Industry 4.0 – getting out of pilot purgatory

by Dr. Bernhard Mühlreiter

tacton day – Stockholm, 24.10.2018
Questions I get asked

1. Really, how optimistic are you about value from Industry 4.0?

2. Too early, too late or perfect timing?

3. How do we get out of pilot purgatory?
Digital will transform Manufacturing as we know it – the 4th industrial revolution…

What happened when
1B People
Became connected?

- Entertainment was digitized
- Communications mobilized
- Social collaboration platforms became mainstream
- Social marketing emerged
- IT architecture virtualized to the cloud
- App-economy erupted
- Ecosystems formed with a few dominant leaders emerging

What happens when
50B Machines
Become connected?

- Monitoring and maintenance is mobilized
- Machines are adaptive / self-correcting
- Problem solving & continuous improvement goes social & mobile
- Analytics become predictive
- IT architecture virtualized to the cloud
- Industrial app-economy erupts
- Ecosystems get formed

SOURCE: Expert interviews; McKinsey analysis
Industry 4.0 leverages digital, analytics and other disruptive technologies to enable new levels of operational performance.

1.0  Mechanization, water and steam power
2.0  Mass production, assembly line and electricity
3.0  Computers and automation
4.0  Cyber-physical systems

Digital-to-physical conversion  Human machine interaction  Analytics and intelligence  Data and connectivity
Disruptive Technologies
More than one-third of “IoT” value will be created in industrial sectors

USD Trillions (2015 dollars)

<table>
<thead>
<tr>
<th>Settings</th>
<th>Size in 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factories</strong></td>
<td>1.2-3.7</td>
</tr>
<tr>
<td><strong>Cities</strong></td>
<td>0.9-1.7</td>
</tr>
<tr>
<td><strong>Human</strong></td>
<td>0.2-1.6</td>
</tr>
<tr>
<td><strong>Retail environments</strong></td>
<td>0.4-1.2</td>
</tr>
<tr>
<td><strong>Worksites</strong></td>
<td>0.2-0.9</td>
</tr>
<tr>
<td><strong>Outside</strong></td>
<td>0.6-0.9</td>
</tr>
<tr>
<td><strong>Vehicles</strong></td>
<td>0.2-0.7</td>
</tr>
<tr>
<td><strong>Homes</strong></td>
<td>0.2-0.3</td>
</tr>
<tr>
<td><strong>Offices</strong></td>
<td>0.1-0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.9-11.1</td>
</tr>
</tbody>
</table>

SOURCE: McKinsey Global Institute
Now… back to our questions

1. Really, how optimistic are you about value from Industry 4.0?
Let’s consider the three major technology innovations happening right now.
What percentage of humankind’s data was created since the Stone Age until 2016?
1. Data and connectivity exponentially expanding

90% of data was created in the past two years

12% of global trade is via e-commerce

8.4 billion connected devices worldwide
What are people’s image and speech recognition error rate?
INDUSTRIAL REVOLUTION OR EVOLUTION?

2  Artificial Intelligence making big steps...

Image Recognition Error Rate  Deep Learning

Speech Recognition Error Rate  Deep Learning

SOURCE: McKinsey
INDUSTRIAL REVOLUTION OR EVOLUTION?

2 ... allowing to put data to action

Offshore oil rig example

100% data captured
40% data stored

1% streamed on shore
~1% monitored post hoc as KPIs
<1% analytical insights sent back to rig
~0% used for preventive maintenance

Data capture
Data infrastructure
Data management
Descriptive analytics
Deployment
People & processes

Reporting and control (e.g., anomaly detection)
Prediction and optimization

SOURCE: McKinsey Global Institute
How much work could be automated?
The rise of machines - 60% of all manufacturing tasks can be automated today.

Robots perform 15% of manufacturing tasks today; in 2020 we expect 3 times more.
Optimism regarding the value of Industry 4.0 has grown significantly among manufacturers between 2016 and 2017, then levelled off.

Percent ‘More optimistic’ on potential of Industry 4.0 compared to last year

<table>
<thead>
<tr>
<th>Region</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>44</td>
<td>67</td>
<td>63</td>
</tr>
<tr>
<td>Europe</td>
<td>19</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>Japan</td>
<td>8</td>
<td>40</td>
<td>31</td>
</tr>
<tr>
<td>China</td>
<td>72</td>
<td>86</td>
<td>87</td>
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</table>
Activity in the tech space by the numbers...

Past 12 months

$3.89B
Funding in last year

Past 12 months

398
Total deals last year

Past 12 months

$12.3M
Avg. deal size

Avg. deals/quarter

99
1 List of companies have expanded since Q4 market pulse
SOURCE: CB Insights
Back to our questions...

Too early, too late or perfect timing?
Successful companies are leveraging a portfolio of targeted use cases to ensure value capture and bottom line impact.

- **Connectivity**
  - Real-time IoT based performance management
  - Augmented reliability-guided operations

- **Intelligence**
  - Predictive forecasting
  - Machine learning supported root cause problem solving for quality
  - Predictive maintenance

- **Flexible Automation**
  - Robots and cobots to automate challenging tasks
  - Automated planning & scheduling
  - Autonomous vehicles

SOURCE: McKinsey and Company in collaboration with the World Economic Forum
The three sources of value in digital manufacturing create impact through a plethora of underlying use cases – selected examples shown below

<table>
<thead>
<tr>
<th><strong>Connectivity</strong></th>
<th><strong>Intelligence</strong></th>
<th><strong>Flexible Automation</strong></th>
<th><strong>Buying and managing suppliers</strong></th>
<th><strong>Forecasting and demand planning</strong></th>
<th><strong>Manufacturing and assembling</strong></th>
<th><strong>Distributing and delivering the product</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Network Symbol" /></td>
<td><img src="image2" alt="Data Symbol" /></td>
<td><img src="image3" alt="Robot Symbol" /></td>
<td>Advanced spend intelligence &amp; automated sourcing insights</td>
<td>Real-time tracking of inventory</td>
<td>Real-time OEE visibility and downtime reduction</td>
<td>Real-time visibility of delivery windows</td>
</tr>
<tr>
<td><img src="image4" alt="Analytics Symbol" /></td>
<td></td>
<td></td>
<td>Analytics enabled tools for product cost (e.g., digital benchmarking)</td>
<td>Simulation-based market/ demand forecasting and inventory management</td>
<td>Predictive maintenance to reduce downtime</td>
<td>AA and AI driven optimization of logistics network</td>
</tr>
<tr>
<td><img src="image5" alt="E-Sourcing Symbol" /></td>
<td><img src="image6" alt="Analytics Symbol" /></td>
<td><img src="image3" alt="Robot Symbol" /></td>
<td>eSourcing events: eRFX, eCatalogs, eAuctions</td>
<td>Automation of production planning process</td>
<td>Vision systems for autonomous quality control</td>
<td>AR-assisted warehouse picking/replenishment</td>
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Example – Highly connected and intelligent computer assembly site in China

Scale

Capture – 1B data points / day
Analyzed < 1%

Capture – 10B data points/day
Able to analyze 100%

Accessibility to data measured in hours / days

Accessibility to data measured in min/secs

Speed

Proactive alerting monitoring critical IoT enabled measurement data

Alerts identify one tester drifting out of control
Tester taken off line, and issue corrected before yield impacted

Alerts identify significantly different battery placement measurements on one line vs others
Fixture alignment issue corrected before quality impact
Example – Highly automated electronics assembly line

- **In-line quality control:**
  - Integrated vision based surface quality check

- **Pick-place-screw stations:**
  - Multitasking tool
  - Automated screw feeder
  - In-line torque monitoring & control

- **Autor: 87%**
  - Simmom
  - Stats

- **Pick-place-screw stations:**
  - Multitasking tool
  - Automated screw feeder
  - In-line torque monitoring & control

- **Automated insertion of cable:**
  - Simple conventional robot

- **Automated testing:**
  - Fully automated, integrated packaging machine
  - Flexibility for different screen sizes

- **Packaging station:**
  - Fully automated, integrated packaging machine
  - Flexibility for different screen sizes

**Part racks**

**Line-side material supply:**
- Dust-proof racks
- Magazines/dispensers for small parts

**In-line quality control:**
- Automated vision based inspection
- Overhead mounted design

**SOURCE:** McKinsey
But most companies find themselves stuck in pilot purgatory

% respondents

Customers piloting/deploying IoT solutions

Time spent piloting by companies
Percent of companies

<1 year 15
1-2 years 56
>2 years 29

Scale

Network

Ecosystem transformation

Company transformation

Use-case Implementation pilots

Isolated efforts

Start
... which brings us to our last question

How do we get out of pilot purgatory?
When we observe financial impact from IoT

% of companies

“Laggards” 20% 20% “Leaders”

60%

Leaders have broken out of the pack and are seeing impact at scale
How to get out of pilot purgatory
Let’s see what separates leaders from the laggards
When we observe key success factors...

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<td>Senior Executive Support</td>
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Top executive support is the biggest difference between leaders and laggards.
Lack of internal alignment could hold you back... even with CEO backing

Key success factors: % citing factor #1 or #2

Success Factors

Strong internal organizational alignment

44

34

Gap Between Leaders vs. Laggards

10

Percent citing factor in top 2
**Have a clear view of value is created before you commit**

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**Gap Between Leaders vs. Laggards**

- 9

Percent citing factor in top 2
Lack of strong business case often holds laggards back

### Key success factors: % citing factor #1 or #2

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Gap Between Leaders vs. Laggards:
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Percent citing factor in top 2
First three factors are organizational, not technical!

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Percent citing factor in top 2
Implementing more IoT use cases correlates with better financial impact. Effect levels out around 30 use cases.

Financial impact vs number of use cases

Increasing number of use cases
Leverage the ecosystem

Leaders are...

- **167% more likely** to choose technology allowing for 3rd party developer ecosystems
- **40% less likely** to require/emphasize in-house SI capability
- **175% more likely** to use external SW/app development
Multidisciplinary teams embrace ‘agile’ as the new ‘way of working’

Multidisciplinary teams bring high velocity of implementation

Leaders are...

5x more likely to...

Have a digital transformation group

more likely to...

Emphasize process re-engineering as part of their program
Do not be afraid of advance end points

Leaders are ...

$185\%$ more likely to ...

Use advance end points such as AR/VR

$2\times$ more likely to ...

require that underlying enabling software (e.g. IoT platform software) specifically support advanced endpoints
Six key success factors to escape ‘pilot purgatory’ and ensure sustainable value capture and business transformation

**Business value**

- Be value-back not technology-forward: create a prioritized roadmap and associated business case
- Develop a **compelling** strategic vision and early ‘lighthouses’ to inspire the organization

**Technology setup**

- Be selective what technology to build in-house vs. partnering with others
- Build capability to test and iterate solutions in an agile manner through a ‘2-speed’ technology organization

**Organizational prerequisites**

- Drive transformation from the top with clear business ownership
- Lock in benefits to the bottom line through capability building and business process change
If you only take away 3 things, remember these:

1. Organizational barriers are holding companies back more than technological barriers

2. Transformation is top down. The biggest difference between winners and laggards is the level of senior executive involvement, especially CEO

3. No single IoT use case is a silver bullet at scale, execution (doing more use cases and getting them to maturity over time) matters more than picking the optimal use case