The Trends & Technologies Driving the Industry in 2024
International Federation of Robotics

- **Global non-profit organization** – active for the robotics sector since 1987
- IFR represent **more than 3,000 organizations** from **30 countries**
  - Robot manufacturers, national robotics associations, universities, start-ups worldwide
- Annual global **robotics turnover $50 billion** (robot systems including software & peripherals)
The Status of the Global Robotics Market
IFR statistics 2023: preliminary results and World Robotics

- Numbers presented here are **preliminary** as of April 2024
- Final results most likely are subject to changes
- They will be published in World Robotics 2024
- Available 24 September 2024
Preliminary global installations 2023: 560,000 units (+1%)
Electronics is largest customer

Annual installations of industrial robots by customer industry - World

1,000 units

- Electrical/electronics: 2023 = 159, 2022 = 157, 2021 = 157, +1%
- Automotive: 2023 = 140, 2022 = 136, 2021 = 117, +3%
- Metal and machinery: 2023 = 68, 2022 = 66, 2021 = 68
- Food: 2023 = 14, 2022 = 15, 2021 = 15

Source: International Federation of Robotics - preliminary results 2023
Asia’s share in installations at 73%

Note: Asia figures are very preliminary yet

Preliminary data 2023 as of April 2024

Shares in annual installations of industrial robots by region– 2023 ('000 of units)

Source: International Federation of Robotics – preliminary results 2023
United States growing +12% on record level

Annual installations of industrial robots - United States

1,000 units


Source: International Federation of Robotics - preliminary results 2023
### Annual installations of industrial robots by customer industry - United States

<table>
<thead>
<tr>
<th>Industry</th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>14,678</td>
<td>14,472</td>
<td>9,854</td>
<td>+1%</td>
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<tr>
<td>Electrical/electronics</td>
<td>5,120</td>
<td>3,732</td>
<td>2,963</td>
<td>+37%</td>
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<tr>
<td>Metal and machinery</td>
<td>4,123</td>
<td>3,900</td>
<td>4,193</td>
<td>+6%</td>
</tr>
<tr>
<td>Plastic and chemical products</td>
<td>3,213</td>
<td>3,065</td>
<td>3,631</td>
<td>+5%</td>
</tr>
<tr>
<td>Food</td>
<td>1,982</td>
<td>2,442</td>
<td>3,443</td>
<td></td>
</tr>
</tbody>
</table>

Source: International Federation of Robotics - preliminary results 2023

Automotive industry is the pillar of US robot demand
Mexico: Unchanged at a high level

Annual installations of industrial robots - Mexico

Source: International Federation of Robotics - preliminary results 2023

2013: 2,739 units
2014: 2,494 units
2015: 5,466 units
2016: 5,933 units
2017: 6,356 units
2018: 5,681 units
2019: 4,562 units
2020: 3,363 units
2021: 5,319 units
2022: 6,000 units
2023: 5,868 units

Annual installations have remained steady, with a slight decrease in 2020 (3,363 units) compared to 2019 (4,562 units). The peak year was 2017 with 6,356 units.
Canada: New record due to strong demand from automotive industry

Annual installations of industrial robots - Canada
units

Source: International Federation of Robotics - preliminary results 2023

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>2,250</td>
</tr>
<tr>
<td>2014</td>
<td>2,333</td>
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<tr>
<td>2015</td>
<td>3,474</td>
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<td>2016</td>
<td>2,334</td>
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<tr>
<td>2017</td>
<td>4,057</td>
</tr>
<tr>
<td>2018</td>
<td>3,582</td>
</tr>
<tr>
<td>2019</td>
<td>3,603</td>
</tr>
<tr>
<td>2020</td>
<td>2,566</td>
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<tr>
<td>2021</td>
<td>4,239</td>
</tr>
<tr>
<td>2022</td>
<td>3,223</td>
</tr>
<tr>
<td>2023</td>
<td>4,616</td>
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</tbody>
</table>

+43%
Global Trends and Outlook
TOP 5 Global Robotics Trends in 2024

1. **AI AND MACHINE LEARNING**
2. **COBOTS IN NEW APPLICATIONS**
3. **MOBILE MANIPULATORS**
4. **DIGITAL TWIN**
5. **HUMANOIDS**
AI and Machine Learning

- Growing adoption in commercial applications
- Machine learning and vision helps robots to respond to real environment
- Machine learning algorithms analyzing data for process optimization
- Predictive AI analyzing robot performance data
- Generative AI allows more intuitive programming by natural language
- Helps to manage variability and unpredictability
Ease of use main benefit for collaborative robots today with intuitive and simple programming

Ecosystems emerging

The range of collaborative applications continues to expand – e.g. cobot welding

Collaborative robots complement investments in traditional industrial robots

AI will allow for further cognitive collaboration with humans
Mobile Manipulators

- Combine the **mobility** of robotic platforms (AMRs) with the **dexterity** of manipulator arms

- Mobile manipulators (mobile cobots) offer **new use cases** that could expand the demand for collaborative robots substantially.
  - Used to automate material handling tasks in industry
  - Opening up new use cases also in service applications

- **Currently still at a moderate volume, but high growth potential**
Virtual Simulation and Digital Twin

- Robots are more and more digitally integrated in factories.
- Simulation is used to check performance before the physical world itself is touched.
- Digital twins can use their real-world operational data to run simulations and predict likely outcomes.
- The twin exists purely as a computer model, it can be stress-tested and modified with no safety implications while saving costs.
- **Digital twins bridge the gap between digital and physical worlds.**
Humanoid robots

- Human-like design - can be used flexibly in work environments that were actually created for humans

- Potential impact on various sectors, e.g. warehouses.

- Humanoids recently receive tremendous attention, e.g. China’s MIIT announcement on detailed goals for the country’s ambitions to mass-produce humanoids by 2025

- Mass market adoption remains a complex challenge.
Outlook for Asia

- 2024 will be challenging
- Order intake in Asia declined in the second half of 2023**
- Foreign Direct Investments in China hit a 30-year low*

Outlook for Europe

- European economy generally promising, while Germany is challenging
- Order intake growing in the single-digits in Q4/2023.**

Sources:
* VDMA Machinery & Equipment in China Q4/2023
** IFR Quarterly Survey
Outlook

Signs of a cyclical downswing in 2024 for North America

- Turnover moving sideways in North America in Q4/2023*
- Double-digit contraction of order intake in Q4/2023*

Source:
* IFR Quarterly Survey and A3