

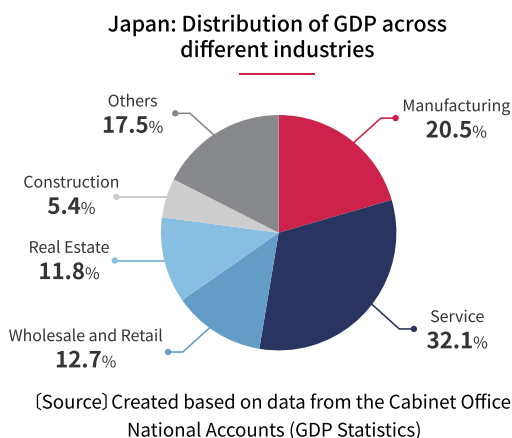
# Manufacturing

## 1. Overview

### The Japanese manufacturing industry is expanding with the promotion of digitalization

Japan’s manufacturing industry is the driving force that has supported the Japanese economy to the extent that it became the third-largest economy in terms of GDP and is known as one of the “Manufacturing Superpowers.” It accounted for about 20% of the total GDP in FY 2019-20, led by automobile and many other players (See Figure 1).

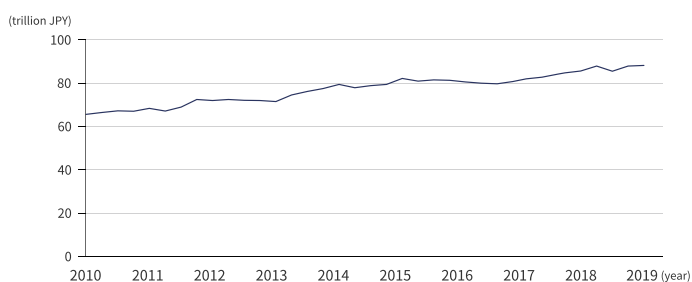
Figure 1



After overcoming the 2008 global financial crisis and the 2011 Great East Japan Earthquake, the economy has been gradually recovering since 2013 owing to improvements in the employment/income conditions and expansion of capital investment. Capital investment in 2019 was the highest in the past decade (See Figure 2).

Figure 2

Capital investment trends in the Japanese manufacturing industry (2010-2019)



On the other hand, since the start of 2019, the global economic slowdown, repeated disasters, unfavorable weather events, trade issues, and uncertainties in overseas economies have made an impact on corporate earnings and investment, especially in the manufacturing field. Additionally, the spread of the novel coronavirus pandemic since January 2020 is exacerbating the uncertainty, making it difficult for the manufacturing industry to formulate a future outlook.

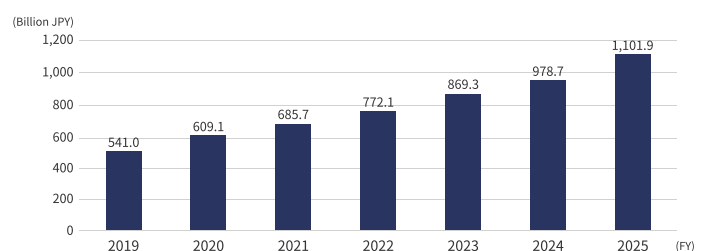
As per the White Paper on Monodzukuri (Manufacturing) 2020, published jointly by the Ministry of Economy, Trade and Industry (METI), the Ministry of Health, Labor and Welfare (MHLW), and the Ministry of Education, Culture, Sports, Science and Technology (MEXT), companies must adapt and transform as the environment and global conditions change in unpredictable ways. Further, digitalization is also considered an effective way to enhance the dynamic capability of the manufacturing industry. It is also a recommended way to cope with the shortage of human resources, which has been a pressing issue for the manufacturing industry.

In this context, digitalization is being promoted not only in the manufacturing industry but also in social infrastructure. In 2016, the Japanese government approved the 5th Science and Technology Basic Plan setting forth “Society 5.0.” Society 5.0 refers to a new society where advanced technologies (IoT, robotics, artificial intelligence, and big data) are incorporated in all industries and social life to realize economic development and resolve social issues.

In 2017, Japan also introduced the concept of “Connected Industries”, which aims to create new added value and resolve social issues by connecting various things such as machines, technologies, and people through data. In light of the above, the size of the factory IoT market in Japan continues to expand, and an increasing number of manufacturers are actively introducing digital technologies (See Figure 3).

Figure 3

Factory IoT Market Size Forecast (Japan)



## 2. Government Initiatives

### Government-led promotion of fundamental reform of the manufacturing industry and strengthening of international competitiveness

#### 1 Support for diversification and the return of production bases to Japan

The vulnerability of the Japanese supply chain, including hygiene products such as masks, has become apparent with the spread of the coronavirus. The government is providing support to establish a robust supply chain through the return of manufacturing bases to Japan and its diversification through multi-year initiatives. One such initiative is METI’s “Program for Promoting Investment in Japan to Strengthen Supply Chains.” This program is designed to support the return of production bases to Japan for products, parts, and materials for which Japan is highly dependent on one country. METI’s “Overseas Supply Chain Diversification Support Project” is another initiative that promotes the establishment of multiple overseas manufacturing bases to supply products and materials to Japan (See Figure 4).

Figure 4 Government support for the return of production bases to Japan and their diversification

	Program for promoting investment in Japan to strengthen supply chains	Project to support the diversification of overseas supply chains to ASEAN countries
Subsidy target	<ul style="list-style-type: none"> <li>Buildings, equipment installation, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Equipment installation, demonstration projects, feasibility studies, etc.</li> </ul>
Grantees / Subsidy rate	<ul style="list-style-type: none"> <li>Large companies: 1/2 or less</li> <li>Small and medium-sized enterprises: 2/3 or less</li> <li>Group of small and medium-sized enterprises: 3/4 or less</li> <li>*The subsidy rate varies depending on the requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Large companies: 1/2</li> <li>Small and medium-sized enterprises: 2/3</li> <li>Group of small and medium-sized enterprises: 3/4</li> <li>*This should be within the percentage obtained by multiplying these with the subsidy rate adjustment index (20% to 100%)</li> </ul>
Subsidy limit	<ul style="list-style-type: none"> <li>15 billion JPY</li> </ul>	<ul style="list-style-type: none"> <li>15 billion JPY</li> </ul>
Business period	<ul style="list-style-type: none"> <li>3 years (4 years in case of large-scale investments)</li> </ul>	<ul style="list-style-type: none"> <li>From grant issue date to March 31, 2025</li> </ul>

(Source) Created based on various documents and media reports

At the same time, some major domestic manufacturers have been able to increase production efficiency through the introduction of advanced IT technologies, which leads to factory automation and increasing in-house production. As a result, some of them have been moving their production bases to Japan even before the pandemic. Since factories are more often located in rural areas, the return of manufacturing bases to Japan will encourage regional revitalization. The strengthening of domestic supply chains will also lead to streamlining and stabilizing the procurement of manufacturing-related goods. It is expected that foreign companies with manufacturing bases in Japan will also benefit from this government support.

#### 2 Promoting Next-Generation Automobile Business

In accordance with the Paris Agreement adopted at the COP 21 in 2015, Japan, which is one of the most advanced countries in terms of technology, industry, and human resources in next-generation automobiles, declared its intention to contribute to the fight against global warming by promoting the electrification of Japanese cars worldwide.

As a specific measure in Japan, the “eco-car tax break” provides preferential treatment (i.e., tax deductions/exemptions) on automobile tax and automobile weight tax for vehicles that meet the emission and fuel efficiency standards set by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and have excellent environmental performance. When a new Clean Energy Vehicle (CEV) is registered or undergoes its first vehicle inspection, it will fully be exempt from the automobile weight tax and the automobile tax will be reduced by 75%. In addition, the government provides partial subsidies on the purchase of CEVs under the “CEV Subsidy” to promote clean energy vehicles, reduce CO2 emissions and oil dependence in the transportation sector, and improve resilience during emergencies due to the use of external power supply (such as electric vehicles and fuel cell vehicles). Moreover, if a local government also has a subsidy program for CEV installation, one can benefit from both the local and national subsidy.

As a result of these endeavors, next-generation vehicles accounted for about 40% of domestic new vehicle sales in 2019, and a further increase in demand is anticipated (See Figure 5).

Figure 5 Ratio of next-generation vehicles to total new vehicle sales in Japan (2019)

Total New Vehicle Sales	430.1 million units
Conventional Vehicles	60.8% (2.61 million units)
<b>Next-Generation Vehicles</b>	<b>39.2% (1.68 million units)</b>
Hybrid Electric Vehicles (HEV)	34.2% (1.47 million units)
Electric Vehicle (EV)	0.49% (21K units)
Plug-in Hybrid Electric Vehicle (PHEV)	0.41% (18K units)
Fuel Cell Vehicles (FCV)	0.02% (685 units)
Clean Diesel Vehicles (CDV)	4.1% (17500 units)

(Source) Created based on data from the Japan Automobile Manufacturers Association (JAMA)

#### 3 Amendment of the Immigration Control and Refugee Recognition Act

With labor shortage being a pressing issue in the manufacturing industry in Japan for many years now, the amendment of the Immigration Control and Refugee Recognition Act is expected to lead to an immediate and effective increase in the number of foreign workers in Japan. The April 2019 amendments to the Immigration Control Act allow foreign workers to be employed in 14 sectors that face a labor shortage. These specific sectors include the materials industry, industrial machinery manufacturing industry, electronics and informa-

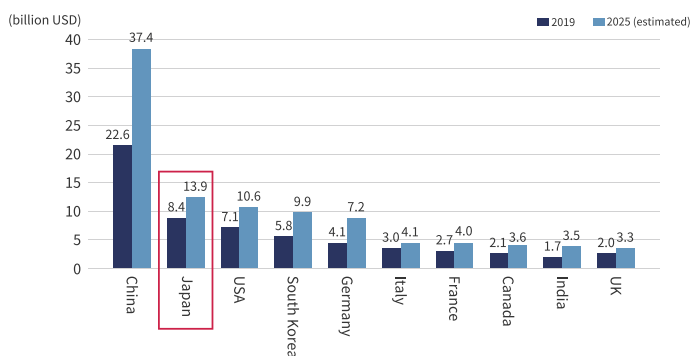
tion-related industries, shipbuilding and ship-related industries, automobile maintenance industry, aviation industry, and food and beverage manufacturing industry. It is expected that the manufacturing industry will benefit from this amendment.

In a JETRO survey of foreign-affiliated companies conducted in 2017, about 60% of the companies took a positive stance on hiring foreign nationals in Japan, answering that they would hire foreign exchange students as well. In past surveys, “difficulty in securing human resources” was seen to be a significant challenge for foreign-affiliated companies. Therefore, it is expected that this amendment would make it easier for them to further their business in Japan.

**4 Smart Factory Promotion Project**

A smart factory is a factory that utilizes IoT and other technologies to acquire data on all equipment and facilities in the factory, as well as the tasks of people working in the factory, and analyses this data to create new added value. Smart factory initiatives are accelerating in Japan, especially in the manufacturing industry, as they could potentially provide a solution to the labor shortage caused by the declining birth-rate and aging population. Moreover, with remote support and wireless communications being recommended in the wake of the coronavirus pandemic, the need for digital technologies is expected to increase. The market for smart factory-related systems and products required for factory DX will also grow. As a result, the domestic market for smart factories, which in 2019 was ranked second in the world after China at 8.4 billion USD, is expected to grow steadily till 2025 (See Figure 6).

Figure 6 Smart Factory Market Size in 10 Major Countries (2019-2025)



(Source) Created based on data from BIS Research

In 2017, the Japanese government launched the “Connected Industries” strategy to promote smart factories. In line with this, the “Connected Industries Tax System (IoT Tax System)” was established to provide financial support for the introduction of systems, sensors, robots, and other equipment needed to improve productivity through data collaboration and utilization, and many companies have benefited from this taxation system.

In addition, considering the growth potential of the market, the strengths of domestic industry, and their social significance, METI has identified the following five priority areas

under the Connected Industries initiative: automated driving and mobility services, manufacturing and robotics, biotechnologies and materials, plant/infrastructure safety management, and smart life. Simultaneously, they plan to promote cross-sectional policies on “sharing and utilization of real data,” “environmental improvement for data utilization, including the promotion of AI chip development and human resource development,” and “further expansion of initiatives to enhance inter-company and worldwide cooperation.”

**5 Local government initiatives**

Local governments in Japan are striving to promote regional development by attracting domestic and foreign companies in a wide range of industries, including manufacturing.

Since 2004, Nagoya City in Aichi Prefecture has been the center of the “Greater Nagoya Initiative,” a joint effort by industry, government, and academia to attract outstanding companies, technologies, people, and information from around the world. Local governments that support this initiative have proposed preferential measures for foreign-affiliated companies that have decided to locate there. They also provide continuous support to help them expand their businesses. As of 2019, as many as 150 foreign companies (including those established by foreign nationals living in Japan) had entered the region through this support.

Further, in Fukushima Prefecture, which suffered extensive damage from the Great East Japan Earthquake and nuclear disaster in 2011, the “Subsidy for Business Location for Reconstruction of Industry in Fukushima” is provided to attract companies. The program encourages the establishment of factories and other manufacturing facilities by providing subsidies on the initial cost of installing machinery and equipment, thereby expanding production capacity, creating employment opportunities, and promoting regional development. This program began in 2012, and as of 2020, 661 businesses have been deemed eligible for grants.

Other local governments also offer high incentives. Nagano prefecture offers a 95% reduction on enterprise tax for three years, Toyama and Ishikawa prefectures offer a 90% reduction, and Gunma and Kagawa prefectures offer a 50% reduction for the first year. Besides, the government is promoting regional development through schemes such as “tax incentives for strengthening local business facilities,” where companies receive tax incentives for relocating their head office from a metropolitan area to regional areas.

### 3. Attractive Markets

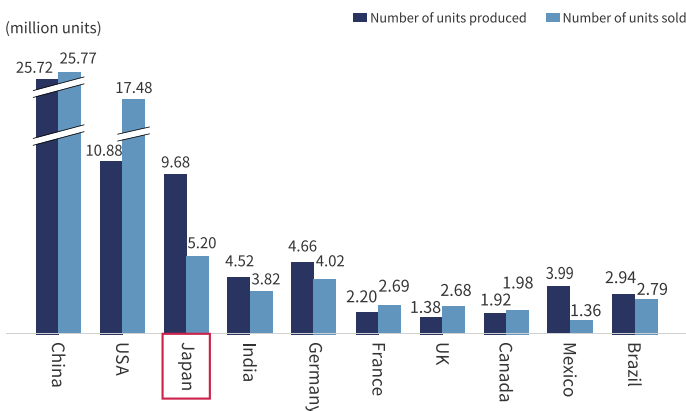
In this report, we focus on the following four attractive markets in the manufacturing industry:

- 1 Automobiles
- 2 Industrial robots
- 3 Semiconductors
- 4 Machine tools

#### 1 Automobiles

The automobile industry is regarded as a key driver of Japan’s manufacturing industry. The number of people engaged directly or indirectly in the industry is about 5.42 million, accounting for about 8% of Japan’s entire workforce. The shipment value for 2018 was 62.3 trillion JPY, accounting for about 19% of the total shipment value of all manufacturing industries. The domestic automobile production in 2019 was 9.68 million units and domestic automobile sales in the same year were 5.2 million units, both of which are the third-largest in the world after China and the U.S. (See Figure 7). Besides this, the capital investment in automobile manufacturing in FY 2018-19 was 1.53 trillion JPY, and R&D spending in the same year was 2.93 trillion JPY, both accounting for more than 20% of total capital investment in major manufacturing industries. Further, it has a significant impact on other parts of the manufacturing industry, including the procurement of materials and parts, which in turn greatly influences the overall Japanese economy.

Figure 7 Production and sales volume of four-wheeled vehicles in major countries (2019)



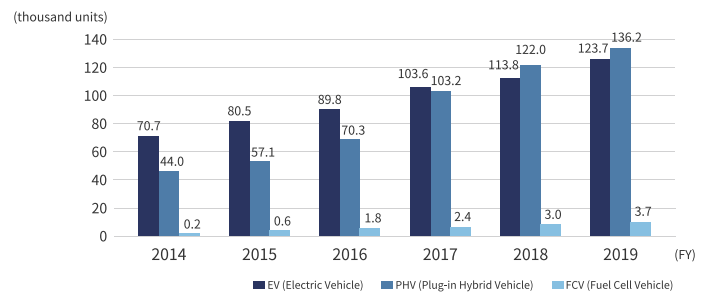
(Source) Created based on data from JAMA

Conventionally, automakers have sought to form international alliances in order to scale up. In recent years, however, alliances have been formed with the purpose of gaining an advantage in developing technologies in a new area called CASE (Connected, Autonomous driving, Sharing, and Electrification). The goal is to bring together technologies from each company to keep costs low and promote its early commercialization. In 2018, Honda Motors announced a series of alliances with General Motors (U.S.) to jointly develop batteries for electric vehicles (EVs) and to develop automated driving technology. In the same year, Toyota Motor Corporation partnered

with SoftBank Group (a major IT investment fund in Japan) to develop next-generation vehicle businesses such as automated driving, and is forming alliances with other industries as well.

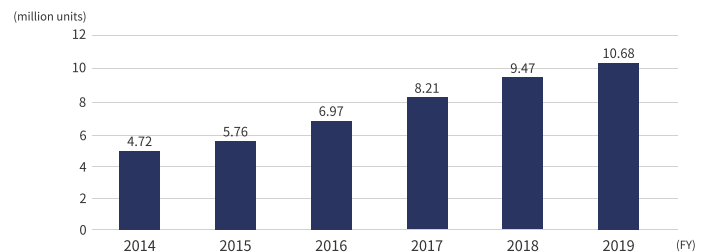
In this context, the Japanese government announced the “Carbon Neutral Declaration,” which aims to reduce GHG emissions to net-zero by 2050, in its policy statement on October 26, 2020. It is considering a policy to effectively prohibit the sale of gasoline vehicles and switch all new car sales in Japan to hybrid electric vehicles (HEV) or other EVs by the mid-2030s. Automobile manufacturers are currently striving to become carbon neutral, and the number of CEVs owned in Japan is increasing year after year. In particular, the number of HEVs has already exceeded 10 million (Figures 8 and 9).

Figure 8 Number of CEVs owned in Japan (2014 to 2019)



(Source) Created based on data from the Next Generation Vehicle Emerging Center (NeV)

Figure 9 Number of HEVs and others owned in Japan (2014 - 2019)



(Source) Created based on data from the Next Generation Vehicle Promotion Center (NeV)

CEVs require charging spots and hydrogen stations instead of gas stations. With the support of government subsidies, the number of charging spots nationwide has been expanded to 18,270 as of March 2020, equivalent to about 60% of the total number of gas stations in Japan. Hydrogen stations to provide fuel for fuel cell vehicles (FCVs) are under construction mainly in the four major metropolitan areas of Tokyo, Chukyo, Kansai, and Northern Kyushu, as well as along the main lines connecting the four metropolitan areas. As of December 2020, a total of 137 hydrogen stations have been built.

The government’s carbon neutral declaration has also triggered a flurry of activity among foreign automakers. South

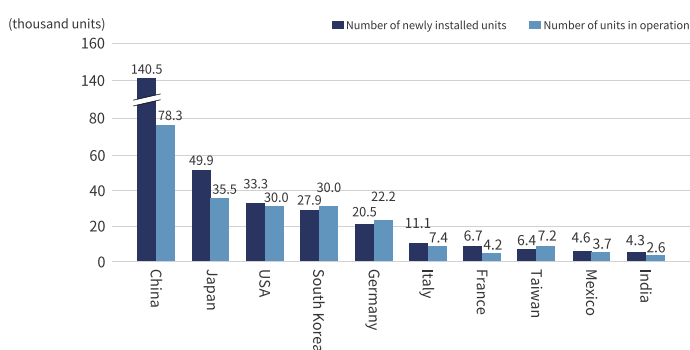
Korea’s Hyundai Motor Company, which withdrew from the Japanese market in 2009, is set to re-enter the market in 2022. The company plans to develop its business by focusing on hydrogen-based FCVs and EVs, which command the largest share in the global market. In this way, the electric vehicle market is expected to expand even further with the entry of not only Japanese manufacturers but also foreign manufacturers.

## 2 Industrial robots

The wide application of industrial robots began around 1980, during the period of rapid economic growth. By the 1990s, Japan’s presence in the market stood unchallenged, with Japanese manufacturers accounting for about 90% of global sales. Although the percentage of robots made by foreign manufacturers has dramatically increased since 2010, even as of 2018, more than 210,000 of the approximately 380,000 units sold annually are made by Japanese manufacturers, giving them a global share of approximately 60%. The automotive industry is the largest user of these industrial robots. For example, robots made by the Japanese company FANUC are used in the factories of the EV manufacturer Tesla. Other Japanese companies such as Yaskawa Electric Corporation and Kawasaki Heavy Industries are also leaders in the global robot market.

At the same time, the demand for robots in Japan is extremely high due to the country’s thriving manufacturing industry. In 2019, the operational stock of robots in Japan was 355,000 units, the second-highest in the world. In the same year, 44,900 robots were newly installed robots in Japan, the second-highest figure in the world. With labor shortages becoming severe, industrial robots play an especially important role in Japan’s manufacturing industry (See Figure 10).

Figure 10 Top 10 countries in terms of number of new industrial robots installed and in operation (2019)



(Source) Created based on data from the International Federation of Robotics (IFR) and the Japan Robot Association

Against this background, foreign companies are also focusing on the Japanese market. For instance, among all of the robotics businesses of ABB (Switzerland) around the world, Japan is one of the few places where everything from system development, manufacturing, and support is available. In the past, most of their products were used in the automotive industry. However, since 2014, they have been active in the food, medical, and cosmetics industries as well. KUKA (Ger-

many), which established a Japanese subsidiary in 2007, is actively engaged in the automotive and electrical/electronic industries, as well as niche fields such as the medical industry, where it has introduced new robots for medical use in Japan.

Currently, there is a growing interest in “collaborative robots” (Cobots). Collaborative robots are robots that work close to workers on production lines, etc., and are equipped with a sensor to detect people to avoid contact accidents. In the wake of the coronavirus pandemic, when working in crowded and enclosed spaces is restricted even at manufacturing sites, there are high expectations for applications that can replace some of the human work. In Japan, the regulation requiring the installation of safety fences when installing robots on production lines was abolished in 2013, and since then, many manufacturers have started to make collaborative robots. Currently, Universal Robots (Denmark) is leading the collaborative robot market, followed by Japanese manufacturers.

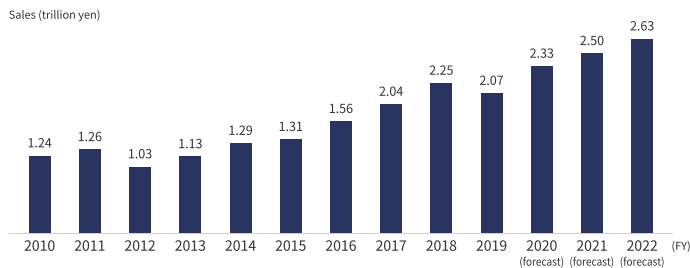
## 3 Semiconductors

Japan used to hold more than 50% of the global market share in the semiconductor field, but the domestic production value declined to 4.6 trillion JPY in 2019, and the global share to 10%. Against this backdrop, Toshiba’s NAND flash memory, Sony’s CMOS image sensors, and other products are showing some growth. Among foreign companies, TSMC (Taiwan), the largest semiconductor contract manufacturer, announced in 2019 that it has formed a company-wide and university-wide alliance with the University of Tokyo to jointly promote research on semiconductor systems. In this way, semiconductor development in Japan is gradually recovering.

Japanese companies, on the other hand, are focusing on producing equipment used to manufacture semiconductors, and are increasingly forming alliances and collaborations with foreign companies. Amid the growing demand for devices in markets such as IoT, AI, and automotive, in July 2019, Tokyo Electron (Japan’s top company) partnered with BRIDG (USA), which possesses the development infrastructure in this field, to introduce its technology. Apart from this, in anticipation of a future increase in semiconductor demand, in October 2019, Panasonic announced a collaboration with IBM (USA), which has data analysis technology, to stabilize the quality of semiconductor manufacturing equipment and improve equipment utilization rates.

As a result of this steady progress in digital-related investment in collaboration with overseas companies, domestic sales of semiconductor production equipment in 2020 are projected to be 2.33 trillion JPY, a 12.4% increase from the previous year. It is expected that sales will continue to grow steadily from FY 2021-22 onwards as foundries show a high willingness to invest, and investment in memory will recover as well (See Figure 11).

Figure 11 Trends in domestic sales of semiconductor manufacturing equipment



(Source) Created based on data from the Semiconductor Equipment Association of Japan (SEAJ)

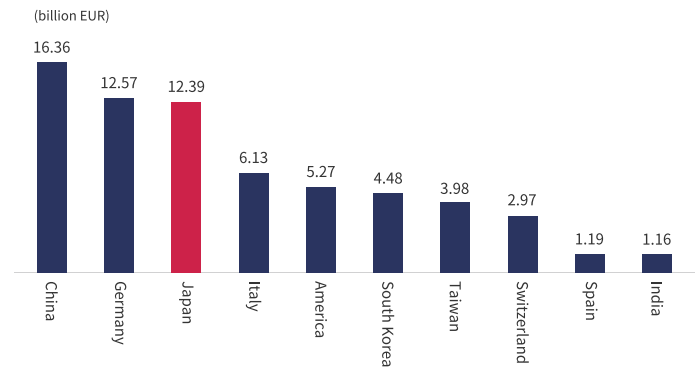
Moreover, to enhance their strength as foundry companies, foreign semiconductor manufacturers have begun to build under-the-radar factories in Japan by strengthening their ties with manufacturers of semiconductor manufacturing equipment and precision machinery. Furthermore, many Japanese companies are competitive in the field of semiconductor-related materials, and have a significant global market share in ultra-high-purity hydrofluoric acid, photoresist, silicon, ceramics, etc., making it possible to procure high-purity and ultra-fine semiconductor components more efficiently. As a result, semiconductor manufacturing in Japan is expected to flourish in the future.

#### 4 Machine tools

A machine tool is used to make machines, and is also called a “mother machine.” Machine tools can be broadly divided into general-purpose machine tools, which are operated manually by turning a handle, etc., and NC (numerical control) machine tools, which are operated automatically by a computer. Japan is particularly strong in NC machine tools, which require advanced manufacturing technology. These account for about 90% of Japan’s machine tool production.

Japan’s machine tool industry surpassed that of the U.S. and Germany to become the world’s largest in 1982 and remained at the top spot for 27 years until the 2008 global financial crisis. At present, China is the largest machine tool producer. In 2018, Japan ranked third in the world with a 16.8% market share and a production value of 12.4 billion euros, just behind Germany (See Figure 12).

Figure 12 Machine tool production value of 10 major countries (2018)

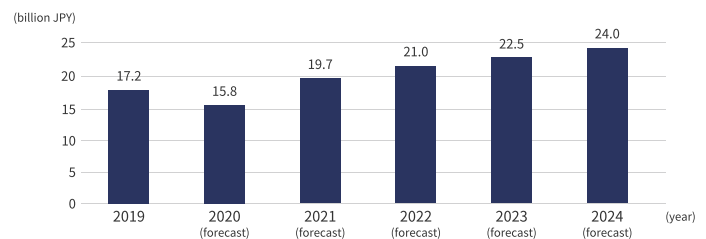


(Source) Created based on data from STATISTA

With manufacturers in developing nations catching up in terms of the technology level of NC machine tools in recent years, alliances between Japanese and European manufacturers have been progressing. Mori Seiki and Gildemeister (Germany) signed a production cooperation agreement that includes the production of both manufacturers’ products at each other’s plants. This reduced costs and shortened delivery times, and finally in October 2013, they merged their companies under the name DMG Mori Seiki. In June 2012, Amada, a leading manufacturer of sheet metal processing machinery, allied with Prima Industrie (Italy), a panel bender maker, to jointly develop control devices and software.

Meanwhile, there is a worldwide competition to achieve smart manufacturing through the use of AI and IoT. Machine tool manufacturers are focusing on developing products and technologies that support the Industrial Internet of Things (IIoT), such as smart factories that optimize production for the entire factory. Three-dimensional additive manufacturing technology (3D printing) has also entered the stage of commercialization with a wider range of options for the layering process. Since there have been many cases in Japan and abroad of 3D printers being used to manufacture parts during the coronavirus emergency, it is expected that the applications of 3D printers will further increase and new businesses will be created. Moreover, the spending on 3D printers is expected to remain strong as they are steadily being used to transform processes in the manufacturing industry (See Figure 13).

Figure 13 Domestic 3D Printer Expenditure Forecast (2019-2024)



(Source) Created based on data from IDC Japan

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