Welcome to the IFR Press Conference
18 October 2018
Tokyo
Agenda

Welcome

Presentation of the speakers

World Robotics 2018 Industrial Robots
  • Review 2017 and forecast 2018-2021
  • Main markets – customers - trends
  • Robot density

World Robotics 2018 Service Robots
  • Professional Service Robots
  • Personal/Domestic Service Robots
  • Companies

Questions
Speakers on the panel

Junji Tsuda
IFR President
Representative Director
Chairman of the Board
Yaskawa
Japan

Steven Wyatt
IFR Vice President
Group Vice President, and Head of Marketing & Sales Robotics, ABB
Switzerland

Gudrun Litzenberger
General Secretary
International Federation of Robotics
Germany
International Federation of Robotics – Representing the global robotics industry

- Robotics turnover 2017: $48 billion
- More than 50 members:
  - National robot associations
  - R&D institutes
  - Robot suppliers
  - Integrators
- Sponsor of the annual International Symposium on Robotics (ISR)
- Co-sponsor of the IERA Award
- Primary resource for world-wide data on use of robotics – IFR Statistical Department
Records, records

2017: 381,300 units, +30%

2018: 421,000 units, +10%

2021: 630,000 units, +14% on average per year
Continued record sales since 2013

Estimated annual worldwide supply of industrial robots
2009-2017 and 2018*-2021*

+14% on average per year

Source: IFR World Robotics 2018

*forecast
Emerging region Asia

Estimated worldwide annual supply of industrial robots 2016-2017 and forecast for 2018*-2021*

*000 of units

2016 2017 2018* 2019* 2020* 2021*

Asia/Australia Europe America

Source: IFR World Robotics 2018
China has significantly expanded its leading position

Estimated worldwide annual supply of industrial robots
15 largest markets 2017

<table>
<thead>
<tr>
<th>Country</th>
<th>'000 of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>137.9</td>
</tr>
<tr>
<td>Japan</td>
<td>45.6</td>
</tr>
<tr>
<td>Rep. of Korea</td>
<td>39.7</td>
</tr>
<tr>
<td>United States</td>
<td>33.2</td>
</tr>
<tr>
<td>Germany</td>
<td>21.4</td>
</tr>
<tr>
<td>Taiwan</td>
<td>10.9</td>
</tr>
<tr>
<td>Vietnam</td>
<td>8.3</td>
</tr>
<tr>
<td>Italy</td>
<td>7.7</td>
</tr>
<tr>
<td>Mexico</td>
<td>6.3</td>
</tr>
<tr>
<td>France</td>
<td>4.9</td>
</tr>
<tr>
<td>Singapore</td>
<td>4.5</td>
</tr>
<tr>
<td>Spain</td>
<td>4.2</td>
</tr>
<tr>
<td>Canada</td>
<td>4.0</td>
</tr>
<tr>
<td>India</td>
<td>3.4</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: IFR World Robotics 2018
China: Strong increase of robots sales of foreign companies

Annual shipments of industrial robots in China 2007 - 2017

Source: IFR World Robotics 2018
Top 5 countries represent 73% of total sales in 2017

Estimated worldwide annual supply of industrial robots at year-end main markets 2015 - 2017

- China: 138,000 units, +59%
- United States: 87,000 units, +7%
- Rep. of Korea: 69,000 units, +6%
- Japan: 41,000 units, -4%
- Germany: 20,000 units, +18%

Source: IFR World Robotics 2018
Main drivers of the growth 2017: automotive, electronics, metal

Estimated annual supply of industrial robots at year-end by industries worldwide 2015-2017

<table>
<thead>
<tr>
<th>Industry</th>
<th>2017</th>
<th>2016</th>
<th>2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>103</td>
<td>98</td>
<td>81</td>
<td>+22%</td>
</tr>
<tr>
<td>Electrical/electronics</td>
<td>121</td>
<td>121</td>
<td>96</td>
<td>+33%</td>
</tr>
<tr>
<td>Metal</td>
<td>45</td>
<td>29</td>
<td>29</td>
<td>+55%</td>
</tr>
<tr>
<td>Plastic and chemical products</td>
<td>29</td>
<td>20</td>
<td>20</td>
<td>+9%</td>
</tr>
<tr>
<td>Food and beverages</td>
<td>10</td>
<td>8</td>
<td>20</td>
<td>+19%</td>
</tr>
<tr>
<td>Others</td>
<td>19</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Unspecified</td>
<td>25</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Source: IFR World Robotics 2018
Key Drivers for Automation
more relevant than ever

Shift to high mix/low volume production
Global competitiveness
Digitalization of manufacturing – Industry 4.0
Growing consumer markets
Energy efficiency-driven technology shifts
Regionalized production
Main customer: automotive industry

Transition from Internal Combustion Engines (ICE) to electric vehicles/hybrids
Increased complexity
Customization – increasing mix requires more flexible production
Automation of final assembly
Automotive parts suppliers – more SME’s will use robots
Main customer: electrical/electronics industry

Continuously increasing demand for batteries, chips and displays

Short life cycles of electronic products

High turnover of people with associated labor shortages

Increasing degree of robot adoption

Higher quality demands on manufacturing process
Robot sales will increase in all other industries

Metal industries – more flexibility and cost efficiency
Rubber and plastics industry – more integrated manufacturing concepts
Food and beverage industry – shift to even shorter production runs
Pharmaceutical industry - improving productivity without sacrificing quality
Highest robot density in Korea - lowest average in Asia

Number of installed industrial robots per 10,000 employees in the manufacturing industry 2017

- Rep. of Korea: 710
- Singapore: 658
- Germany: 322
- Japan: 308
- Sweden: 240
- Denmark: 230
- United States: 200
- Taiwan, Prov...: 197
- Belgium: 192
- Italy: 190
- Netherlands: 172
- Austria: 167
- Canada: 161
- Spain: 157
- Slovakia: 151
- Slovenia: 144
- Finland: 139
- France: 137
- Switzerland: 129
- Czech Rep.: 119
- China: 97

Average Europe: 106
Average America: 91
Average Asia: 75
Average world: 85

Source: IFR World Robotics 2018
Technological Developments expanding Robot Adoption

Today
- More intelligent components, e.g. Smart Grippers
- Greater connectivity, e.g. “Plug & Play” interfaces and Cloud Computing
- Easier to Use, e.g. “Programming by Demonstration”

Tomorrow
“Machine learning” enables robots ....
- to learn by trial-and-error or by video demonstration.
- to self-optimize.
- to communicate with other machines to improve entire processes.

New business models, e.g. Robotics as a Service (RaaS)
2021: 3.8 Million Industrial Robots in the World’s Factories

Estimated worldwide operational stock of industrial robots 2016-2017 and forecast for 2018*-2021*

Source: IFR World Robotics 2018

*forecast
Professional Service Robots have entered our daily lives

**Value of sales**
- 2017: US$ 6.6 bn, +39%
- 2018: US$ 8.7 bn, +33%
- 2019-2021: US$ 37 bn, +19% (CAGR)

**Unit sales:**
- 2017: 109,500 units, +85%
- 2018: 165,300 units, +32%
- 2019-2021: 736,600 units, +21% (CAGR)
Professional Service robots: Main drivers of the value growth are logistic systems

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019*-2021*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistic</td>
<td>3,865</td>
<td>2,383</td>
<td>1,001</td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>9,560</td>
<td>2,302</td>
<td>1,911</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>4,365</td>
<td>1,068</td>
<td>966</td>
<td>984</td>
</tr>
<tr>
<td>Defense</td>
<td>3,392</td>
<td>953</td>
<td>902</td>
<td>793</td>
</tr>
</tbody>
</table>

*forecast

Source: World Robotics 2018
AGVs in factories, warehouses, logistic centers, hospitals…

69,000 units installed in 2017, 162% more than in 2016

- 6,700 units in manufacturing
- 62,200 units in warehouses, logistic centers, hospitals …

2018:
115,000 units, 66% higher than in 2017

2019-2021:
485,000 units, +18% on average per year
Medical robots – most valuable service robots: US$ 1.9 billion in 2017
- 2017: 2,900 units, +75%
- 2018: 4,400 units, +49%
- 2019-2021: 22,100 units, +27% (CAGR)

Field robots – mostly milking robots
- 5,400 milking robots in 2017, slight increase
- Still low number but high increase: agricultural robots – 520 units in 2017 up from 190 units
- 2018: 7,200 field robots, +17%
- 2019-2021: 32,700, +22% (CAGR)
Logistic systems are also the drivers of the growth in units

Service robots for professional use. Main applications
Units sales 2016 and 2017, forecast 2018*, 2019*-2021*

*forecast

Source: World Robotics 2018
High potential for exoskeletons

Service robots for professional use. Other applications
Unit sales 2016 and 2017, forecast 2018* and 2019*-2021*

- Field: 32.7, 7.2, 6.4, 5.9
- Exoskeletons: 40.5, 7.0, 6.1, 5.6
- Medical: 22.1, 4.4, 2.9, 1.7
- Construction: 4.2, 1.1, 0.9, 0.7

*forecast

Source: World Robotics 2018
Vacuuming and floor cleaning robots are most established personal/domestic service robots / revised graph 5 Dec. 2018

Service robots for personal/domestic use.
Estimated value 2016 and 2017, forecast 2018* and 2019*-2021*

Household robots
- 2016: 11.1 billion US$
- 2017: 2.0 billion US$
- 2018: 1.6 billion US$
- Forecast 2019*-2021*: 1.2 billion US$

Entertainment and leisure robots
- 2016: 2.0 billion US$
- 2017: 2.0 billion US$
- 2018: 0.5 billion US$
- Forecast 2019*: 0.4 billion US$
- Forecast 2020*: 0.4 billion US$

*forecast

Source: World Robotics 2018
2017: 8.5 million units, +25% - considerable increase expected

Service robots for personal/domestic use.
Unit sales 2016 and 2017, forecast 2018* and 2019*-2021*
More than 700 service robot companies identified

Number of service robot manufacturers of all types (professional and personal/domestic use) by region of origin

- Europe, 307
- North America, 250
- Asia, 133
- Others, 29

Source: World Robotics 2018
Thank you!

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