

# Taiwan's Fastening Tools

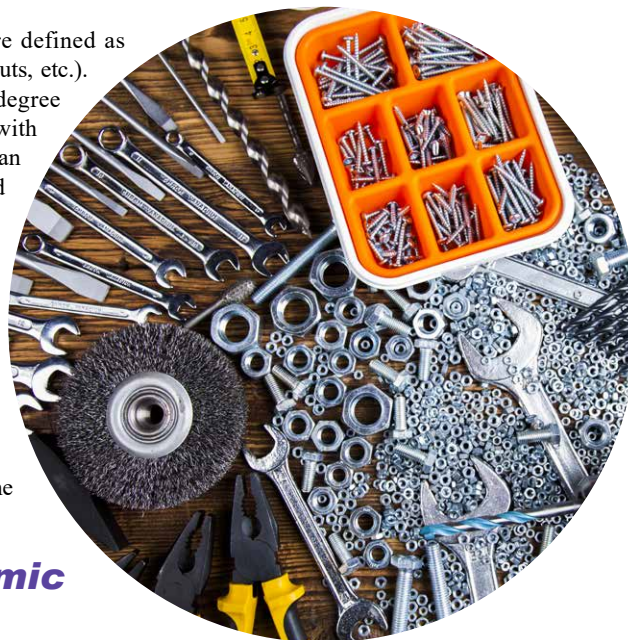
## Development Trends and Competitiveness

### 台灣扣件緊固工具產品發展趨勢與競爭力

#### ● Foreword

Taiwan is the world's 2nd largest exporter of fastening tools which are defined as handheld tools for fastening/loosening fasteners (screws, nuts, studs, bolts, nuts, etc.). Fastening tools and fasteners are different products, but there is a high degree of relevance, i.e., these two products need to be operated in conjunction with the performance and proper application of the industry. The value of Taiwan fastening tools export even surpassed those of Japan, Germany, the U.S. and other advanced countries, but what is worth exploring behind the bright figures is that the export value only revealed the short-term export scale, which is vulnerable to industry trends and competition, but the long-term competitiveness of products requires solid industrial manufacturing capacity and a sound industrial supply chain.

Overall, the new product development trends of fastening tools are: ergonomics, ease of operation, application of new materials, lightweight design, digital technology, etc. This article analyzes the product development trends and competitiveness of Taiwan's fastening tools, and explores the scope of products (including wrenches & spanners, socket wrenches, screwdrivers, etc.) as well as the industry trends, materials, and net-zero carbon reduction.



#### ● Review and Analysis of the Economic and Trade Development Trends of Global Fastening Tools

##### a. Import:

**Table 1** shows the global major importers of fastening tools and the import trend from 2018 to 2022. In 2022, the global import value of fastening tools was about US\$8,612 million (about NT\$256,465 million) and the total import value of the top 10 importing countries was US\$4,477 million, accounting for 52% of the global total import, and the compound growth rate of the imports in the past five years was 3.3%, slightly higher than the global compound growth rate of 3.1%; among them, **the respective import values and shares of the top 5 importing countries in order were: the U.S. (US\$1.569 billion/18.2%), Germany (US\$766 million/8.9%), Canada (US\$321 million/3.7%), France (US\$320 million/3.7%), and the UK (US\$301 million/3.5%).** Although imports may not be always equivalent to industrial demand and the domestic production and stock still have to be considered, the trend of imports also reflects the demand for products in various countries. **The U.S. is still the world's leading importer of fastening tools and in 2022 it further expanded its import share from the world. The U.S. with the highest import value (US\$ 1.569 billion) and a stable compound growth rate (6.6%) plays a role in driving the demand for fastening tools in the global market.**

**Table 1. Global Major Fastening Tools Importing Countries and the Import Trend in 2018-2022**  
(Unit: US\$0.1 bn;%)

Ranking	Country	2018	2019	2020	2021	2022	2022 Share of Total	CAGR
1	USA	12.16	12.30	11.01	14.33	15.69	18.2%	6.6%
2	Germany	6.57	6.34	5.99	7.67	7.66	8.9%	3.9%
3	Canada	2.54	2.74	2.54	2.91	3.21	3.7%	6.0%
4	France	3.63	3.25	2.59	3.32	3.20	3.7%	-3.1%
5	UK	2.95	2.69	2.42	3.01	3.01	3.5%	0.5%
6	Mexico	2.22	2.18	1.72	2.26	2.50	2.9%	3.0%
7	China	2.70	2.57	2.50	3.35	2.47	2.9%	-2.2%
8	Netherlands	2.05	2.12	2.14	2.66	2.45	2.8%	4.6%
9	Thailand	2.59	2.53	2.10	2.57	2.33	2.7%	-2.6%
10	Poland	1.96	1.76	1.70	2.35	2.26	2.6%	3.6%
Subtotal of Top 10 Importers		39.38	38.50	34.71	44.42	44.77	52.0%	3.3%
Subtotal of Other Importers		36.88	35.23	32.19	40.19	41.35	48.0%	2.9%
Total		76.25	73.73	66.90	84.62	86.12	100.0%	3.1%

Source: ITC/compiled by MIRDC

Note: Based on the 2022 average exchange rate (NT\$29.78 per US\$1) of the Central Bank of Taiwan

##### b. Export:

**Table 2** shows the global major fastening tools exporting countries and the export trend from 2018 to 2022. In 2022, the global fastening tools export amounted to about US\$8.021 billion (NT\$238.865 billion) and the total export value of the top 10 exporting countries was US\$6.116 billion, with the export compound growth rate averaged at 4.1%, which was slightly higher than the global compound growth rate of 3.5%, and the total export value already accounted for 76.3% of the global total, a highly concentrated export structure. Among them, **the respective export values and shares of the top 5 exporting countries in order were: China (US\$2,312 million/28.8%), Taiwan (US\$1,074 million/13.4%), Germany (US\$1,057 million/13.2%), the U.S. (US\$516 million/6.4%), and Italy (US\$241 million/3.0%).** Compared to 2021, Taiwan even surpassed Germany to become the world's second largest fastening tools exporting country in 2022, with a compound growth rate of up to 7.8% in recent five years, a remarkable performance.

China continues to be the world's leading fastening tool exporter. Even under the multiple impacts of the global political & economic situations, it still ranked first with the highest export value (US\$2.312 billion) and a stable high compound growth rate (8.7%), which demonstrates that with the production advantage of the economy of scale China's leading position has been not that easy to be challenged by various global variables.

**Table 2. Global Major Fastening Tools Exporting Countries and the Export Trend in 2018-2022**

(Unit: 0.1 bn USD; %)

Ranking	Country	2018	2019	2020	2021	2022	2022 Share of Total	CAGR
1	China	16.54	16.65	17.08	22.69	23.12	28.8%	8.7%
2	Taiwan	7.96	8.31	8.04	10.33	10.74	13.4%	7.8%
3	Germany	10.37	9.77	9.31	11.35	10.57	13.2%	0.5%
4	USA	5.29	5.22	4.16	4.92	5.16	6.4%	-0.7%
5	Italy	2.50	2.41	2.05	2.74	2.41	3.0%	-0.9%
6	India	1.87	1.71	1.52	2.25	2.09	2.6%	2.8%
7	Netherlands	1.79	1.82	1.64	1.92	1.93	2.4%	1.9%
8	France	2.22	2.44	1.74	1.99	1.84	2.3%	-4.5%
9	Switzerland	1.72	1.61	1.41	1.78	1.74	2.2%	0.3%
10	Singapore	1.89	1.56	1.52	1.42	1.56	1.9%	-4.8%
Subtotal of Top 10 Exporters		52.15	51.50	48.46	61.39	61.16	76.3%	4.1%
Subtotal of Other Exporters		17.87	16.65	15.43	18.62	19.04	23.7%	1.6%
Total		70.02	68.16	63.89	80.01	80.21	100.0%	3.5%

Source: ITC/compiled by MIRDC

electronic circuits, and bluetooth wireless communication technology, etc., and is coupled with the introduction of ergonomics and aesthetics of engineering design, compliance with the ISO-6789 standard, and the service life of more than 10,000 cycles. It is sufficient to detect small changes in torque (up to 0.1N-m) and simultaneously integrates FM wireless transmission technology to realize the product networking function; this type of digital torque wrenches can increase the unit price of traditional torque wrenches from NT\$2,000 to NT\$20,000, and the unit price of cloud database digital torque wrenches with networking function can be even increased to NT\$33,000.

**a-2. The Development of Fully Insulated Adjustable Wrenches:** With the green energy trend leading to the development of EV and to consider the voltage of EV being about 650V, higher than the voltage of traditional vehicles (DC 12-24 volts), the demand for fully-insulated fastening tools is becoming increasingly important, so the entry barrier of fully-insulated hand tools in the processing and application of materials will be also higher, and they need to comply with a more complete set of certification standards, including obtaining the European standards such as DIN EN 60900 (insulation hand tools common test and product size requirements), German DVE electrical safety certification, DIN, ISO, JIS, ANSI, ASME & BSI, and other national standards bodies certifications. The use of chrome vanadium steel can withstand the voltage of about 1000V; however, the price of an adjustable wrench is already 2-5 times higher than a general hand tool and the price of an fully-insulated adjustable wrench is even 10% higher than a general adjustable wrench. Accordingly, fully-insulated adjustable wrenches are high value-added products. A few manufacturers in Taiwan are key suppliers in the insulated fastening tools market in Asia. Even though adjustable wrenches are a more advanced category in manufacturing of non-powered hand tools, leading Taiwanese manufacturers of fully-insulated wrenches can still make profits as high as 40% with their mature technology.

## b. Socket Wrenches (HS code 820420)

**b-1. Fixed Torque Socket Wrenches:** Currently, Taiwanese fixed torque socket wrench manufacturers have obtained patents for new types and torque design in many countries, which can be matched with various handles to increase their peripheral functions suitable for precision assembly lines; the current positioning of these products is mainly for fastening. Torque control is used to standardize tool operation during the fastening process, providing better fastening accuracy and service life. After the rotation to reach the required torque, there will also be an alert sound to inform the user that the torque has reached the preset standard value or tightening limit, avoiding the fastener damage caused by over-torque. In addition, color management is also used to avoid incorrect torque application and the precision tolerance is within  $\pm 10\%$ ; in addition, the fixed socket wrenches also have a non-return function, which means that they can be simultaneously used to loosen fasteners, standardizing the fastening process and enhancing work efficiency.

**b-2. Prestressed Socket Wrenches:** A patented ring is used to apply stress around the hexagonal hole to counteract tensile stress, achieving higher torque strength and extending the service life by 3 times. The product is also available in a variety of colors to differentiate between sizes.

## ● The Development Trends of Fastening Tools

### a. Wrenches & Spanners (HS codes 820411 and 820412)

**a-1. The Development of Digital Adjustable Wrenches and Spanners:** Digital wrenches refer to traditional wrenches embedded with chips. When the nut is turned, it'll display the torque value on the screen, avoiding the technician to turn too loose or too tight, which is helpful for specific operating conditions and industries (such as automotive, 3C manufacturing, etc.) to achieve higher precision assembly and stability; although Europe, the U.S. and Japan have developed digital fixed wrenches, only Taiwanese manufacturers successfully developed the digital adjustable wrenches for all sizes of nuts.

The R&D of digital adjustable wrenches in the ICT field focuses on the design of sensor circuits, the design of microelectromechanical sensor circuits to reduce the error rate, the program design of torque precision controllers, Anti-EMI circuit design considering electromagnetic compatibility (EMC) and electromagnetic interference (EMI), the design of TFT display circuits, the design of wireless and baseband



## c. Screwdrivers (HS code 820540)

### c-1. Labor-saving Ratchet Screwdrivers:

New screwdrivers are developed and improved in the direction of lightweight and labor-saving. The labor-saving ratchet screwdriver on the market features a hexagonal palm handle with a special triple molded design. The labor-saving ratchet screwdriver has been verified by the Human Factors Engineering Bionic Laboratory to increase the rotational torque, allowing the user to utilize 2-3 times the rotational torque of a conventional screwdriver when gripping and operating it, and at the same time, through the internal plastic structure to do universal swing to increase the operating space and angle to absorb the force of movement and reduce the burden of the wrist joints. In addition to the above features, the use of labor-saving ratchet screwdrivers also reduces the risk of deviation and skewing of screw drilling operations, increasing the speed and reliability of the work. The products are designed and manufactured by Taiwanese companies, and are sold to the U.S., Canada, Russia, and Scandinavia, and have been patented in Taiwan, the U.S., and China.

### c-2. Digital Power Screwdrivers:

They are mainly used in mobile phones, tablets, industrial PCs with bluetooth connection to grasp torque data in real time. Torque sensors provide direct and real-time torque information, and can customize torque, speed, and angle to achieve the desired fastening result. Torque data and fastening status are displayed as "OK" or "NG" for real-time feedback. It is also possible to set the screw torque and the angle after fastening for achieving more precise fastening; In addition, the digital power screwdriver recently developed by a Taiwanese manufacturer has completed the compliance with the ISO-6789 standard, as well as the durability level of the service life of 10,000 cycles or more.

## ● Other Factors Affecting the Competitiveness of Fastening Tools

### a. Application of Premium Materials

#### a-1. Application of SVCVM+ Materials in Tooling Products

Chrome Vanadium Steel (CR-V) is a common alloy steel highly resistant to wear and maintains a stable high hardness after heat treatment, as chromium increases hardness and vanadium increases toughness. The combination of these two materials, combined with proper heat treatment, provides a significant increase in durability and tolerance accuracy. SVCVM is a top-grade alloy tool steel containing Si, V, Cr and Mo, and the higher-grade SVCVM+ material is even superior to CR-V, which is sufficiently hard but not tough enough, and may result in wrench fracture if used with too much force at a certain point of application. SVCVM+ has the advantage of being more torsionally resistant than CR-V, but there is a 40% difference between the prices of these two materials.

#### a-2. Application of High Entropy Alloys in Fastening Tools

With the evolution of metal materials, new materials such as high-entropy alloys have emerged. The so-called high-entropy alloys are alloys with more than five major elements, and the atomic percentage of each major element should be between 5% and 35%, while each minor element is less than 5%. Different metals formulated into comprehensive alloys can feature higher strength, hardness, ductility, high temperature resistance, corrosion resistance and other functions than traditional alloys, and because of the unlimited number of formulas, more elements can be added to enhance the alloy characteristics, so the high-performance alloys still offer diversified R&D and application opportunities in the future fastening tools market. To this end, a team of academics has developed a beryllium-free, non-toxic high-entropy alloy non-sparking tools, specifically for use in explosion and combustion hazardous areas, such as mine pits, oil tanks, refineries, gas plants, powder factories, explosives factories, etc., to replace the use of beryllium-containing copper alloys that have been in use for 100 years. In addition, the high entropy alloy featuring a permanent sterilization effect can be also used to make sterilized knives, cutting boards, door knobs, or railings & handrails in public areas, to replace the existing materials such as stainless steel, the traditional easy-to-rust low-strength copper alloys, plastics and wood.

### b. Impact of Intelligent and Decarbonized Processes on Product Competitiveness

**b-1. Intelligent Transformation:** Currently, the intelligent production lines of Taiwanese fastening tool manufacturers can be all automated from grinding & polishing, mechanical processing, laser engraving, packaging and stacking to lathe processing. With the accumulated efforts in recent years, Taiwan fastener industry has advanced from single-station intelligent automated production lines to multi-station cascade automation and intelligent information integration. The new line allows for faster tool changes, reducing the time for a specific process from the previous 30 minutes to 15 seconds, and reduces the number of people required on a production line from four to one, which not only improve efficiency, but also solve the problem of labor shortages in recent years. Through intelligent transformation, labor requirements have been significantly reduced by 60%~80%, and deliveries can be made one week ahead of schedule, with an increase in production capacity of nearly 30%. The upfront investment in automation is high, but the long-term benefits to manufacturers are substantial.

**b-2. Low Carbon Green Process:** The EU's CBAM has been implemented on a trial basis since October 2023 and has become an important rule in int'l trade. It is roughly estimated that there are about 3,500 steel, fastener, and aluminum product manufacturers in Taiwan who will be affected by the mechanism; although fastening tools are not yet included in the scope of CBAM, it is likely to be expanded in the future, and the ways to do so will include an increase in the number of economies (or countries) and the increase in the scope of products.

**(1) Increase in the number of economies (or countries):** Currently, there is only the EU, but considering the response of various countries, it is very likely that the U.S., Japan, China and other major manufacturing countries may create their own CBAM in the future, forming a new global trade barrier.

**(2) Increase in the scope of products:** In the future, CBAM may be extended to 52 types of products regulated by the EU ETS, and among these 52 types, those related to fastening tools are "iron castings", which will also affect Taiwan's fastening tools export. Taiwanese manufacturers may be impacted in the EU or the world if they do not react to this problem ASAP. Therefore, Taiwanese fastening tool manufacturers not only need to continuously strengthen product design, but also introduce low-carbon green processes or intelligent production lines in the long run, which is the key to maintaining the market and expanding the competitiveness of their products. ■

