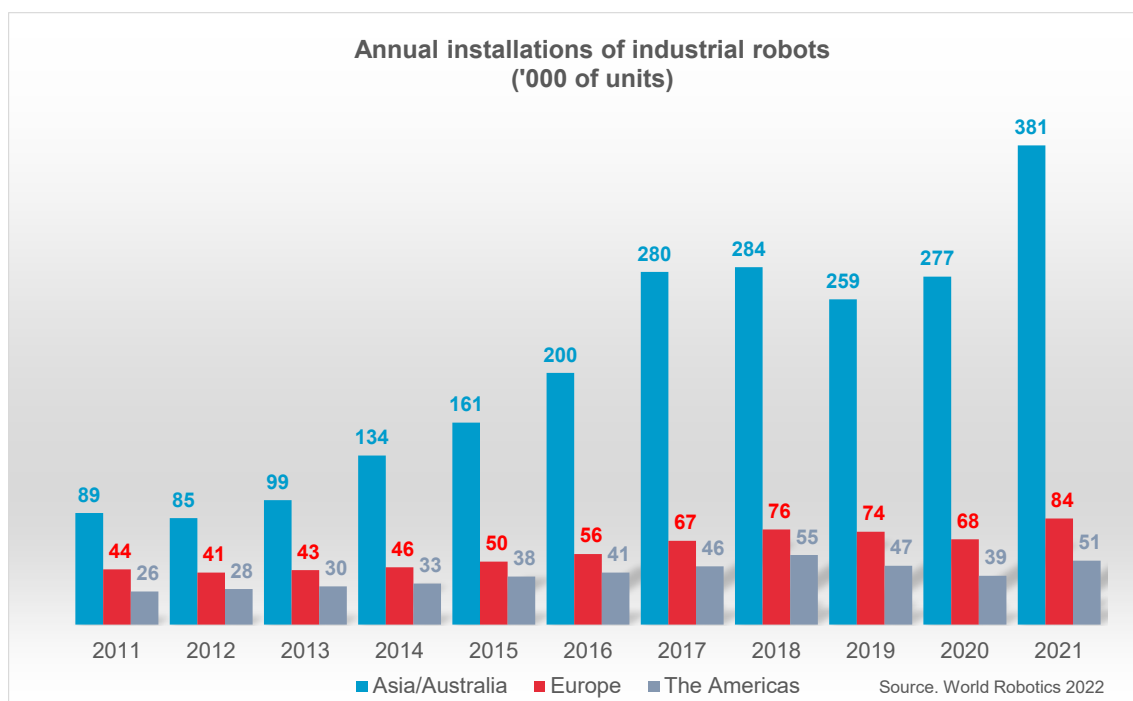


Executive Summary World Robotics 2022 Industrial Robots

Robot installations 2021: Robot installations surging - Covid-19 pandemic as a digitalization booster

In the second pandemic year, robot installations skyrocketed to a new record level of 517,385 units. This represented a growth rate of 31% over 2020 and exceeded the previous record level of 423,321 units achieved in 2018 by 22%. Installations grew strongly in all major customer industries, although supply chain disruptions and the scarcity of inputs as well as different local or regional headwinds hampered production. The electronics industry surpassed the automotive industry in terms of annual robot installations in 2020 and held on to this position in 2021, installing 26% of all robots installed that year (-1 pp). The automotive industry followed with 23% of installations (+2 pp), mainly driven by the parts supplier segment. The metal and machinery industry retained its third place (12%; +1 pp) just ahead of the plastic and chemical products industry (5%) and the food and beverage industry (3%). Note that for 20% of the robot installations (-2 pp) there is no information on the customer industry.

In 2021, the operational stock of industrial robots was computed at 3,477,127 units (+15%). Since 2016, the operational stock of industrial robots had been increasing by 14% on average each year. China's operational stock of industrial robots had been growing impressively by 28% on average each year and exceeded the one-million-unit mark in 2021 with a total of 1,224,236 units (+27%). The Japanese operational stock increased by 5% to 393,326 units in 2021. The European operational stock of robots was computed at 678,706 units and the Americas held a stock of 451,400 units (+10%).



Growth in all major markets and regions

Asia¹ is the world's largest industrial robot market. In 2021, 380,911 units were installed, up 38% from 276,651 units in 2020. 74% of all newly deployed robots were installed in Asia (2020: 70%). From 2016 to 2021, annual robot installations grew by 14% 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 globally installed in 2021 ended up in China: Installations surged by 51% to 268,195 units. Installations in Japan were up 22% to 47,182 units. The Korean market, in contrast, remained rather steady at 31,083 units (+2%). Robot installations in the second largest market, **Europe**, were up 24% to 84,302 units. The annual average growth rate from 2016 to 2021 was +8%. Installation counts in Germany, the largest European market and the only European one in the global top five, gained 6% to 23,777 units. In contrast, installations in the second largest European market, Italy, skyrocketed by 65% to 14,083 units. The third largest European market, France, gained 11%, installing 5,945 units. In the **Americas**, installations surged by 31% to 50,712 units in 2021. The United States is the largest American market and accounted for 68% of the installations in the Americas (34,987 units; +14%) in 2020. The two other major markets are also in North America and grew substantially: Mexico had 5,401 units (+61%) and Canada 4,257 units (+66%) installed.

78% 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 78% of global robot installations.

China has been the world's largest industrial robot market since 2013 and accounted for 52% of total installations in 2021. For more details, see chapter 3.3.1.

Robot installations in **Japan** recovered from a downswing in 2019 and the pandemic dip in 2020 as installations returned to the 2017 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 2021. For more details, see chapter 3.3.4.

The **United States** accounted for 7% of robot installations in 2021. The United States leapfrogged the Republic of Korea into third place with a record installation count of 40,373 units in 2018 and has since maintained this position. For more details, see chapter 3.2.1.

In the **Republic of Korea**, annual robot installations had been declining since reaching a peak level of 41,373 units in 2016. In 2021, installations in Korea accounted for 6% of the overall total. For more details, see chapter 3.3.5.

¹ Including Australia and New Zealand.

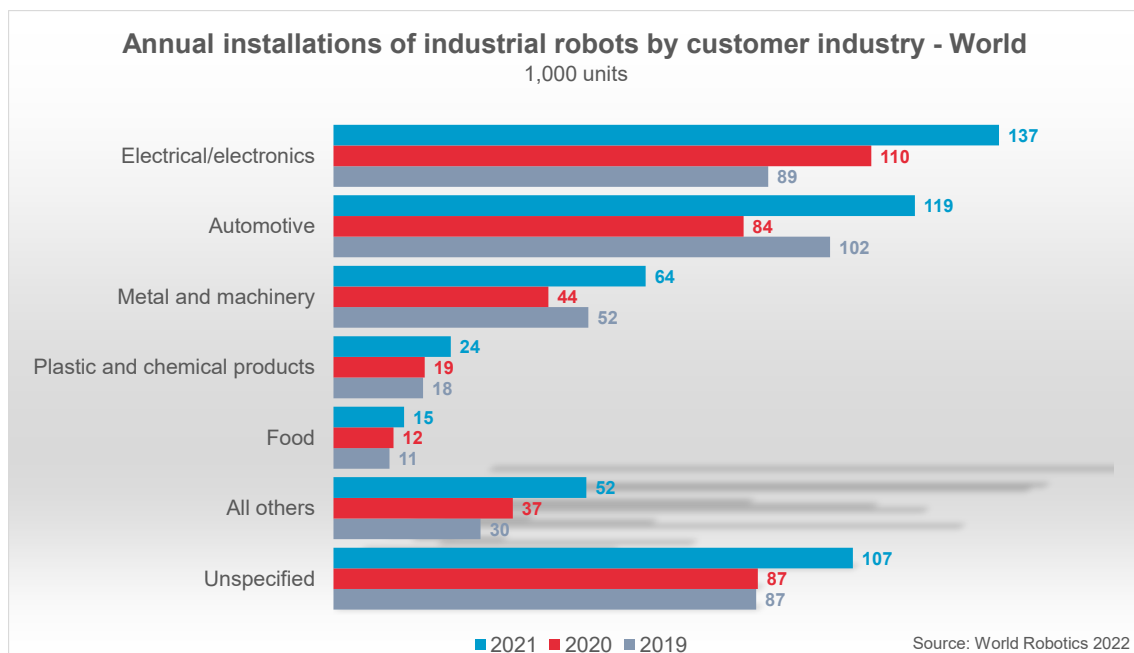
Germany is the fifth largest robot market in the world, accounting for 5% of the global robot installations in 2021. For more details, see chapter 3.4.12.

Other important markets

Chinese Taipei ranked sixth in terms of annual robot installations from 2014 to 2018 before dropping to eighth in 2019. In 2020 and 2021, this market ranked seventh worldwide and fourth in Asia, accounting for 2% of the global installations, or 9,644 units (+31%), in 2021. Installations in **India** surged by 54% to 4,945 units in 2021 and those in **Thailand** gained 36% to 3,914 units. Robot installations in **Singapore** depend to a large extent on the electronics industry, which cut its installations in 2021 substantially, following a peak level in 2020, when the country installed almost four times as many robots as in the previous year. This small country was the seventh largest Asian robot market in 2021 with 3,467 units (-35%) installed. Other Asian markets with more than 1,000 industrial robots installed in 2021 were **Vietnam** (2,372 units; +17%) and **Malaysia** (1,929 units; +37%). For more details, see chapter 3.3.

Spain is the fourteenth largest robot market in the world and the fourth in Europe. Installations remained steady at 3,423 units (+1%) in 2021. Installations in the **Nordic countries** saw a 31% increase to 3,472 units and those in **Central and Eastern Europe** surged by 47% to 12,210 units. For more details, see chapter 3.4.

Robot installations in **Brazil** were up 7% to 1,702 units. Compared to 2016, this implies an average annual growth rate of +7% (CAGR).



The **electrical/electronics industry** became the main customer of industrial robots in 2020 and maintained this position in 2021, when 136,670 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 24% more than the previous year and the highest level ever recorded. Since 2016, robot demand from this industry had grown by 8% 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 because of the pandemic have 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 42% to 119,405 units in 2021, this industry remained in second place. The automotive industry had been the most important customer of industrial robots since the first ever commercially sold unit was installed at the General Motors plant in New Jersey in 1961. In 2017, the electronics industry came close but remained 1,500 units shy of the automotive industry. In 2018, installations in the electronics industry declined, while those in the automotive industry reached a new peak level of 125,581 units, building a gap of more than 19,000 units to the electronics industry. This gap remained large, some 13,000 units in 2019, when robot demand in both industries declined. The pandemic forced many automotive suppliers and car manufacturers to cease production temporarily, as global supply chains were disrupted. Upstream products (inputs) were unavailable and outputs could not be delivered because of closed borders and other restrictions. The global production of cars and commercial vehicles dropped by 16% in 2020 and recovered by just 3% in 2021.² Therefore, many major investments were stopped or postponed. But even before the pandemic, global car and commercial vehicle production had declined two years in a row, by 5.2% in 2019 and 1.1% in 2018.³ 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 2016 to 2021, annual installations in the automotive industry increased by 3% on average each year (CAGR). The share of the automotive industry in total installations declined continuously from 34% in 2016 to 23% in 2021.

² OICA: Production Statistics 2021, 2020.

³ OICA: Production Statistics 2019, 2018.

In 2021, the average⁴ **robot density** in the manufacturing industry was 141 robots per 10,000 employees. Driven by the high volume of robot installations in recent years, Asia's average robot density had been growing by 18% CAGR since 2016 to 156 units per 10,000 employees in 2021. The European robot density had been growing by just 8% CAGR since 2016 and was 129 units per 10,000 employees in 2021. In the Americas, it was 117 robots per 10,000 employees (+8% CAGR since 2016).

Outlook 2022 – 2025

The ongoing year 2022 is characterized by a drift apart. Global robot installations are expected to grow by 10% to almost 570,000 units in 2022. Robot installations are surging in North America and will likely exceed the 50,000-unit mark. Growth in Asia is determined by China, where economic growth is currently decelerating. But with three out of the top five markets for industrial robots being there, the installation of more than 400,000 units is expected for 2022 in Asia. Robot installations in Europe are expected to grow slowly. The war in Ukraine and the trade embargo on Russia, the threat of cutting natural gas supplies, and the tightening of monetary policies are weakening the propensity to invest. A lower single-digit growth rate, resulting in around 87,000 robot installations in 2022 would be a good result in this challenging economic environment.

The “boom after crisis” experienced in 2021 is expected to fade out in 2022. From 2022 to 2025, average annual growth rates in the medium to upper single-digit range are forecast. Minor contractions may occur as a statistical effect when catch-up effects fade out in 2023, but this will not break the overall long-term growth trend. The mark of 600,000 units installed per year worldwide is expected to be reached in 2023, approaching 700,000 in 2025. The North American market is expected to grow by 6% on average each year, factoring in inflation and tighter 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 and grow by high single-digit rates. Medium single-digit growth rates are expected for the Korean market.

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