces (Examples)

- **Resources** comprise employees and all necessary production factors, which communicate as smart objects with each other:
  - How could physical objects be able to perceive their environment and to communicate with this?
  - How flexible could this objectives be applied?

- **Information systems** comprise integrated systems, which capture data and information, process it and provide it context-based:
  - To what extent is the proactive supply of necessary information supported by IT-systems?
  - How far is high-quality knowledge generated from raw data?

- **The Organizational Structure** enables an effective and secure collaboration along the entire value chain.
  - How flexible are changing general conditions adapted by the company?
  - How far do the employees work together in networks?

- **Company Culture** supports a mindset of continuous learning and improvement:
  - How is information exchanged between employees?
  - How far is the continuous development anchored in and accepted by the company?
Industrie 4.0 maturity assessment enables the definition of a long term, company specific roadmap of specific actions

**Identified challenges**
- Reduced process stability due to numerous manual activities
- Integration of different IT-systems improvable
- Implementation of an automated feedback system for production orders
- Identification of media breaks and improving the integration of IT-Systems
- Low transparency of orders in the production
- Tracing orders is complicated
- Further automation of working steps and creation of transparency in IT-systems
- Setting up a dynamic planning approach on basis of the digital shadow
- Potential of the digital shadow is not completely accessible
- Impact of changes in the planning process cannot be simulated yet
- Utilizing the digital shadow; Automatic detection of malfunctions
- Upgrade of dynamic planning approach by real time control mechanisms
The assessment by means of the I4.0 Maturity Index enables the development of a customized roadmap within weeks and an autonomous implementation.

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kick-Off</strong></td>
<td><strong>Factory Tour</strong></td>
<td><strong>Workshop</strong></td>
</tr>
<tr>
<td>Getting to know the participants and introduction of the procedure</td>
<td>Recording the production procedure of a typical item</td>
<td>Group workshop for analyzing the production procedure in terms of digitalization potentials</td>
</tr>
<tr>
<td>Self-assessment as to the current status of the digitalization in the company</td>
<td>Tracking of the recorded procedure and analysis of the used aggregates</td>
<td>Additional questions asked by FIR-experts</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td><strong>Post processing</strong></td>
<td><strong>Presentation</strong></td>
</tr>
<tr>
<td>All participants are able to understand the model</td>
<td>Evaluation of the workshop based on a substantial survey</td>
<td>Preparation of the workshop results and interviews with maturity index</td>
</tr>
<tr>
<td>Evaluated maturity level of digitalization is available</td>
<td>Determination of the maturity level and deduction of guidance</td>
<td>Deduction of actions and initial scheduling of layout planning</td>
</tr>
<tr>
<td>Insights won in the Kick-Off extended</td>
<td>Digitalization potential determined and FIR-View added</td>
<td>Fields of action for digitalization roadmap</td>
</tr>
<tr>
<td>Findings gathered, serving as a basis for the group workshop</td>
<td>Potentials summarized and broadly prioritized</td>
<td>Recommend action for preparing the implementation</td>
</tr>
<tr>
<td><strong>Gain of knowledge</strong></td>
<td></td>
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<td>© FIR e. V. an der RWTH Aachen</td>
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