Industrie 4.0

Challenges and opportunities for German equipment producers

Roland Berger
Strategy Consultants

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As a global strategy consulting firm, we are one of the thought leaders in digitalization and Industrie 4.0

Overview: Roland Berger Strategy Consultants

**Snapshot**

- **50 offices in 36 countries**, with around **2,400 employees**
- **About 220 RB Partners** currently serving **~1,000 international clients**

**Market position**

- Germany: #2
- Growth regions China and Russia/CEE: #2
- Core markets in Western Europe: #3

**Digitalization/Industrie 4.0 references**

- [THINK ACT](#)
- [Industrial 4.0: What really matters for equipment producers](#)
- [Industrie 4.0: Feedback for industrial partners](#)
- [Industrie 4.0: The digital transformation of industry](#)
- [Additive manufacturing: A game changer for the manufacturing industry](#)
- [Big Data monetization strategy](#)
Industrie 4.0 is part of a comprehensive digital transformation with highly disruptive effects

Industrie 4.0 vs. digital transformation (non-exhaustive)

Digital transformation
> ... refers to any changes resulting from the application of digital technologies to any area of human society

Industrie 4.0
> ... is the full integration and digitization of the industrial value chain by combining new technologies from the "cyber" world with traditional production systems from the "physical" world

Source: Plattform Industrie 4.0, MIT Sloan Management Review, Roland Berger
Industrie 4.0 solutions arise in the symbiosis between classical production technologies and new IT technologies.

Technologies and successful solutions:

**Cyber-world**
- **Computer Hardware**
  - Data storage hardware
  - Embedded systems
  - High-performance computing
  - In-Memory computing
  - Micro computing
- **Software**
  - Real-time data processing
  - Business process software
  - Database management systems
  - Cloud computing
  - Real-time image processing (e.g. OCR)
  - Advanced algorithms
  - Machine learning
- **Connectivity**
  - High speed mobile broadband (e.g. 3G/4G)
  - Industrial Ethernet
  - Internet protocols (IPv6)
  - Local broadband (e.g. WiFi)
  - Short range/low power transmissions (e.g. Bluetooth, NFC)

**Physical-world**
- **Traditional Products**
  - Industrial goods
    - Robotics
    - Trad. Machinery
    - Automation equipment
  - Consumer goods
    - Cars
    - Home appliances
    - Packaging
  - Mass customization
- **Interfaces**
  - Biometrics
  - Camera & imaging systems
  - LCD / touch interfaces
  - Magnetic stripes
  - RFID
  - Traditional /semiconductor sensors
  - LCD / touch interfaces

- **Base technologies**
- **Solutions**

1) Efficient Agriculture Systems

Source: Roland Berger
Industrie 4.0 is quickly gaining momentum on a global scale – German equipment producers need to respond accordingly

Our hypotheses on the Industrie 4.0 development path

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**Recent developments**

1. **Industrie 4.0 will be a "real industrial revolution"** – and much faster than many currently expect.
2. Industrie 4.0 innovation and business development will follow new rules-of-the-game.
3. Industrie 4.0 will be driven by those equipment producers that actively explore new ways of doing business right now.

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1. **Selected large scale examples**
2. **Industrial Internet of Things [2014]**

*Source: World Economic Forum, Industrial Internet Consortium, Company websites, Roland Berger*
In the cyber world, low initial adoption rates are usually followed by exponential growth – Speed increases with each new technology

Adoption rates in the cyber world

**Hardware adoption rates**

<table>
<thead>
<tr>
<th>Cumulative sales [First five years, m units]</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Graph showing cumulative sales for iPhone and iPad]</td>
</tr>
</tbody>
</table>

**Software adoption rates**

<table>
<thead>
<tr>
<th>Active users [First five years, m users]</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Graph showing active users for WeChat, Facebook, and WhatsApp]</td>
</tr>
</tbody>
</table>

Development rates show exponential growth for both hardware and software – Speed of penetration increases with each new technology

Source: Statista, Company Website, TechCrunch, Roland Berger
Car2Go and DriveNow have transformed the transportation business – Key are the changes in the business model

Success story: Free float car sharing

Traditional solution

- Rental cars are rented out on a **day-to-day** basis
- Pricing is done on a **daily rate** – independent of usage
- Pick-up and drop-off is **predefined** by rental car company locations
- Cars can be **hired** during business hours only

Digitized solution by DriveNow

- Free **floating fleet** of self-service cars spread across the city and can be **parked anywhere** at any time
- Pricing is based on **driving time** or kilometers driven and is calculated to the minute
- **Fully automated rental process** via **smartphone** and verification through key card

Benefits

- Minute based rental periods
- No more extensive branch network
- No limitation of business to business hours

Both Car2Go and DriveNow are already **profitable** as of today

Enabler

- **Network infrastructure**
- **Omnipresent mobile devices**

Business model changes

- **Value proposition**
- **Value chain**
- **Revenue model**
- **Target customers**

Source: DriveNow, Car2Go, Roland Berger
In a more industrial context, precision farming leads to increased productivity and output.

Success story: Precision Farming

<table>
<thead>
<tr>
<th>Traditional solution</th>
<th>Digitized solution by CLAAS</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Machines are solely operated by driver with <strong>limited systematic considerations of external data</strong></td>
<td>&gt; Combination of <strong>existing hardware with connectivity and big-data</strong> in turnkey solution, connecting different information in a <strong>real-time analysis</strong></td>
<td>&gt; Higher yields due to optimal utilization of farming machinery</td>
</tr>
<tr>
<td>&gt; <strong>Coordination</strong> is a key issue</td>
<td>&gt; This information is centrally distributed to all machines, who in turn <strong>optimize harvesting speeds, fuel consumption and capacity utilization</strong></td>
<td>&gt; Optimized energy consumption</td>
</tr>
<tr>
<td>&gt; Agricultural business is highly dependent on crop, thus <strong>zero down-time is key</strong></td>
<td></td>
<td>&gt; Cost decrease per harvested ton of grain</td>
</tr>
</tbody>
</table>

**Enabler**
- > Camera & imaging systems
- > Real-time data transmission and processing

**Business model changes**
- > Value chain

Source: Claas, Deutsche Telekom, Roland Berger
The growth rate in robotics is an indicator for future developments in Industrie 4.0

Exponential market growth – Example case: Robotics

- Drivers
  - Physical world
    > Lightweight construction
    > Low-cost sensors
    > Dual-arm robots
    > Parallel kinematics
  - Cyber world
    > Visual servoing (allows for unstructured work environments without cage)
    > Computing and embedded systems
    > Trainability
    > AI-methods / self-learning (deep-learning)

- Dynamic market development

- Implications
  1. Growth rate of robotics market as an indicator for upcoming developments in Industry 4.0
  2. Increased customer expectations regarding flexibility caused by widespread use of robotics
  3. Increased competition for equipment producers in high-end and high-speed functions (through substitution)

Source: Japan Robot Association (JARA), SPARC, Roland Berger
The digital economy uses a fundamentally different approach to innovation compared to traditional industries

Clash of innovation cultures

<table>
<thead>
<tr>
<th>Innovation pattern of traditional industries</th>
<th>Innovation pattern of the digital economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Very long product development cycles are characterized by plenty of physical product tests</td>
<td>&gt; Existing space for basic innovations frequently leads to revolutionary new products</td>
</tr>
<tr>
<td>&gt; New products are mostly incremental advancements of already proven solutions</td>
<td>&gt; Dynamic software development process leads to fast results – failures can easily be reset</td>
</tr>
<tr>
<td>&gt; Traditional, straight careers and experiences in one area of specialization are very appreciated</td>
<td>&gt; Young, dynamic employees are multicultural experience and have a high ability to abstract</td>
</tr>
<tr>
<td>&gt; Business operation is always linked to very high investment needs and financial risks</td>
<td>&gt; Market is characterized by very low entry barriers – a striking idea and a computer are enough as financing is broadly available</td>
</tr>
<tr>
<td>&gt; Limited production capacity and long supply chains usually result in slow product introduction</td>
<td>&gt; Internet based product platforms enable very fast dissemination of new products</td>
</tr>
</tbody>
</table>

New winners/new losers!

Source: Roland Berger
Pure digital innovations built upon an extremely powerful and well established infrastructure

Ecosystem of the cyber world

1. Omnipresent mobile devices
   - Smartphones/Tablets
   - Wearables/smart watches
   - Laptops

2. Network infrastructure
   - Mobile broadband anywhere
   - High-speed fixed line connections

3. Online platforms
   - Based on public or private clouds
   - High computing power and storage capacity available on demand

4. Algorithms
   - Pattern recognition and indexing (e.g. Google PageRank)
   - (Real) artificial intelligence
   - Big data

5. Digitized distribution systems and front-ends
   - Apps and app stores
   - Online distribution via web shops

Source: Roland Berger
The active and potent IIoT-venture-capital-scene in the U.S. pushes startups to create innovative and customer-oriented solutions

Financing-, research- and development-landscape – Industry 4.0 vs. IIoT

**Industrie 4.0**

- **Semi-government. associations**
  - Plattform Industrie 4.0
  - Dominated by incumbents from the physical world
  - Focus on Industry in DE

- **Governmental research funding**
  - Stable funding of approx. EUR 100 m per year by Germany and EU

- **Incumbent-led research projects**
  - About 50 projects with 3-5 years time horizon
  - Projects lead by incumbents

- **Mostly risk-averse adopters**
  - Decision makers at incumbents incentivized to take non-risky decisions
  - Only few new factories

**Industrial Internet of Things**

- **Industry Consortium IIC**
  - Players from the cyber (e.g. IBM) and physical world (e.g. GE)
  - Global focus on all non-consumer applications

- **Venture Capital**
  - USD 1.5 billion VC used for IIoT in 2014 alone + USD 500 m for Robotics

- **Commercial-oriented Startups**
  - Software focus
  - ~200 commercially oriented IIoT startups in the US, increase 10-fold since 2013

- **Mostly risk-neutral adopters**
  - Starting reindustrialization drives greenfield installations by old- and newcomers

Note: IIoT=Industrial Internet of Things  1) Industrial Internet Consortium: Founded in 2014 by AT&T, Cisco, IBM, Intel & GE: Global nonprofit partnership of industry, government and academia

Source: Roland Berger
Equipment producers have to enhance their business setup in several dimensions, in order to play a leading role in Industrie 4.0.

Fields of action for equipment producers

A
Differentiated enhancement of competence and technology portfolio
> Redefinition of own core competencies and targets in the context of Industrie 4.0
> Set-up of strategic partnerships for the completion of the portfolio

B
New ways in innovation management
> Development of new solutions from a customer perspective – Particular focus on existing vulnerabilities and additional customer benefits
> Acquisition and integration of non-conformative / conventional employees
> Flexibilization of innovation-organization and -processes

C
Ready-for-digitalization go-to-market model
> Adjustment and expansion of distribution channels for digital service components
> Incorporation of new purchasing decision makers on the client side in sales process

D
Elimination of fundamental acceptance barriers
> Support of and active use of 'open standards'
> Generation of a company wide security concept for software and data ("Cyber-Security")

Source: Roland Berger
Missing competences need to be build up in-house in due time and have to be complemented by strong partnerships.

Industrie 4.0 competence landscape

Options for competence development

A  Build up internally
B  Purchase from external supplier
C  Acquisition of company or team
D  Cooperation with partner
A pure technology push without looking the customer perspective is rarely successful

Creating innovative solutions – Technology vs. customer perspective

<table>
<thead>
<tr>
<th>Technology perspective</th>
<th>Innovation perspective</th>
<th>Customer perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pure technology Push</strong></td>
<td>Question: Want can we do with our technology?</td>
<td></td>
</tr>
<tr>
<td><strong>Intelligent technology Push towards clear pain point</strong></td>
<td>Question: With which technology can we solve this problem?</td>
<td>1. Eliminate a pain point (for an existing want)</td>
</tr>
<tr>
<td><strong>Iterative process</strong></td>
<td>Qs: Is this “want” important to the customer? With which technology can we improve it? Let’s try out if it creates value in practice</td>
<td>2. Increase convenience (for an existing want)</td>
</tr>
<tr>
<td><strong>Inspiration and ideation</strong></td>
<td>Qs: From which other fields can we get inspiration? How can we experience the “journey” of our customers?</td>
<td>3. Create a new want</td>
</tr>
</tbody>
</table>

Source: Roland Berger
Innovation leaders use think tanks or corporate entrepreneurship activities in order to develop out-of-the-box solutions inhouse.

Think-tanks and corporate entrepreneurship

**Examples**

**Intel**
New Business Initiative

**Qualcomm**
Venture Fest

**SAP**
Global Business Incubator

**Sun Microsystems**
The Green Team

**IBM**
Emerging Business Opportunity Group

**Google**
New ventures

**BASF**
The Chemical Company

Even companies with extremely high intrinsic innovation power (e.g. Google, 3M) rely on think-tanks for **out-of-the-box ideas**

Source: Company information, Roland Berger
Substantial development of sale channels needed for successful sales of an enhanced product portfolio

Digitalization-ready market-approach

Business activity of OEM

- Machine
- Spare parts
- Repair / Maintenance
- Software applications
- Software updates
- Remote maintenance
- Online support
- Remote installation

Decision makers on customer side

- Factory planning
- Procurement
- Maintenance
- IT department
- Autonomous / Intelligent systems
- Marketing / sales

- KAM, Field sales, service sales
- Tele-sales
- Webshop
- Online / Completely digital
- Distributor

> Extension of the channel mix
> Interlocking and interaction between the channels
> Congruent sales- and dealer-management

Source: Roland Berger
Industrie 4.0 solutions require an expansion of security services and measures to the complete ecosystem

Cyber security – Safeguarding scenario

**PAST**
- Targeted espionage ("crown jewels")
- Computer-infrastructure
- Damage caused by unintentional negligence (e.g. viruses, loss of data)

**FUTURE**
- Targeted espionage ("crown jewels")
- Production-Ecosystem
- Customer-suppliers/buyers
- Customers
- Damage caused by unintentional negligence (e.g. viruses, loss of data)
- Direct attacks on customers via the infrastructure provided by the own company
- Criminal attacks on products or locations of your own company

**KEY QUESTIONS**
1. Does your company have cyber-security guidelines that cover production / product risks?
2. Have you cataloged your assets, and do you know the gateways for potential cyber-attacks on them?
3. Do you know which of your assets are critical in the event of an attack?
4. Are your current measures sufficient to guard the company against potential losses?
5. Has your company defined cascading spheres of responsibility for cybersecurity?

**Protection** of traditional IT infrastructure within own company

**Safeguarding of the entire production-ecosystem** including customers, OEMs, customer-suppliers and your own company

Source: Roland Berger
Let's think: act!

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