Man vs. Machine?
Self-driving cars and digital factories

Wolfgang Schäfer, CFO Continental
Börsen-Zeitung im Dialog, Düsseldorf, November 26, 2015
Internet of Everything (IoE): A key driver of economic growth

Outlook 2020

- **6 trillion USD**
  - Economic impact of IoE
- **50 billion**
  - Connected devices and machines
- **> 250 million**
  - Connected cars

Source: Forrester, Gartner, McKinsey Global Institute
Internet of Everything (IoE): Considerable sales potential for the automotive industry

Fleet management

Safety & security

Toll systems

Maintenance management

Traffic management systems

€57 bn
Focus market 2020
Digitalization is Changing Companies Fundamentally: Products, business models, and IT/production
Megatrends in the Automotive Industry
Digitalization is setting the pace of innovation

Doing more.
For safe mobility.

Doing more.
For clean power.

Doing more.
For intelligent driving.

Doing more.
For global mobility.
Digitalization
The car has already become a rolling computer

- More than 170 sensors
- Up to 90 control units
- More than 150 actuators
Digitalization
The proportion of software contained in cars has risen rapidly

- Space shuttle
- Drone
- Mars Rover "Curiosity"
- Boeing 787
- Car Driving Sub-System

2 http://www.wired.com/2012/11/navy-killer-drone/ and Northrop
3 http://www.verticalsysadmin.com/making_robust_software/ and NASA
4 Boeing
5 Own estimates
Automated Driving
A gradual introduction
Automated Driving
Relieving drivers when required
Automated Driving
Car drivers expect entry into normal everyday driving

Automated driving is a useful step forward.

Automated driving will form part of normal everyday driving in ten to fifteen years.

<table>
<thead>
<tr>
<th>Region</th>
<th>Agreement Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>53%</td>
</tr>
<tr>
<td>China</td>
<td>79%</td>
</tr>
<tr>
<td>Japan</td>
<td>61%</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>41%</td>
</tr>
</tbody>
</table>

Figures in %
Proportion in agreement shown
Automated Driving
Anticipated additional costs at a realistic level

- Germany: €2,900
- China: €2,600
- Japan: €2,300
- U.S.A.: €1,100

Figures in %
Proportion in agreement shown
Automated Driving
Suppliers must prove their systems expertise

 Drivers
- Attention management
- Interior camera
- Speech recognition
- Augmented Reality Head-up display

 Environments
- Radar
- Camera
- Lidar
- Ultrasound
- Digital maps
- Cooperative cars
- Back-end

 Vehicles
- Brakes
- Sensors
- Engine
- E/E architecture
- Transmission
- Actuators

✔ Continental portfolio
Digitalization Is Changing Every Dimension of a Company: Products, business models, and IT/production
Industry 4.0
Demarcation

First industrial revolution
Introduction of mechanical production facilities with the help of water power and steam power

Second industrial revolution
Introduction of mass production based on the division of labor with the help of electricity

Third industrial revolution
Use of electronics and IT to automate production further

Fourth industrial revolution
On the basis of cyber-physical systems

Late 18th century  Early 20th century  Early 1970s  Today
Industry 4.0

Key aspects

Vertical integration and connected production systems

Horizontal integration via value-added networks

Digital consistency of engineering along the entire value chain

Humans as directors of value creation
Production Index – Manufacturing Industries
Germany leading the industrial nations

Index 2005 = 100

<table>
<thead>
<tr>
<th>Year</th>
<th>Germany</th>
<th>UK</th>
<th>France</th>
<th>U.S.A.</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>113,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>93,9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>114,1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>112,9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Statistisches Bundesamt (Federal Statistical Office)/United Nations

Share represented by industry in Germany’s GDP has remained virtually constant for the last 20 years (22.3% in 2014)
**Industry 4.0**

Significant increases in productivity possible by 2025

Potential additional productivity by 2025 thanks to Industry 4.0 (%)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Additional increase in productivity</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive industry</td>
<td></td>
<td>6–9</td>
</tr>
<tr>
<td>Food industry</td>
<td></td>
<td>5–10</td>
</tr>
<tr>
<td>Mech. engineering (components)</td>
<td></td>
<td>4–7</td>
</tr>
<tr>
<td>Mech. engineering (machines)</td>
<td></td>
<td>10–15</td>
</tr>
<tr>
<td>Wind energy</td>
<td></td>
<td>9–12</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>4–7</td>
</tr>
</tbody>
</table>

**Total additional productivity:**

5–8% (€90-150 billion)

Source: Boston Consulting

+6% extra jobs (400,000) by 2025
Collaborative Robotics
Seamless collaboration between man and machine
Training
Automotive software developers
Continental
Already a software company

Sales generated with digitalized technologies (€ billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales (€ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>1.6</td>
</tr>
<tr>
<td>2010</td>
<td>10.2</td>
</tr>
<tr>
<td>2015</td>
<td>&gt;12</td>
</tr>
</tbody>
</table>

Digitalization at Continental today

- >12 € billion sales generated with digitalized technologies
- 80% of innovations in automotive thanks to software functionality
- 12,000 software developers
  Continental is one of the major "software firms" in Germany

60% of automotive sales generated with electronics, sensors, and software.
Software is the "new wheel" of the industry
Nothing works without it anymore