

Chapter 10 Fabricated Metal Products Industry

Introduction

Based on the eighth revision of the Standard Industrial Classification of the Republic of China by the Directorate-General of Budgeting, Accounting, and Statistics, of the Executive Yuan in May 2006, the fabricated metal products industry (industrial code is 25) is defined as: the industry engaged in the manufacturing of metal hand tools, metal molds and die, metal structure and construction assemblies, metal containers, metal processing and other fabricated metal products. The eighth version indicates that industry of 2 decimal numbers has undergone significant change and thus the code of the fabricated metal products industry has changed from 24 to 25. Additionally the metal mold & die industry, was originally classified under the category of machinery and equipment (code no. 29) and was then assigned to the category of fabricated metal products, after which the industry code was changed from 2592 to 2512. The industry code and ranking of the other industries (of four decimal numbers) under the category of fabricated metal products have also changed, but the name is essentially remains unchanged.

Since the scope of fabricated metal products industry is very wide, industries of 4 decimal

numbers are divided into 15 major divisions, while products/industries of 7 decimal numbers are classified into 157 major divisions. Michael E. Porter defined an “industry” as a group of companies offering products with high substitutability”. Based on this definition, the fabricated metal products industry cannot be regarded as an industry, but rather is a group of industries. Consequently, attempts to analyze the fabricated metal products industry as a whole face various limitations, including market supply and demand analysis, market forecast, competitive analysis, strategic analysis, etc. are not applicable. Analysis can focus specifically on various market statistics, including production value, imports and exports, industrial structure, etc. The analytical results may provide an in-depth understanding of industry profile, but it is difficult to make predictions regarding future market direction. Additionally industries with 4 decimal numbers do not necessarily conform to the definition of “industry”, for example “metal door and window” and “metal stairs” are belonging to the “metal structure industry”. However metal doors and windows and metal stairs obviously do not have any substitutive or competitive relationship.

Based on the above description, in-depth industrial analysis should be focused on industry of 7 decimal numbers. The detailed classification of the fabricated metal products comprises 157 major divisions, but does not include transportation vehicle, sporting goods, electronics components, etc. Bicycle, motorcycle bracket, wheel, golf head, golf club, notebook, housing of desktop computer, etc. are closely related to fabricated metal products. Restated, more than 200 industries are closely related to the fabricated metal products industry. Conducting an in-depth analysis of such a large number of industries given limited time and resource is extremely difficult. Therefore just a few representative industries are selected for conducting in-depth industrial analysis.

As described above, industrial classification of 7 decimal numbers conforms to the definition of “industry”, but detailed classification product/industry of 7 decimal numbers in the part of industries with 4 decimal numbers, such as metal hand tools, fasteners, metal mold and die, etc., do not necessarily produce products that are highly substitutable, though their products are always somewhat substitutable. Therefore the 4 decimal number industries can be used to conduct an in-depth analysis. Based on consideration of production value, domestic influence, international competitiveness and future growth, this work focuses on metal hand

tools, fasteners and metal molds and dies as the target industries for further analysis.

I. Hand Tools Industry

Introduction

Industry scope

Hand tools primarily deal with people demand in the industrialization era. Demand for hand tools is created when people require hand tools to assist in disassembly, assembly, adjustment, etc. The hand tools industry is generally divided into hand tools for machinery maintenance (such as pliers, hammer, wrench, socket wrench, screw driver, etc.) hand saws (including steel saw, backsaw, rip saw, chain saw, etc.), edged hand tools (such as ax, chisel, knife, etc.) and other hand tools (including spade, shovel, harrow, fork, hoe, brush, etc.).

Production of hand tools mainly involves metal second processing technologies, such as forging, metal cutting, polishing, heat treatment, surface treatment, packaging, etc. The upper stream materials are steel bar and steel plate. Steel products include socket wrench, hybrid wrench, pliers, screw drivers, various hand tool set, hammer, pneumatic tools, etc. Meanwhile products made from steel plate include shovel, scissors, hoe and saws. Along with improvement in quality and the development of high value added products,

low alloy steel, chromium molybdenum steel, chromium vanadium steel and various alloys steel, excluding carbon steel have been widely used. Steel has to consider hot forging, modularizing treatment before cold forging and heat treatment following machining. Due to product variety, the manufacture of products from steel is outsourced to professional manufacturers including electroplating, heat treatment, etc. based on consideration of cost, manpower, delivery and sound and convenient outsourcing system. The increased technical capabilities of these peripheral industries can facilitate the improvement of hand tools quality. The hand tools industry is wide ranging in scope, ranging from steel in the upper stream, through to hybrid materials, rubber and the processing of various components and parts. Additionally the downstream automobile, motorcycle and machinery equipment industries purchase hand tools as assemblies for maintenance of vehicle and machinery. Export channels to Europe and America include home centers, DIY building material chain stores, electrical goods shops and hardware stores, like Sears, Wal-Mart and Radio Shack that sell to families and amateurs (see Figure 2-10-1).

Industrial environment

Since production of hand tools is labor-intensive industry, the required technologies are

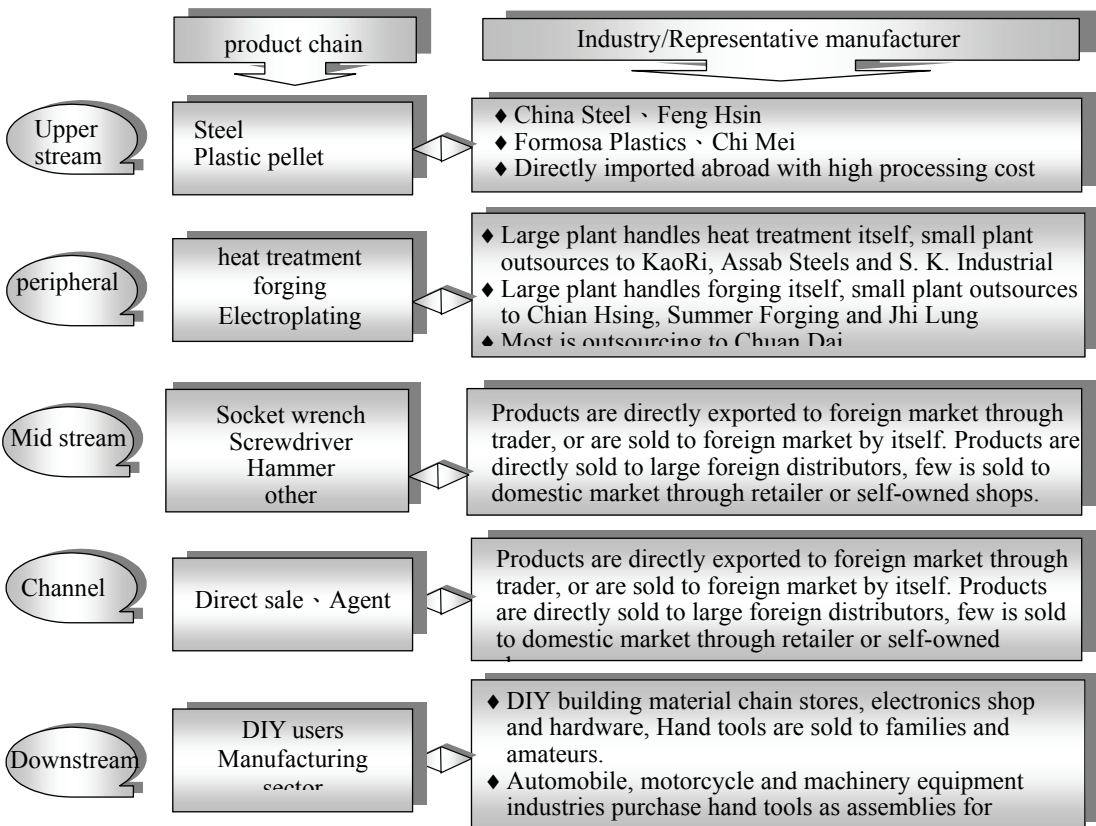
extremely mature. Technologies are easy to obtain domestically, and thus the hand tools industry is classified as having low technology intensiveness and being dominated by medium & small enterprises. When product quality achieves a certain level, price and product innovation become the major considerations for consumers in relation to procurement. Highly industrialized countries have high demand for machinery maintenance, DIY activity, automobile repairing or housing renovation creating strong demand for hand tools.

The Taiwanese hand tools industry possesses various characteristics, including operational features, division of labor, export orientation, highly concentrated export markets, etc. The hand tool industry is relatively mature and its upper stream, mid stream and downstream have developed respective system following 30 years of development. The upper stream of the hand tools industry is dominated by the steel industry, while peripheral industries include the metal processing. However steel quality significantly influences hand tool quality, and thus the prosperity of the hand tool industry is closely related to the basic capabilities of the steel industry. Peripheral manufacturers in the domestic hand tools industry have complete outsourcing systems, flexible value chain and can locate the suppliers or sub-contractors in each stage of the manufacturing process, including mold & die, heat treatment, surface

treatment, electroplating, packaging, etc. Additionally suppliers and sub-contractors are clustered in neighboring areas, such as Taichung, Changhwa, etc. making production and sale convenient, economical and fast. Marketing channels can include domestic traders, plants in foreign countries, etc. for sale both domestically and internationally.

Taiwan has approximately 616 hand tool manufacturers, and the industry is classified as labor intensive and export oriented with 90%

of hand tool products being exported. Hand tool manufacturers are concentrated in central Taiwan (Taichung, Changhwa and Nantou) with 80% of all manufacturers located in this area, especially in Taichung County. The northern area followed in second place (Taipei, Taoyuan and Hsin Chu) at 12%. Regarding employee numbers, manufacturers of hand tools are primarily small & medium enterprises, and 93% of manufacturers hire fewer than 50 employees.



Source: ITIS Program, MIRDC (2006/12).

Figure 2-10-1 Taiwanese Hand Tools Industrial Links

Overview of the Hand Tools Industry in 2006

Technical analysis

Domestic hand tools manufacturers are small and medium enterprises and thus most of them perform machining and assembly themselves and source out the remaining processes. Few large manufacturers conduct casting, forging, welding, heat treatment, surface treatment and mold and die design and manufacturing within their plants. Hand tools are forged products using carbon steel, alloy steel or stainless steel as material. Given proper forming ratio, steel ingot or billet are forged to obtain the required mechanical properties and subsequently are heat treated. Production of hand tools involves forging, metal cutting, polishing, heat treatment, surface treatment, packaging, etc. The most widely used forging technologies include blanking, heating, forging machine and billet

manufacturing equipment. Meanwhile the main casting technologies include melting, pouring and molding. Metal cutting technologies are workpiece feeding, tribology, cutting machine, tools, etc. Furthermore, polishing technologies include grinder, polisher, polishing material, workpiece feeding, etc. Additionally heat treatment technologies include heat treatment equipment, inspection instrument, parameter control, etc. Surface treatment technologies are electroplating, corrosion resistance, etc.

Hand tools have different process and equipment due to different products. Large manufacturers possess complete production equipment, while small manufacturers, resulting in an easily formed regional industrial circle and high mobility. Division of labor with subcontractors can easily achieve efficient small batch production and represents the key advantage of Taiwanese industry (see Table 2-10-1).

Table 2-10-1 Key Technical Analysis of Hand Tools Industry

Key technologies	Explanations	Importance
Process automation	Manufacturers are lack of talents and urgently require automation, however; manufacturers and the related organizations to offer assistance are short of R&D personnel, capabilities and budget.	★★★
Near shape forging	In line with diversification and production of small quantity from consumers, forging industry must simplify the post machining of high cost. Products of traditional hot forging and cold forging have poor precision, large machining volume and expensive cost that will not be competitive in the future. Forging industry must gradually upgrade to level of precision forging.	★★

Table 2-10-1 Key Technical Analysis of Hand Tools Industry (Continue)

Key technologies	Explanations	Importance
Metal surface treatment	Application of surface treatment includes from traditional industry to high technology industry. Surface treatment technology makes product (or material) to be corrosion resistant, wear resistant, thermal resistant, longer life and surface property improving (such as anti-bacteria) so that product value added is increased.	★★★
Heat treatment	Hand tools have high requirements on hardness and strength. Good heat treatment can increase product quality and can prevent deformation after quenching.	★★
Surface treatment (Electroplating, polishing)	Hand tools quality is affected by appearance, especially high quality product cares about surface technology. Electroplating has pollution problem, while polishing technology mainly rely on man power to process, yet quality is not stable.	★★
Packaging	Product packaging will directly affect the purchasing willingness of consumer, yet traditional packaging requires man power so that packaging automation and beautification cannot be neglected in the production.	★★

Source: ITIS Program, MIRDC (2006/12).

Market analysis

Production value of Taiwanese hand tools increased from 2002 to reach NT\$50 billion in 2004 (see Table 2-10-2) due to increased steel price. In 2005, downstream traders reduced their orders owing to expecting steel price to continue increasing and maintained high stock levels. The production value of hand tools during 2005 totaled NT\$51.98 billion, increased a slight 1.2% from 2004. From 2002 to 2005, the annual compound growth rate of the hand tools industry reached 2.6%. Regarding exports, export value reached NT\$48.05 billion during

2005, increased 0.6% from 2004. The slow growth was mainly driven by exchange loss of the NT dollars against the US dollars as well as China growing its share of the US market. Regarding imports, the import value of hand tools continuously increased from 2003 to 2004. However, import value decreased 7.3% during 2005 compared to 2004, amounting to NT\$3.45 billion owing to slow demand and reduced supply of semi-finished products from Taiwanese enterprises with production facilities in China.

The total export value of the domestic hand tools industry during the first three quarters of 2006 was NT\$38.39 billion, increased 8.2% from the same period of 2005. Meanwhile, export value for the second and third quarters have exceeded reached NT\$13 billion. Due to the Christmas busy period during the fourth quarter, annual production value during 2006 is expected to increase more than 10%, reaching NT\$57.2 billion. During the last few years, domestic manufacturers have attempted to combat price cutting competition from China and reduced price differentials of Taiwanese tools with hand tools of Japan and Europe and America as part of a strategy of proactively developing high value products. The incorporation of digital technology into traditional hand tools has led to the development of “digital hand tools”. In 2005, China Steel Corp., MIRDC and 20 hand tools manufacturers organized the establishment of the “Hand Tools Industry R&D Alliance” to assist the domestic hand tools industry in upgrading and transforming by improving quality, cold and hot forging technologies, heat treatment and

electroplating technologies. During 2007, the capacity of “digital hand tools” and the introduction of key technologies from “Hand Tools Industry R&D Alliance” will generate NT\$67 billion in production value.

Though production value has increased year following year, added value for Taiwanese hand tools generally declined from 2002 to 2005. The SARS outbreak in 2003 influenced the willingness of foreign buyers to place the orders and reduce expenditure on personnel, thus reducing added value by 11.8% compared to 2002, amounting to NT\$14.16 billion. In 2004, material costs and outsourcing expense increased considerably, thus reducing added value to NT\$12.01 billion. However material costs gradually stabilized in 2005, meaning added value changed little compared with 2004. In 2006, hand tools manufacturers shifted their focus to producing small quantities of a large variety of tools, and the government promoted the production of high quality hand tools, helping added value to increase 9% compared to 2005, reaching NT\$13.61 billion.

Table 2-10-2 Supply and Demand Analysis of Taiwanese Hand Tools Market from 2002 to 2006

Unit: NTS100 million; %

Item Year	Production Value (A)	Value Added	Export Value (B)	Import Value (C)	Total Domestic Value (D=A-B+C)	Demand Growth Rate (E)	Export Ratio (F=B/A)	Domestic Self Sufficient Ratio (1-C/D)
2002	476.3	160.7	429.2	28.0	75.1	-21.2	90.1	62.7
2003	488.9	141.6	444.9	30.1	74.1	-1.3	91.0	59.4
2004	513.7	120.1	477.7	37.2	73.2	-1.3	93.0	49.1
2005	519.8	124.2	480.5	34.5	73.8	0.9	92.4	53.2
2006(e)	571.8	136.1	534.6	35.2	72.4	-1.8	93.5	51.3

Source: Industrial Production Statistics Monthly, Taiwan Area; Customs Import & Export Statistics ; Compiled by ITIS Program, MIRDC (2006/12).

Important Issues in the Hand Tools Industry

China has become largest global OEM manufacturer of hand tools

From 2003, China replaced Taiwan as the largest global exporter of hand tools, with annual growth rate of 25%. The value of hand tool exports from China reached US\$2.31 billion in 2005, ranking first worldwide. Taiwan followed in second place with US\$1.49 billion. The total annual compound growth rate of the ten top hand tools exporting countries (including China, Taiwan, seven EU countries and Japan) was 5% from 2002 to 2005. However the annual compound growth rate of China was 28%, demonstrating its amazing

growth compared to the other countries in the group. Affected by exchange losses and cost considerations, Europe, America and Japan outsourced the low level products to China making China the largest global OEM manufacturer of hand tools. Though China is the main producer of hand tools, it has also become the global potential consuming market of hand tools along with fast economic growth of its inland. The domestic market in China resembles the European or North American markets. China has a domestic market for hand tools comprising 400 million people that will undoubtedly attract more hand tools enterprises to enter the market in future.

Influence of EU environmental regulations on surface treatment technologies used by hand tools manufacturers

The EU has stipulated numerous environmental regulations on electrical & electronics products during recent years, including WEEE and RoHS. WEEE demands that manufacturers, importers and retailers assume responsible for the recycling or treatment of waste. Meanwhile RoHS, implemented on July 1, 2006, limits the content of lead, cadmium, Hg, Cr+6, PBB and PBDE in the electrical and electronics equipment, exported to Europe with the hope that manufacturers can actively upgrade the greening of electronics products.

Though the above two directives focus on electrical and electronics equipment, yet environmental concern are becoming a global trend so that the above two directives will inevitably be imposed on other products. Therefore domestic hand tools manufacturers should prepare in advance to comply with such directives. Hand tools traditionally use Cr+6 to prevent rusting, yet Cr+6 is a toxic and environmentally hazardous substance and its use is likely to gradually be limited by various governments. Hand tools manufacturers must adopt the other substitutes to achieve sustainability. Though manufacturers can use Cr+3, yet the technology still remains to be established and the cost is 2~3 times higher

than Cr+6. Additionally the antirust properties of Cr+3 are inferior to those of Cr+6.

Dealing with the implementation of RoHS directive, surface treatment manufactures should adopt (1) the use of Cr+3 or phosphoric acid film to substitute for toxicant Cr+6, the use of pure tin plating to replace tin-lead plating, the use of alternative to cyanide plating, etc. (2) antirust deposition in line with Cr+3 as a means of conforming to antirust requirements. (3) antirust depositing process using zinc alloy electroplating as a substitute for traditional pure zinc electroplating. The antirust properties of zinc alloy electroplating are approximately 3~5 times those of pure zinc electroplating, yet the cost of zinc alloy electroplating is 2~5 times that of pure zinc electroplating. Due to the high cost, fasteners rarely used zinc alloy electroplating. However the use of Cr+6 is forbidden and the application of zinc alloy electroplating with Cr+3 or passivation without chromium provide an alternative means of meeting antirust requirements.

Promotion of a hand tool strategic alliance creates a new value curve

From 2003, China replaced Taiwan to become the largest global exporter of hand tools, and thus the Taiwanese government has realized the threat of low-priced hand tools produced in China and has begun proactively

assisting the transformation of domestic hand tools manufacturers to get rid of fierce competition in the past. Therefore the Industrial Development Bureau, MOEA and Mechanical Industry Research Laboratories, ITRI assisted eight manufacturers in establishing the “Intelligent Hand Tools R&D Alliance” in 2003 to use micro process to overcome technical bottlenecks. Intelligent and digital practices have been introduced to traditional hand tools. Currently digital wrench and digital screw driver are being successfully promoted and attracted the attention of large international distributors at the National Hardware Show during 2006.

Additionally the Taiwan Hand Tool Manufacturers Association, sponsored by the Ministry of Economic Affairs, established “Hand Tools R&D Alliance” during 2005 with the assistance of China Steel Corp. and MIRDC. This alliance aims to cultivate R&D talents in terms of material technology, appearance design, manufacturing technology research and certification technology, increase technical level and product quality and increase international competitiveness. The Alliance established the “Bar & Wire Hand Tools R&D Alliance” to produce a strategy for upgrading industrial products. The alliance hopes to increase exports of bar and wire hand tools to NT\$750 million. In 2007, the “Plate Hand Tools R&D Alliance” is expected to be

established together with hand tools R&D center, which was set up by MIRDC in Central Taiwan, to improve the competitiveness of Taiwan in the global hand tools market.

「 Branding Taiwan 」 has assisted domestic hand tools industry in own brand development

Since most hand tools manufacturers are OEM/ODM, their gross profits are limited by increasing material price and low-priced competition from China. Luck Brand Industrial Co., Ltd. was able to break out of OEM production in the hammer industry, promoted its own brand and won the Germany IF design award in 2006. This award represents a great honor for the Taiwanese hand tools industry and indicates that own brand manufacturers in the Taiwanese hand tools industry have achieved international recognition. To encourage hand tools manufacturers to develop their own brand, the Taiwanese government has strengthened the R&D capabilities of hand tools manufacturers and is proactively promoting brand marketing. The Ministry of Economic Affairs plans to invest approximately NT\$2 billion to entrust professional companies for management, including digital technology, the hand tools industry, the flower industry, etc. Additionally the government provides preferential medium and long term loans. NT\$50 billion is offered to the category of “M&A of

international brand”, while NT\$30 billion is provided for the category “Own brand promotes foreign market”. The Taiwanese government is fully dedicated to reducing the distance between Taiwanese brand and international brand that will assist domestic hand tools industry in promoting its own brand.

Development Trends for the Hand Tools Industry in 2007

DIY application and AM product become the future mainstream

America is the largest global consumer of hand tools and the largest export destination for Taiwanese hand tools, comprising 40% of total exports. Since 2003, the new house market has become bigger and renovations have increased, driving hand tools sales in America. Additionally America has 200 millions automobiles which act as another driver since hand tools are also required in automobile maintenance. Historically, the American domestic demand market was focused on professional hand tools. Along with economic development and DIY prevalence, hand tools for consuming purpose become the main driver of development in the American hand tool market, with especially urgent demand existing for hand tools with ergonomic characteristics.

Though the hand tool market growth is affected by a strong substituting effect of

power hand tools, yet both has a considerable segmentation. Due to their safety and durable properties, hand tools have developed towards light weight, multi-function and ergonomics so that room remains for development. In the future, the development of American hand tools will rely entirely on the DIY market and the AM market for automobiles and motorcycles.

Product upgrading and creation of own brand have become the focus of domestic development

Previously, hand tools manufacturers were entirely OEM focused. Facing the cost advantages and low-price of China, domestic hand tools manufacturers faced declining profits. Hand tools manufacturers desperately need to break out of this old model, locate existing technological and marketing niches, gradually upgrade into ODM and OBM manufacturers, and proactively create their own brands. Only brand marketing and continuous innovation can create high added value. Innovative R&D thinking and marketing have replaced the historical manufacturing orientation. Through pursuing these paths manufacturers can avoid price cutting and the erosion of gross profits by rising material prices. Additionally domestic manufacturers can achieve a sustained advantage by innovating sufficiently quickly to prevent competitors in China from duplicating their products. Manufacturers must rely on

material upgrading and innovative design to increase product added value, facilitating market segmentation, preventing price cutting competition and developing towards digital/medical/multi-functions of hand tools.

Conclusions

The Taiwanese hand tools industry is internationally famous. However facing rising materials prices, gradually rising domestic manufacturing costs and the threat of rapid expansion from China, Taiwanese hand tools manufacturers face significant pressures. Taiwanese hand tools manufacturers recently have been proactively performing product upgrading and achieved excellent performance at the National Hardware Show and the German Koln International Hardware Fair. Additionally Luck Brand Industrial Co., Ltd. achieved an internationally famous IF award, opening gateway to the international arena for Taiwanese brands.

Facing low-priced products from China, the Taiwanese hand tools industry must transform products and markets as mature products are no longer competitive. Regarding current trends, design should be innovative, use new materials, ergonomic and digital/medical/multi-function. Constantly increasing product quality and added value is the only way to maintain the international competitiveness of

Taiwanese hand tools. At the current stage, industrial advantages of Taiwan, including its excellent talent, stable quality and flexible production efficiency to construct into international production and development centers. Hand tools manufacturers thus can put themselves into a good position to face the environmental changes, input new life and create another peak for the industry.

II. Fasteners Industry

Introduction

Industry Scope

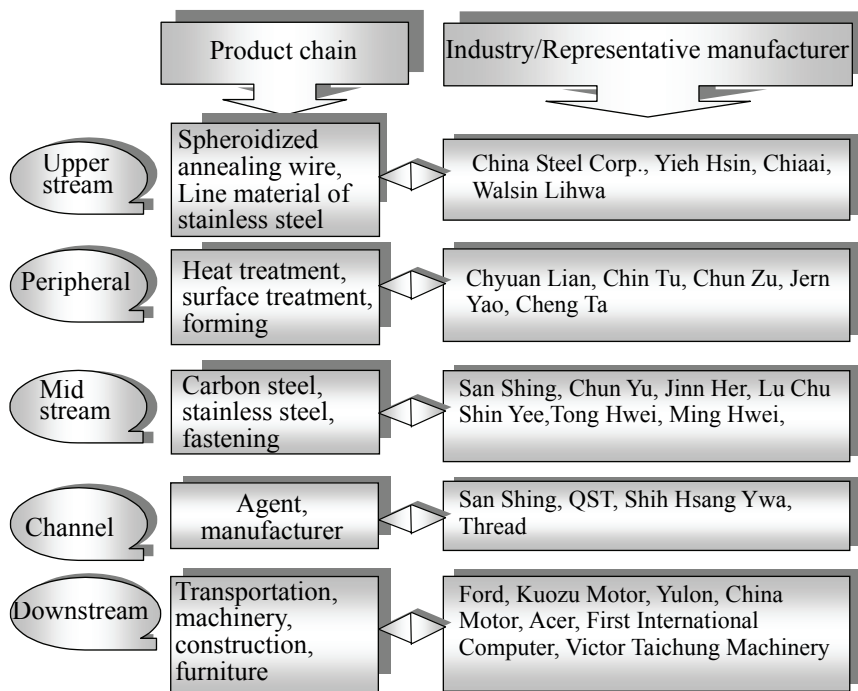
Screw and nut products are generally called wire (wire rod) fasteners. Fasteners can be divided into two categories, threaded products, including bolt, stud, screw and nut, and non-threaded products, such as rivet, washer, pin and ring.

Fasteners can combine various components into a single unit or system, facilitating the easy assembly or disassembly of components. The locking function of fasteners enables components to be assembled as a part of a complete object. Additionally fasteners offer convenient assembly, maintenance, replacement and re-assembly. Though fasteners are not cutting-edge products, yet they are important in the industry and construction. Additionally fasteners

consumption is considered an index of national industrial development.

The main industries related to the fasteners industry are wire and spheroidized annealing wire. Spheroidized annealing wire uses wire rod as material to create metallographic structures from steel which are spheroidized through heat treatment to avoid cracking during subsequent machining. Regarding bar and rod, China Steel Corp. is the largest plant,

followed by Yieh Hsin, Chiaai, Tycoons, Feng Hsin, etc. Prices of bar and rod are set based on listed price released by China Steel on a quarterly basis. Peripheral industries include former, mold and die heat treatment, surface treatment, etc. Furthermore, downstream industries include the transportation, machinery, furniture, electrical, electronic and construction industries (see Figure 2-10-2).



Source: ITIS Program, MIRDC (2006/12).

Figure 2-10-2 Linkage of Taiwanese Fasteners Industry

Industry Environment

The Taiwanese fasteners industry developed from 1945 and has evolved to the point where it can provide all required materials and produ-

ction machinery domestically with excellent quality and reasonable price. Suppliers and subcontractors exist for every manufacturing

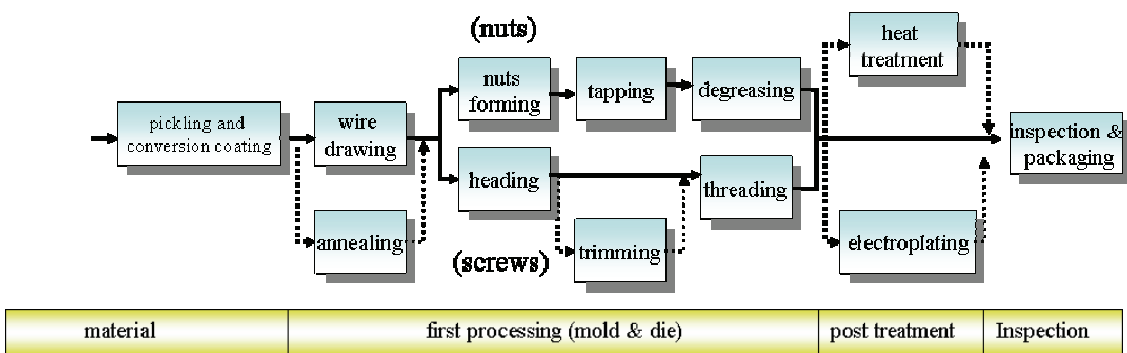
process, such as mold and die, heat treatment, surface treatment, electroplating, packaging, etc. Additionally the industry is clustered in limited areas of Taiwan, making production and sale convenient, economical and fast. Marketing channels are in line with domestic traders and plant set up at foreign countries, Peripheral manufacturers in the domestic fasteners industry have complete outsourcing system and a flexible value chain, features that are lacking in foreign production environments and represent the competitive advantages of Taiwan.

Owing to the enormous volume of fasteners production of Taiwan, its experience in cost control, industrial machinery and equipment, booming peripheral industries, competitive price and delivery times and talented and hard-working labor force, Taiwan has become the main global supplier of fasteners and Taiwanese product are exported to over 150 countries.

Overview of the Fasteners Industry in 2006

Technology

The process of machining fasteners can generally be divided into material purchase; first processing (mold and die), post treatment (treatment) and inspection (see Figure 2-10-3). During the last few years, domestic fasteners manufacturers have sought to increase added value, for example the major medium and large manufacturers of automobile fasteners have transformed their businesses and now receive regular orders from European and American auto makers. However automobile fasteners still require the coordination of peripheral industries in technical upgrading, including materials, molds and dies, surface treatment, inspection, etc. (see Table 2-10-3).



Source: ITIS Program, MIRDC (2006/12).

Figure 2-10-3 Fasteners Manufacturing Process

Table 2-10-3 Technologies required to be promoted for peripheral industries to develop fasteners for automobile in Taiwan

Item	Existing problems	Technologies to be cultivated
Material	<ol style="list-style-type: none"> 1. Cold working of wire 2. Development of fitting steel 3. Development of high temperature resistant wire for automobile engine 	<ol style="list-style-type: none"> 1. Improvement of surface defects for billet 2. Development of steel with cold forging and cutting properties 3. Development of high temperature resistant nickel-chromium-molybdenum-vanadium steel
Mold & Die	Manual machining has poor precision, while quality of grinding and polishing is not stable.	Automatic grinding, polishing and CNC control technologies are introduced.
Surface Treatment	<ol style="list-style-type: none"> 1. ELV environmental regulations 2. Some electroplaters are good, while some are bad. 3. Patent of coating agent is monopolized. 	<ol style="list-style-type: none"> 1. Introduction of coating agent, and establishment of alkaline alloy electroplaters, accredited by auto maker 2. Development of substituting technologies for Cr+6
Inspection	<ol style="list-style-type: none"> 1. Manual complete inspection is hard to control. 2. Expensive imported equipment is hard to maintain. 	<ol style="list-style-type: none"> 1. Increase inspection speed and precision. 2. Development of non-destructive inspection automatic equipment

Source: China Steel Corp. ; compiled by ITIS Program, MIRDC (2006/12).

Market

During 2005, the production value of the Taiwanese fasteners industry was NT\$92.4 billion (see Table 2-10-4), increased slightly from 2004. However in volume terms the production of 1.42 million tons represented a decline of 14% from 2004. In retrospect, the production value of fasteners has always showed an increasing trend. Following 1998, production value maintained a level of over NT\$60 billion. Along with the economic recovery in 2002, rising steel prices and the transformation of domestic industry, the production value of fasteners continuously set

new records. During 2002, annual production value of the Taiwanese fasteners industry exceeded NT\$65 billion for the first time, and reached NT\$94.3 billion in 2006. During 2007, annual production value is estimated to reach NT\$96 billion owing to continuously increasing product unit prices though in volume terms production is expected to decrease slightly only to competition from China.

In terms of added value, international steel prices increased more than 60% from the end of 2003 to the third quarter of 2004. However soaring material prices did not translate into significant additional revenue and added value

reduced. During 2005, steel prices remained high and added value declined slightly. Added

value is expected to increase moderately during 2006 assuming that steel prices remain stable.

Table 2-10-4 Supply and Demand Statistics of Taiwanese Fasteners from 2002 to 2006

Unit: NT\$100 million; %

Year \ Item	Production Value (A)	Value Added	Export Value (B)	Import Value (C)	Total Domestic Value (D=A-B+C)	Demand Growth Rate (E)	Export Ratio (F=B/A)	Domestic Self Sufficient Ratio (1-C/D)
2002	653	201	542	24	135	0	83	18
2003	740	205	629	31	142	4.9	85	22
2004	918	200	799	51	170	16.5	87	30
2005	924	198	804	35	155	-8.7	87	23
2006(e)	943	200	811	34	166	7.1	86	24

Source: Industrial Production Statistics Monthly, Taiwan Area; Customs Import & Export Statistics ; Compiled by ITIS Program, MIRDC (2006/12).

Regarding production, domestic fasteners production volume peaked in 2000 at 1.66 million metric tons. Due to the recent economic slowdown, during 2001 production declined to below 1.4 million metric tons. However production began to pick up again from 2002. In 2004, global steel supply was unable to meet the demand and downstream industries increased their inventory resulting in domestic production of 1.65 million metric tons, the second highest in the world. Nevertheless, growing competition from China and the meeting of inventory needs resulted in, annual production reducing to 1.42 million metric tons during 2005. Annual production during 2006 is expected to be similar to that during 2005.

Regarding imports, in volume terms imports

totaled during 2005 was 280,000 metric tons, reduced 17.9% from 2004, when in value terms they recorded NT\$3.52 billion, and reduced 30.3% from 2004. The decline resulted from demand following the completion of the Taiwan High Speed Rail project. Starting from 2002, the Taiwan High Speed Rail imported small quantities of fasteners from Japan, reaching NT\$1.6 billion in 2004 and taking up 33% of total import value in 2004. The import source country was Japan. However, with the completion of the High Speed Rail project the importation of fasteners, reduced to NT\$300 million.

In terms of exports, export volume in 2005 was 1.27 million metric tons, decreased 10.4% over 2004, while export value totaled NT\$80.36 billion, and increased 5% from 2004. The

average unit price for exports was NT\$63/per kilo, increased 12.5% from 2004. Since steel increased tremendously in 2004, large OEM makers placed their orders in advance and export thus declined in 2005 owing to inventory consumption and competition from China. However, average unit price for exports increased for four consecutive years, indicating a transformation in the performance of the domestic industry.

Important Issues in the Fasteners Industry

ISO/TS 16949 is the prerequisite for entering the auto manufacturer supply chain

To meet the requirements of global economic integration, avoid duplicating supplier accreditation, and decrease unnecessary operations and resources waste of suppliers, the International Automotive Task Force (IATF) and the Japan Automobile Manufacturers Association Inc. (JAMA) drafted ISO/TS 16949 : 2002 with the support of ISO/TC 176.

Based on the requirements of ISO 9001 : 2000, ISO/TS 16949 : 2002 combined the common requirements of the automotive industry to integrate the requirements of QS 9000, VDA 6.1, EAQF, AVSQ, etc. Any automotive industry supply chain organization (including firms involved in the automobile,

truck, public bus and motorcycle industries) can apply for ISO/TS 16949 : 2002.

Since the integration of the existing quality system used by the global automotive industry, automotive parts suppliers can hold a single certificate to satisfy customer quality system demands and prevent international customers from demanding that suppliers to register other standards or requirements. Firms, including Ford, GM, DaimlerChrysler, BMW, Fiat, PSA Peugeot-Citroen, Renault SA, Volkswagen, etc. have also expressed support for TS 16949.

Implementation of ISO/TS 16949 is expected to generate benefits, including improving product and process quality, providing global customers with reliable materials, offering a common quality management system for supply chain development and consistency, decreasing quality management system auditing of second party (customer), decreasing repeated certification from third parties and providing a common language for recognized quality requirements. Domestic manufacturers currently are proactively applying for ISO/TS 16949 accreditation. Though ISO/TS 16949 accreditation is stricter than QS 9000 and must provide product performance handed to auto makers to apply for certification, ISO/TS 16949 is the threshold for manufacturers to enter the auto manufacturer supply chain.

AS 9100 is quality accreditation system developed by aerospace industry

AS 9100 was an important achievement of international aerospace industry and resulting from the concerted effort of numerous organizations, and was formally announced in 1999 and subsequently become Revision A. Based on ISO 9001 : 2000, AS 9100 Revision A increases the requirements regarding the safety, reliability and quality of aerospace products in the hope of ensuring customer satisfaction and creating world class products at a reasonable cost. AS 9100 Revision A helps aerospace manufacturers to follow a single aerospace quality system and thus save on the costs of establishing a huge system and the subsequent auditing required by different customers.

For security, aerospace fasteners set strict requirements regarding materials, manufacturing and quality insurance inspection and these requirements have the additional benefits of helping the aerospace industry achieve high added value, stable market and avoidance of price wars. The main entrance barrier facing firms in this industry is the related accreditation. Only accreditation is obtained to enter aerospace market. Consequently, the Taiwanese fasteners industry must help both international aircraft manufacturers and foreign aerospace manufacturers recognize the Taiwanese quality system and it's developed aerospace fasteners.

Domestic manufacturers planning to develop aerospace fasteners have acquired AS 9100 accreditation. Additionally Taiwan has signed BASA, becoming the 32nd country to do so. In the future, following Taiwanese fasteners acquire the certification of the Civil Aerospace Administration, MOTC, they will be able to be applied in the aircrafts with ROC nationality number and obtain recognition from international aircraft manufacturers (such as Boeing, Airbus), aircraft engine manufacturers (such as GE, P&W) and foreign aerospace fasteners manufacturers (such as Textron, PCC, etc.) becoming qualified suppliers.

EU Environmental Directives

After the EU recognized the environmental impact of waste treatment, it began making plans for waste disposal in the early 1990s. The Fifth European Community Framework Program specifically laid out of a plan of starting from improving product design and manufacturing and then changing the consumer habits to decrease environmental impact. The proposed approach thus had two focuses; first to improve product design to decrease the waste output, and second to increase product re-use, recycling and renewable ratios.

Under these two principles, the Directive on Packaging and Packaging Waste (PPW, 1994), the Directive on End-of life Vehicles (ELV, 2000), Directive on the Waste of the Electrical

and Electronic Equipment (WEEE, 2003) and Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (ROHS, 2003) were developed. Meanwhile, how to deal with end-of-life products also became a concern. Comprehensive green product requirements have become an inevitable trend. The Directive on End-of life Vehicles (ELV, 2000) and the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (ROHS, 2003) clearly specify that the use of Cr+6 is forbidden.

These regulations require changing traditional electroplating processes using pure zinc with Cr+6. The application and development of the alloy electroplating, Cr+3 and without chromium process have become the main issue facing the fasteners industry.

The surface treatment technology of Taiwanese fasteners requires upgrading

The domestic fasteners industry is proactively developing high value products, with automobile fasteners being one of the major development directions. Local manufacturers possess excellent forming technologies, with material being supplied by China Steel Corp., Taiwanese manufacturers are good at mold and die design and manufacturing and thus forming high quality fasteners is not a problem. Facing

EU environmental directives and the increased product quality offered by auto makers, surface treatment technologies currently face difficulties in increasing product added value.

The development of Electroplating technologies for automobile fasteners faces two urgent problems: (1)EU environmental regulations, including ELV and ROHS forbidding the use of Cr+6 when the traditional method of achieving antirust properties in traditional automobile fasteners uses pure zinc electroplating along with passivation by colored or black Cr+6. Cr+3 is a potential substitute for Cr+6, but costs 2~3 times more than Cr+6. Additionally the antirust properties of Cr+3 are inferior to Cr+6, meaning additional anti-rust materials must be applied (such zinc alloy electroplating) to achieve an equivalent level of protection. (2) Electroplaters must obtain the accreditation from auto makers, tier one supplier and chemical manufacturers to process fasteners. Additionally electroplaters must obtain accreditation from fasteners manufacturers to process their products. The fasteners manufacturers must maintain QS/TS qualification to be included in the list of suppliers.

Though domestic electroplaters can offer zinc alloy electroplating service, the quality of their work is not trusted by foreign auto maker or tier one supplier. Automobile fasteners thus are exported in bare condition (without surface

treatment) and surface treatment is conducted in the home country or (elsewhere). After surface treatment exported fasteners generally enter AM or are re-treated locally. The average unit price of automobile fasteners (bare) is about NT\$50~60/per kilo. However domestic auto makers import fasteners at a price of NT\$200~400/per kilo, a difference of more than three times. Domestic electroplaters thus have lost the opportunity to achieve high profits. Electroplaters should rapidly obtain the accreditation of auto makers to make they appear attractive to customers and should enter the supply chain of international auto makers and help in developing automobile fasteners.

Development Trends for the Fasteners Industry in 2007

China is good at serving low quality market

During the last few years, China has achieved rapid growth in volumes of fastener exports. Regarding figures indicating the export volume of 20 major industrialized countries, together these 20 countries exported 6.85 million metric tons during 2005, with Taiwan exporting 1.27 million metric tons, while China exported 2.47 million metric tons. Export volume from the two sides of the Taiwan strait thus accounted for 54.6% of total export volume from the 20 countries. In 2003, China overtook Taiwan in terms of

export volume. Initially, the difference was 60,000 metric tons, but China expanded its lead to 1.2 million metric tons during 2004 and 2005. In the aspect of growth rate, the annual compound growth rate of export volume for the 20 countries was about 14.6% from 2001 to 2005. Taiwan achieved growth of 3.9% during the period, while China achieved 32.7%. Average unit prices of exports on both sides of the strait were similar at US\$1.97/per kilo for Taiwan during 2005 and US\$1.04/per kilo for China. Given the limited growth in the global market, the rapid growth of China will inevitably gradually erode Taiwanese market share.

Both Taiwan and China consider the US to be their main export market. In 2005, America imported US\$1.35 billion worth of fasteners from Taiwan, representing 30.4% of its total fastener imports, while imports from China reaching US\$990 million, for a 22.3% share of the total. This compared with a market share for China just 10% during 2001. In contrast, Taiwan's market share reduced from 31.8% in 2001.

Though Taiwan is famous as Kingdome of Fasteners, the Chinese fasteners industry is becoming stronger, and 30% of fastener imports to Taiwan already come from China, meaning China ranks second behind Japan as the largest supplier of fastener imports. The average unit price of imports from China is NT\$28/per kilo. Continuous investment by Taiwanese and foreign businessmen, increased product quality

and cheap manufacturing costs have helped China increase its market share in the import markets of America and EU. China thus dominates the market for low quality products.

Transformation towards high value is inevitable

Taiwanese fasteners do not have high added value. Additionally the entrance barriers to the fasteners industry are low, and the industry has low entry barriers. Trends in global fasteners, standard and low added value products have reached saturation as low-price producers in China and South East Asia have increased their production. Taiwan thus has gradually lost its competitiveness in the low value added market. Facing by competition from China, the export volume of China has exceeded that of Taiwan during 2003 and China overtook Taiwan in terms of export value in 2005. Therefore upgrading and transformation represent the only option for the Taiwanese industry. Fasteners products include fasteners for the automobile, 3C micro and aerospace industries that are classified as high added value products and also represent the optimal transformation direction for the domestic industry.

Regarding automobile fasteners, one automobile uses an average of more than 2,000 pieces of fasteners in the engine, suspension, body, interior, etc. The total cost of these fasteners is about US\$200. Continuously increasing of

steel prices and high manufacturing costs has resulted in products from Europe and America gradually losing their competitiveness. Domestic fasteners manufacturers therefore have received more and more orders for automobile fasteners from Europe and America. About 25% of current domestic production is automobile fastener.

In terms of micro fasteners for 3C industries, domestic fasteners manufacturers are always OEM base of 3C/IT. Along with the prosperous development of the global 3C/IT industries, diversified digital products create annual production value of US\$10 billion. However light, thin, short, small and multi-function products generally comprise the main stream and trend for 3C/IT products/devices. Therefore demand of micro fasteners, key parts in the assembly and transmission of 3C/IT product/device is growing.

Regarding aerospace fasteners, the global production value of aerospace fasteners exceeds US\$2 billion. The aerospace industry includes the manufacturing of civilian and military aircraft, missiles and space machinery (such as satellite, landing craft, etc.). All of these products contain rivets, bolts, screws, etc. Though the aerospace industry requires high technical capability and is a major source of profit for the fastener industry, it is difficult to enter the aerospace industry supply chain. However, provided the Taiwanese fasteners

industry can enter the aerospace industry supply chain, it can ensure avoiding a price war and producing profitable products.

Conclusions

In the face of fierce competition, manufacturers are demanding that their suppliers to continuously decrease costs, including transportation vehicle, machinery, electronics and other costs. Equipped with advantage of low manufacturing costs, Asia has thus become the center of global production. In the fasteners industry, Taiwan ranks behind Japan in terms of having the most mature manufacturing and management technology. Additionally industry clusters and professional division of labor are long established enabling the industry to achieve competitive product quality and delivery.

Since various types of fasteners exist and domestic manufacturers are focused on mass production and order-orientation, the related technologies are extremely mature. However the design of special function products, specifications and patents are controlled by advanced countries. Without a stable order source domestic manufacturers are unwilling to develop high specialized products so that industrial transformation requires a market orientation and high added value. Fasteners for automobile, 3C and aerospace industries are the main focus of industrial transformation at the current stage.

Transformation is challenging for enterprises, especially transforming mass production into small-scale and specialized production, requiring upgrading of R&D abilities and talents, improvement of manufacturing process and management system, establishment of a quality insurance system, accreditation acquisition, concurrent upgrading and coordination of subcontractors and abandoning the existing orders and capacity and thus creating a need for a high degree of entrepreneurialism. Facing competition from China, the Taiwanese fasteners industry must make good use of the competitive advantages it has established over numerous years and transform its focus to high value products to ensure its future sustainability.

The domestic fasteners industry currently has excellent opportunities for transformation. Competition from China and South East Asia are driving continued industry growth, while Europe and America are releasing high value added orders due to cost reduction pressures. These are the main forces driving the transformation of the domestic industry. The domestic industry should give up mass production of low value added items and switch to “specialized production” of high value added items to enter the supply chain of large international Europe and American makers and accept the orders for automobile, 3C, aerospace, etc.

III. Mold and Die Industry

Introduction

Industry Scope

Mold and die are essential to mass production. Material, including metal, plastics, rubber, glass or mine, etc. is formed into finished products of specific types at high temperature, high pressure or high impact, a process that requires the use of mold and die. Molds indicate that material is formed while in molten status with examples including plastic mold or die casting molds. Meanwhile dies are used for material that requires directly forming via stamping, forging or extrusion, such as stamping die, forging die, extrusion die, etc. Based on the classification of industrial products by the Industrial Development Bureau, MOEA, metal molds and dies are divided among die casting mold, forging die, stamping die, plastic mold and other molds.

The mold and die industry is classified as a special industry which is high technology, capital intensive and high value added and is an important tool in the mass production of a wide variety of end products. Mold and die industry is thus termed the “Mother of Industry”. Consequently, the development of the mold and die industry can not only increase

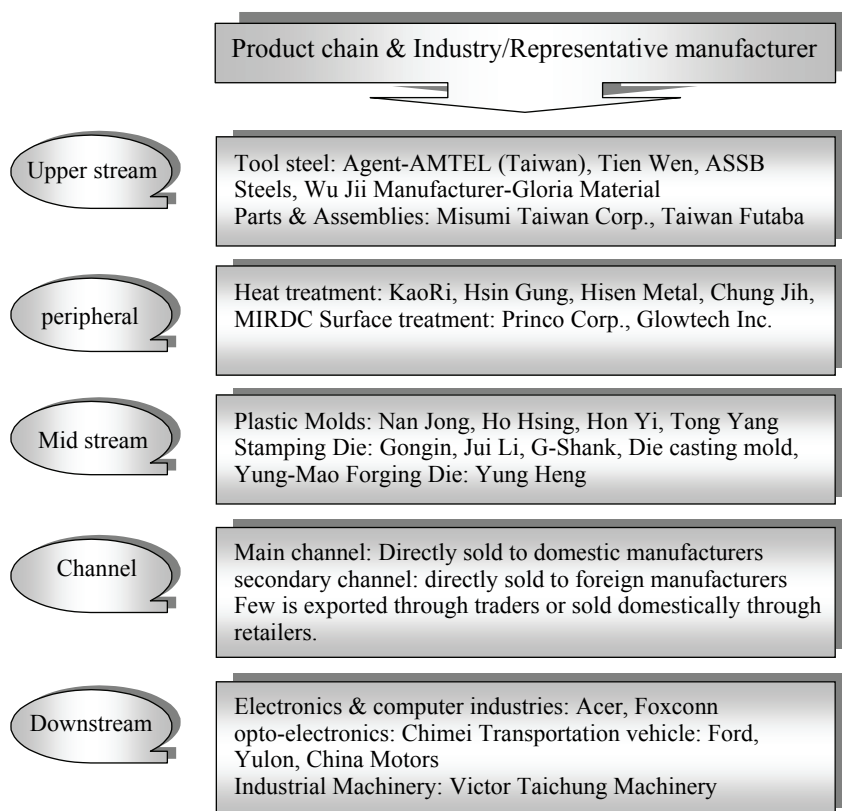
the ability of a country to produce more specialized products, but can also achieve progress in the manufacturing industry and further accelerate industry upgrading. Consequently, the mold and die industry a basic industry supporting the manufacturing industry development.

Dies are generally used from tool steel as material. Meanwhile to avoid corrosion, some plastic molds use stainless steel. Furthermore lower level plastic molds adopt medium carbon steel or low alloy steel, while aluminum alloy is used for blow molding and bubbling. Additionally, carbon steel is the primary material for die sets. Since Gloria Material is the only producer of tool steel in Taiwan, Taiwan relies on imports for most of its tool steel needs. Main agent of tool steel includes AMTEL (Taiwan), Tien Wen and ASSB Steels. Tungsten carbide suppliers are CB Carbide and Porite Taiwan Ltd. Parts and assemblies are supplied by Misumi Taiwan Corp. and Taiwan Futaba (see Figure 2-10-4).

Peripheral industries related to the mold and die industry include heat treatment, surface treatment, tooling and applied software. Representative heat treatment manufacturers include Kaori Heat Treatment, Hsin Gung, while surface treatment manufacturers include Princo Corp. and Glowtech Inc. MIRDC, R&D organization, is equipped with professional R&D team and equipment of heat treatment

and surface treatment for mold and die and can provide manufacturers with the services. Some of the tools required for mold and die machining are imported, and domestic suppliers include Taiwan Precision, Taiho Tool, Su's Precision Tool, etc. Additionally, the use of CAD/CAM/CAE system is very important for

dealing with short delivery, low price and high quality of molds and die. Domestic agent selling CAD/CAM/CAE systems include Duct, Alpha Precision Instrumentation Corp., UGS Corp., Taiwan IBM, Parametric Technology Ltd., Euclid, etc.



Source: ITIS Program, MIRDC (2006/12).

Figure 2-10-4 Linkage of Taiwanese Mold & Die Industry

Industry Environment

The Taiwanese mold and die industry has gradually developed from Taiwan restoration along with development of domestic industry. The main products during the early stage of the industry were molds and die for household appliances, casting mold, wooden mold, mold for glasses and ceramics and plastic molds. During the 70's, the government realized the importance of the mold and die industry for industrial development and gradually made it a "strategic industry" and supported its development, helping the industry to enter its high growth stage. Plastic mold and stamping die have become the main focus of the Taiwanese mold and die industry.

Overview of the Mold and Die Industry in 2006

Technical analysis

Mold and die technologies combine machinery, electronics, chemical, optical, material, computer, precision monitoring and information network. In the future, the mold and die industry will develop in line with the development of the optoelectronics and 3C/IC industries and focus on the short-term around production of higher precision products, including high speed transmission mold, thin wall plastic injection mold, tube hydro forming mold and micro mold. New mold and die technologies

will develop in the direction of high speed, high precision, lightweight, etc.

In terms of technical ability, Taiwanese mold and die manufacturers focus on manufacturing precision and design ability with production speed ranking third. In fact, Taiwanese mold and die manufacturers are the international leaders.

Market Analysis

Overall, the current technical ability of the domestic mold and die industry roughly correlates with the development of the 3C, opto-electronics, telecommunications and automobile industries. Together with material diversification, product complexity and the pursuit of fine, micro features, mold and die manufacturing, quality and design still lag behind advanced countries, forcing reliance on imports for advanced precision mold and die.

Important Issues in the Mold and Die Industry

Collaborative development of precision electronics mold and die

Mold and die development must be combined with product development so that the development mechanism in both areas can be combined to form a cooperative and trustable community and alliance focused on establishing a common collaborative design platform. Such a platform can enable the rapid

exchange and communication of engineering data and technical language. Mold and die manufacturers should therefore establish design management database and development management system for mold and die to enhance product design and development ability for mold and die and to become a good ODM/OBM partner.

Supply the international market with reliable mold and die for automobile

Taiwanese mold and die manufacturers can use technical or capital cooperation with auto makers of China to jointly establish collaborative design platforms, conduct technical R&D and data exchange and enter the supply chain of CBU in China.

Generally, domestic mold and die manufacturers should establish manufacturing ability for lightweight and large automobile parts and proactively join development management platform oriented towards parts manufacturers or central manufacturers, product design, mold and die design, mold and die manufacturing parameters, databank and knowledge bank of standard mold and die parts and work on developing next generation products.

Global supply of high quality mold and die

With trends such as the establishment of global logistics system, the cost pressures and the development of new markets, enterprises

must focus their operations on R&D, design and marketing. Large international makers, such as GE, IBM, HP, HITACH, Johnson & Johnson, Boston Scientific, Medtronic, etc. locate subcontractors and parts procurement companies, and mold and die manufacturers are an important link in the production chain. Since large international makers demand high quality and specialize in metal or plastic mold and die, suppliers are few and profits are high. Consequently, the Taiwanese mold and die industry should focus on technical integration and innovative R&D, assist the upgrading of end product quality, enter the global supply chain in tandem with parts manufacturers and enhance market competitiveness.

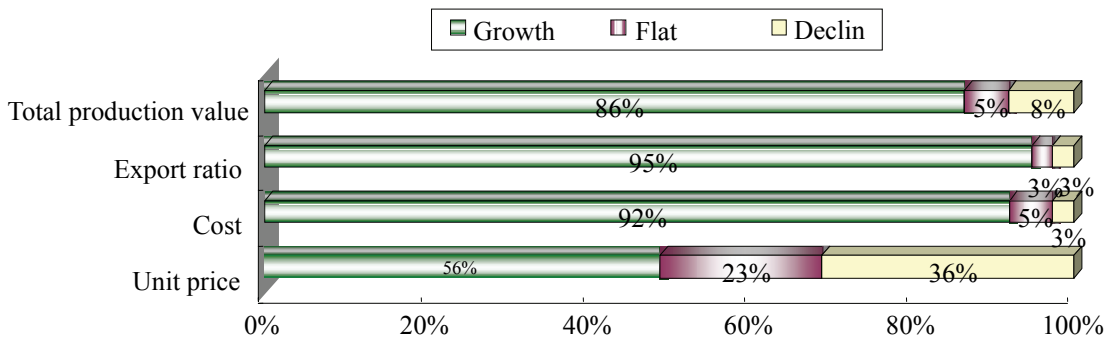
Development Trends for the Mold and Die Industry in 2007

The largest product applications for Taiwanese mold and die are in the 4C industries (3C adds the fourth C industry-automotive), which together are estimated to account for more than 70% of the total production value of mold and die. Therefore growth in the 4C industries will positively impact the development of the mold and die industry. To sum up, prosperous development of 3C industries and increased demand for various components will represent a major business opportunity for mold and die manufacturers.

Automotive electronics are a hot area in the Taiwanese technology industry. Statistics from the Topology Research Institute indicate that the global automotive electronics reached US\$122.4 billion in 2005, representing almost half of the size of the semi-conductor market and double the production value of notebook. Automotive electronics offer tremendous business opportunities. The automotive electronics industry is focused on safety, stability and long accreditation time making it very different from the domestic electronics industry, focused as it is on speed and competitive price. If successful experiences of the production and sale experiences of 3C mold and die can be transferred to automotive electronics market, mold and die manufactures will face another challenge and another transformation opportunity.

Taiwanese mold and die manufacturers forecast domestic mold & die market from 2006 to 2007, including total production value

of mold & die, import value, export value, cost and selling price. Mold and die manufacturers are optimistic regarding the prospects of the market for 2006 and 2007. More than 80% of manufacturers expect total production value was to increase, and 95% expect exports to increase (see Figure 2-10-5). Cost and unit price will reflect the profits reaped by manufacturers. However predictions for these two items are for profits to decline with 90% of manufacturers expecting costs to increase, while 50% of manufacturers expect unit prices to decline. Surveys indicate considerable shrinkage in the profits of the mold and die industry. However, manufacturers must change their old habits of competing based on cost and unit price as competitive means, proactively upgrade their professional technologies and product added value and adjust their operational structures.



Source: Survey by Taiwan Mold & Die Industry Association ; Compiled by ITIS Program, MIRDC (2006/12).

Figure 2-10-5 Forecast of Taiwanese Mold & Die Market from 2006 to 2007

Conclusions

Overall, though the Taiwanese mold and die industry is complete, yet manufacturing of high precision and complex mold and die is limited by material forming properties that cannot be controlled. Furthermore it is necessary to upgrade mold and die design ability to overcome the problem of producers being unable to purchase high precision equipment owing to lack of capital and thus decreasing the number of mold and die manufacturers with high technical capabilities. Since the future direction of product development is toward product with “light, thin, short and small” features, mold and die manufacturers continuously require the upgrading of their technical abilities, including developing super precision mold and die, transforming from “manufacturing” to “design”, and conducting e-engineering for mold and die, ranging from product design and mold and die design, through to development, production management and establishment of enterprise resource databases in order to equip themselves with collaborative development ability and gradually transform themselves into ODM. Through this approach, mold and die manufacturers can quickly connect with automotive, 3C and opto-electronics makers. When technical capabilities and design R&D

abilities are increased, differentiated and value added products can be established, helping Taiwanese manufacturers to enter the supply chain of large international makers.

Besides the upgrading of the internal abilities of mold and die enterprises, government, academic and research institutes have extended appropriate assistance to enterprises in the areas of market exploration, operational environment, technical development and talents cultivation to make up for the inadequacies of manufacturers in terms of capital, equipment, technologies and talents. Mold and die manufacturers should proactively establish mold and die design and development centers and combine the capabilities of the industrial, official, academic and research sectors along with effective operation and execution, thus completely upgrading the competitiveness and added value of the Taiwanese mold and die industry. The setup of mold and die design and development centers provides manufacturers with a correct and feasible means of transformation, helping them develop the advantages they need to become international competitive.

Year	2002	2003	2004	2005	2006
NTD/US	34.58	34.42	33.42	32.17	32.53

Note: Exchange rate of US\$ to NT\$

(MIRDC, ITIS)