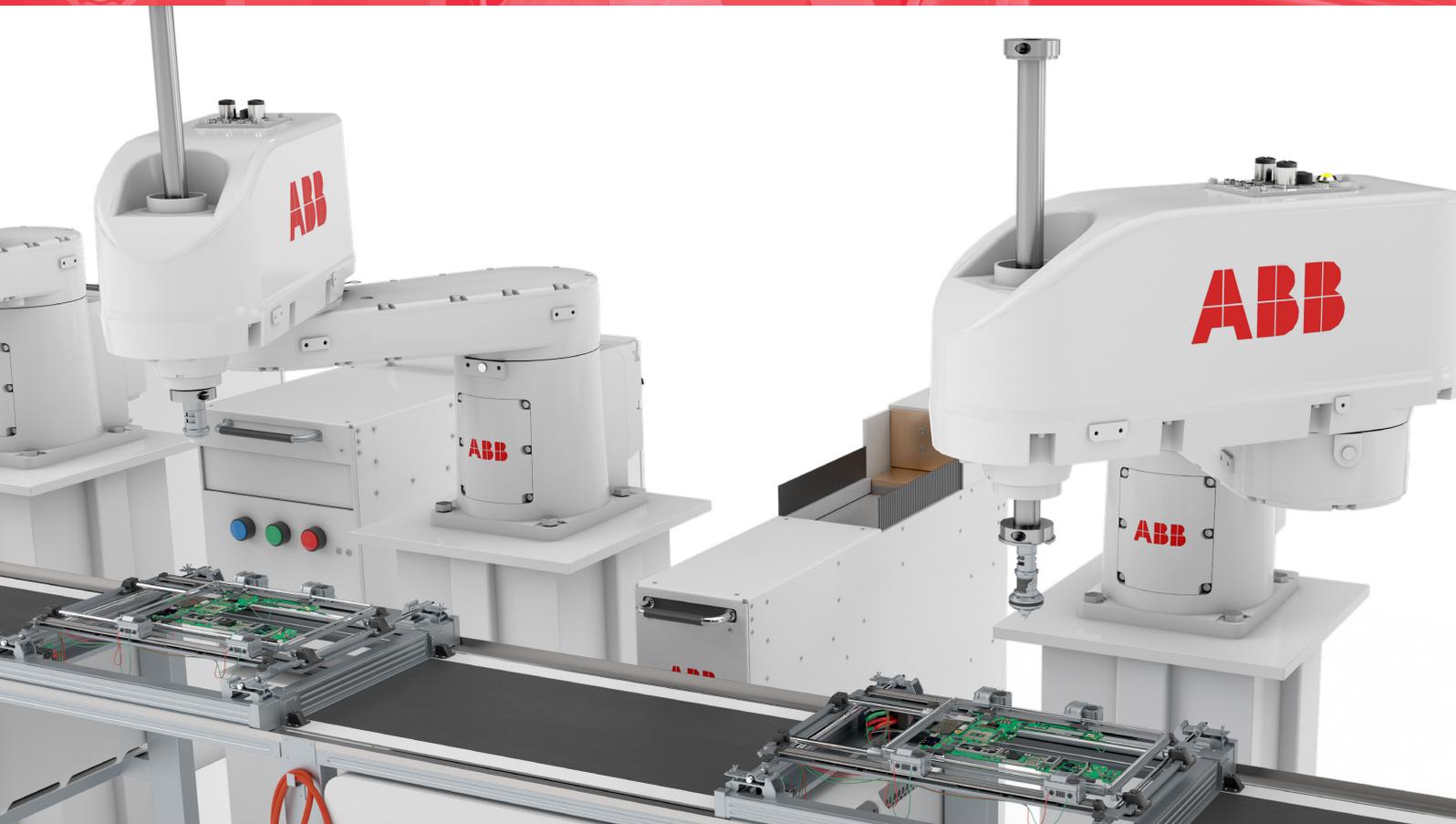


World Robotics

Industrial Robots

2023



Statistics, Market Analysis, Forecasts and Case Studies

World Robotics

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World Robotics 2023 – Industrial Robots

Produced by VDMA Services GmbH, Lyoner Str. 18, 60528 Frankfurt, Germany.

The robot statistics are based on consolidated world data reported by robot suppliers as well as on the statistics and support of the national robotics associations of North America (A3), Spain (AER), People's Republic of China (CRIA), Denmark (DIRA), Poland (FAIRP), Japan (JARA), Republic of Korea (KAR), Italy (SIRI), Sweden (SWIRA), and Chinese Taipei (TAIROA)

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We express our most sincere gratitude to all partners!

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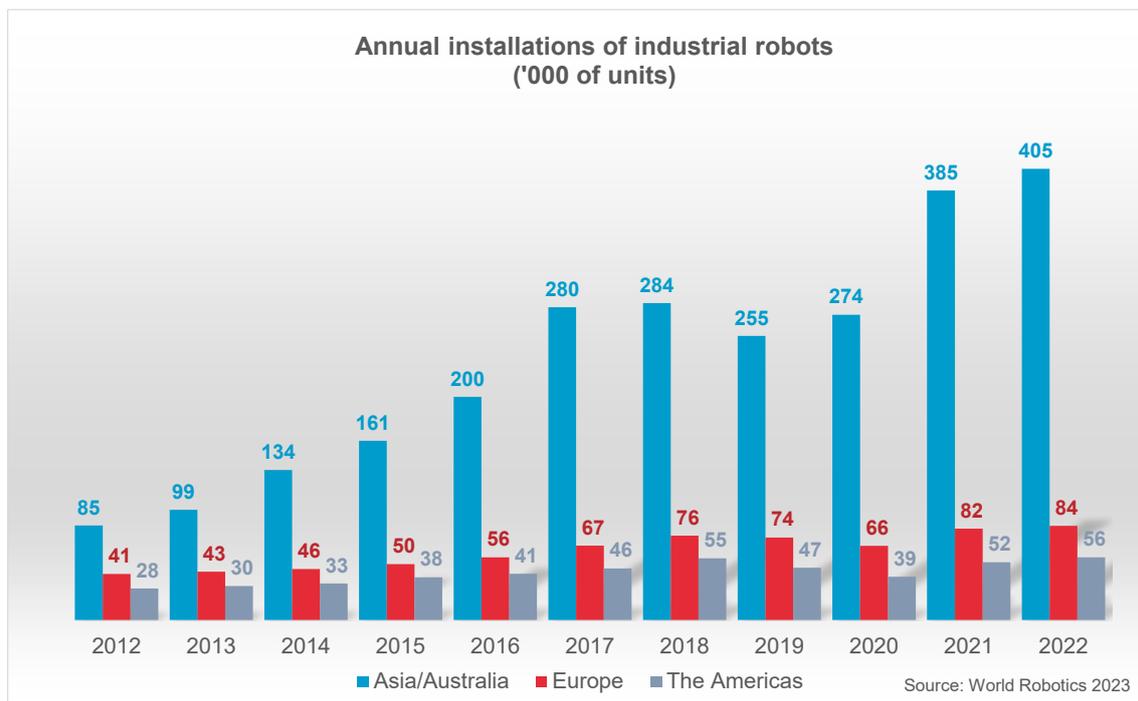
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Executive Summary World Robotics 2023 Industrial Robots

Robot installations 2022: Growing from a high basis

Robot installations hit a new record level of 553,052 units. For the second year in a row, annual installations exceeded the 500,000-unit mark, adding another 5% to the then record figure of 526,144 units installed in 2021. The major customer industries, automotive and electronics, installed substantially more robots than in 2021. Supply chain disruptions and the scarcity of inputs as well as different local or regional headwinds still hampered the completion of projects, but less severely than in the previous year. The electronics industry was the largest customer of robots, a position it gained in 2020 and has maintained since, claiming 28% (+1 pp) of all robots newly installed in 2022. The automotive industry followed suit with 25% of installations (+3 pp), growing in both the car manufacturer and the parts supplier segment. The metal and machinery industry retained its third place (12%; -1 pp), followed by the plastic and chemical products industry (4%) and the food and beverage industry (3%). Note that for 17% of the robot installations (-3 pp), there is no information on the customer industry.



In 2022, the operational stock of industrial robots was computed at 3,903,633 units (+12%). Since 2017, the operational stock of industrial robots had been increasing by 13% on average each year. China’s operational stock of industrial robots, which had been growing impressively by 25% on average each year since 2017, exceeded the one-million-unit mark in 2021 and 1.5 million units in 2022, when it grew by another 22%. This represented 38% of the global stock. The Japanese operational stock was 414,281

units in 2022. The European operational stock of robots was computed at 728,391 units and the Americas held a stock of 491,535 units (+9%).

Growth in all major markets and regions

Asia¹ is the world's largest industrial robot market. In 2022, 404,578 units were installed, up 5% from 385,143 units in 2021. 73% of all newly deployed robots were installed in Asia (2021: 74%). From 2017 to 2022, annual robot installations grew by 8% on average each year. Three of the top five markets for industrial robots are in Asia: China is by far the largest market. Every other robot installed worldwide in 2022 ended up in China: Installations were up 5% to 290,258 units. Installations in Japan were up 9% to 50,413 units. The Korean market, in contrast, remained rather steady at 31,716 units (+1%). Robot installations in the second largest market, **Europe**, were up 3% to 84,226 units. The annual average growth rate from 2017 to 2022 was +5%. Installation counts in Germany, the largest European market and the only European one in the global top five, were down by 1% to 25,636 units. Installations in the second largest European market, Italy, grew by 8% to 11,475 units. The third largest European market, France, gained 13%, installing 7,380 units. 84% of all European robot installations in 2022 took place in the European Union² (70,781 units; +5%) and 71% took place in the Euro Area³ (59,592 units; +6%). In the **Americas**, installations were up 8% to 56,053 units in 2022, surpassing the previous peak level of 55,212 units achieved in 2018. The United States is the largest American market and accounted for 71% of the installations in the Americas (39,576 units; +10%) in 2022. The two other major markets are also in North America: Mexico had 6,000 units (+13%) and Canada 3,223 units (-24%) installed.

79% of global robot installations in five countries

The five major markets for industrial robots are **China, Japan, the United States, the Republic of Korea, and Germany**. These countries accounted for 79% of global robot installations (437,599 units).

China has been the world's largest industrial robot market since 2013 and accounted for 52% of total installations in 2022.

Robot installations in **Japan** continued to recover from the pandemic dip in 2020 as installations returned to the 2019 level. Installations were remarkably high in 2017, 2018, and 2019 for a country which already had a high level of automation in industrial production. The country accounted for 9% of the global robot installations in 2022.

¹ Including Australia and New Zealand.

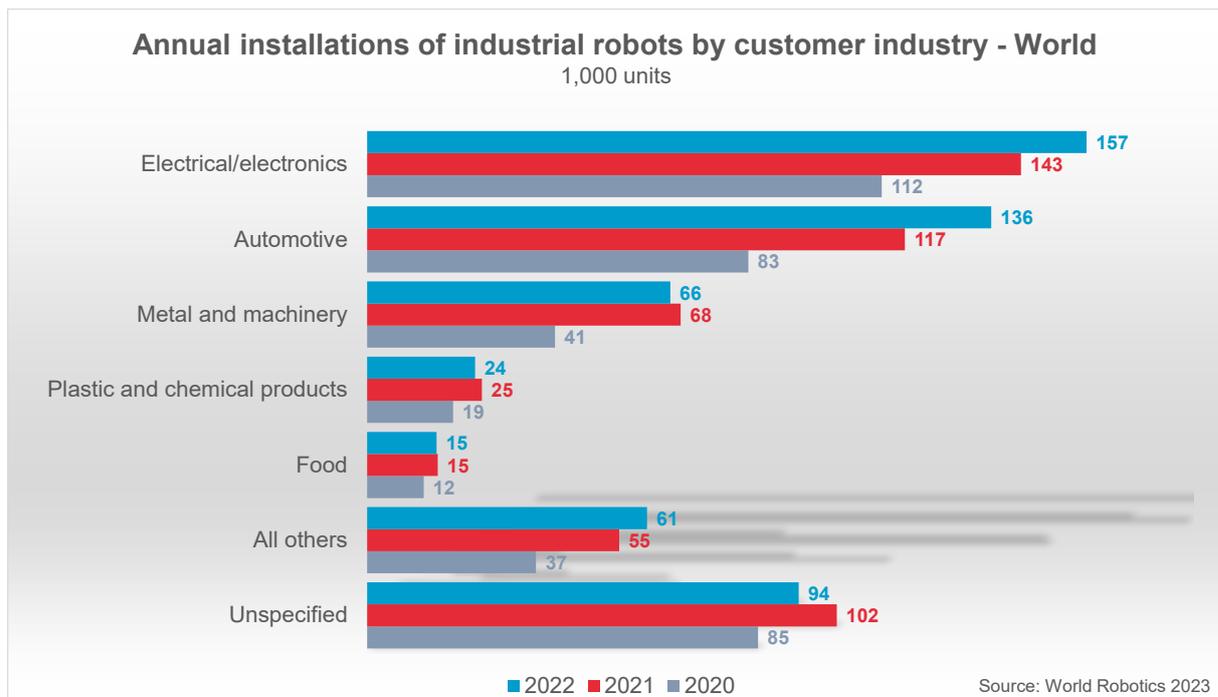
² EU_2020 as defined by Eurostat.

³ Countries using the Euro as their official currency, as of 2023.

The **United States** accounted for 7% of robot installations in 2022. The United States leaptfrogged the Republic of Korea into third place with a record installation count of 40,373 units in 2018 and has since maintained this position.

In the **Republic of Korea**, annual robot installations had been declining from the peak level of 41,373 units in 2016 until 2020 and have been growing slowly since then. In 2022, installations in Korea accounted for 6% of the overall total.

Germany is the fifth largest robot market in the world, accounting for 5% of global robot installations in 2022.



The **electrical/electronics industry** became the main customer of industrial robots in 2020 and has maintained this position since then. In 2022, 156,936 robots were installed in the production of household appliances, electrical machinery, semiconductors, solar panels, computers, telecommunication devices, and video and electronic entertainment goods. This was 10% more than in the previous year and the highest level ever recorded. Since 2017, robot demand from this industry had grown by 5% per year on average. In 2018 and 2019, global demand for electronic devices and components decreased substantially. This customer industry was among the most affected businesses that suffered from the China-US trade conflict, as Asian countries are leaders in the manufacture of electronic products and components. However, demand for consumer electronics skyrocketed during the COVID-19 pandemic, and electronic components are crucial components in all kinds of engineering, including automotive and industrial machinery. The limited production capacity and the disruptions in supply chains due to the pandemic demonstrated the need for additional production capacity in the electronics industry.

The **automotive industry** lost its position as the largest customer of industrial robots in 2020. Despite a strong growth rate of 16% to a new peak level of 136,130 units in 2022, this industry remained in second place. While the automotive industry needs to invest in the transition from combustion engines to alternative drives, decreasing demand limits the need for capacity expansion. From 2017 to 2022, annual installations in the automotive industry increased by 2% on average each year (CAGR).

In 2022, the average⁴ robot density in the manufacturing industry was 151 robots per 10,000 employees. Driven by the high volume of robot installations in recent years, Asia's average robot density grew by 15% CAGR from 2017 to 168 units per 10,000 employees in 2022. During the same time period, the European robot density grew by 8% CAGR to 136 units per 10,000 employees. In the Americas, it was 120 robots per 10,000 employees (+7% CAGR since 2017).

Many governments see the crisis as a chance for modernization. Direct and indirect subsidies for digitalization of domestic production have been granted or will be granted in many countries. But these programs address only those companies that are already aware of robotic automation as a solution to their problems. The share of companies that use robots is still rather small, especially among SMEs. Additional effort is needed to spread knowledge especially among SMEs to avoid inefficient technology being used in large parts of the industry. The IFR's new campaign Go4Robotics (<https://go4robotics.com/>) contributes a vendor-neutral first orientation for companies new to robotic automation. But there is more to it. Without sufficient knowledge, expertise and resources, it is hardly possible to reap the benefits of robotic automation to a full extent. The wide range of engineering capabilities needed also in peripherals such as vision or process design often prevent the adoption of robots, especially in SMEs. A developed ecosystem of system integrators that provide these capabilities is key – and also often the bottleneck. Government programs should focus on the support of such robotics infrastructure.

Outlook 2023 – 2026

The ongoing year 2023 is characterized by a slowdown of global economic growth. Robot installations in 2023 are not expected to follow this pattern. Robot demand is still at a higher level than it was before COVID-19. Global robot installations are expected to grow by 7% to more than 590,000 units in 2023. The global economic slowdown is expected to manifest in robot installations in 2024 but growth rates are expected to accelerate slightly in 2025 and more strongly in 2026. There is no indication that the overall long-term growth trend will come to an end any time soon. Rather the contrary will be the case. The mark of 600,000 units installed per year worldwide is expected to be reached in 2024, and the 700,000-unit mark will be smashed in 2026. The North American market is expected to grow by 7% on average each year, factoring in inflation and tighter

⁴ Average values for geographic aggregates (e.g. the world, Europe, and Asia/Australia) include only those territories listed in tables 2.6, 2.7, and 2.8.

monetary policies. Medium-term perspectives for the European market are dampened by the high probability of recession. The Asian market will remain strong. Robot demand in China will continue to grow from a very high level by high single-digit rates. Robot installations in Japan will slightly accelerate in 2024 and grow by high single-digit rates. Medium single-digit growth rates are expected for the Korean market.