

Technology Accumulation and the Division of Labour between China, Taiwan and Japan: Taiwanese Automotive Parts, and Die and Mould Firms in China

Yuri Sadoi
Faculty of Economics
Meijo University, Nagoya, Japan
Email: sadoi@meijo-u.ac.jp

Abstract: This paper seeks to analyze changes in the technical division of labour of Taiwanese automotive parts, and die and mould manufacturers in China using empirical data from a 2010 survey conducted in Kunshan. The evidence shows that these firms have upgraded considerably through strong technical collaboration with firms and imports of capital equipment from Japan. Both competition and cooperation have played an important role in the advancement of Taiwanese component and parts firms. The division of labour of automobile parts and dies and moulds appear to show firms in Japan and Taiwan enjoying cutting edge and intermediate technologies, while those in China are characterized by low end technology. However, owing to intense competition, the catching up speed of Chinese firms in China has accelerated and the gap has narrowed.

Keywords: automotives, China, international division of labour, Japan, Taiwan, technology

JEL classifications: L62, O19, O31, O33

1. Introduction

The international division of labour has faced considerable transformation arising from significant changes in the global market economy. Changes in the investment, production, and distribution decisions made by firms and individuals have had major impact on changes in the international division of labour. The globalization process has unleashed greater competition from both factor and final markets with important ramifications for location decisions of multinational firms.

Large labour endowments and growing effective demand has accelerated the relocation of production to China with major consequences for the international division of labour. The initial relocation of multinational

operations in developing countries was driven by natural resources and labour endowments for firms to exploit geographically, differences in access to natural resources and production costs, as well as, efforts to appropriate oligopolistic advantages (Hymer, 1972; Dunning, 1988, 1997).

This study aims to analyze recent developments in the division of labour between Taiwanese automotive supplier firms located in China and automotive firms in Taiwan and Japan. Li and Sadoi (2008) had shown from a survey conducted in 2006-2007, that the technical division of labour between Taiwan, China and Japan in automotive parts suppliers left firms in China seriously lacking in high technology, though the Taiwanese suppliers were accumulating advanced technologies from Japan through technology collaboration, capital investment and competition.

However, there has been a sudden rise of Taiwanese electronic manufacturing system (EMS) firms in China that has triggered a different pattern of international technological division of labour between firms in China, Taiwan and Japan, which is reflected in the leading EMS firms. Foxconn for example has facilitated considerable changes in the division of labour in automotive parts, and dies and moulds division of labour. However whereas the number of publications on Taiwanese electronics firms in China has been growing, similar work on automotive parts manufacturing has been scarce.

Hence, this paper seeks to examine the technical division of labour between Taiwanese die and mould manufacturers in China and automotive parts manufacturers in Japan and Taiwan. The rest of the paper is structured as follows. The second section presents a theoretical guide. The third section analyzes the international division of labour between Taiwanese die and moulds manufacturers in China, and suppliers in Japan and Taiwan, comparing in the process the results presented in Li and Sadoi (2008). The subsequent section evaluates the impact of changes in the die and mould technologies and the proliferation of EMS on the international division of labour, based on a survey of firms undertaken in March 2010 in the Kunshan Industrial Park. The final section presents conclusions.

2. Theoretical Guide

Technology transfer largely refers to the movement of technologies across, and to a lesser degree within, countries (Lall, 2001). Much of technology flows from persons to persons and firms to firms, but it is often captured at the aggregate level by the impact it generates in recipient countries. Technology and knowledge has moved across enterprises and counties from the earliest days of productive activity (Lall, 2001). In recent years there has been increased interest in the issue of technology accumulation and international division of labour in many countries. Technology accumulation plays a central

role in economic development. Empirical research has drawn attention to two aspects of technology accumulation – technical change and the acquisition of technological capabilities (Lall, 1993). Rasiah (1994, 1995) argued using empirical evidence of the importance of technical external economies in the flow of technology from foreign sources to local firms, which has implications for analyzing the economic performance of firms in developing countries. Recent theories have demonstrated that incremental technology accumulation can have a positive impact on firm-level efficiency and productivity (see Rasiah, 1996; Kim, 1997).

Lall (2001: xii) describes four levels of technological capabilities. The simplest operational level needed for utilizing technology efficiently involves basic manufacturing skills as well as some more demanding troubleshooting, quality control, maintenance and procurement skills. At the intermediate level, duplicative skills are also critical, which include the investment capabilities needed to expand capacity and to purchase and integrate foreign technologies. Next come adaptive skills where imported technologies are adapted and improved, and design skills for more complex engineering are learned. Innovative skills are also important to creatively absorb technologies (see Kim, 1997). Finally, as firms get close to the technology frontier, formal R&D will be needed for firms to participate in the creation of new technologies.

The international division of labour in production involves the geographical separation of different production stages across the world's different economies in order to exploit differences in factor costs and capabilities (see Hymer, 1972; Rasiah, 1988, 1995). Hymer (1972) argued that the drive to retain oligopolistic control of markets and the advantages of host sites resources over the home sites resources, essentially governs the geographical dispersal of production by multinational firms. Dunning (1988, 1997) used his eclectic theory to argue that ownership, location, and internalization (OLI) are instrumental in driving the internationalization of production. Reduction of trade costs makes firms more likely to choose vertical foreign direct investment (FDI), which allows a relocation of a part of the production process to cheap-labour countries, and engages in vertical production process division between host and home countries. Substantial reduction in trade costs between Taiwan, China and Japan has led to an increase of vertical FDI from Taiwan and Japan to China. Although the jury on spillovers – over whether they are positive or negative – is still unresolved, there are significant works that demonstrate positive spillovers from foreign firms to the local economy (Rasiah, 2004; Hahn and Narjoko, 2010).

The acquisition of skills and investment in human capital are seen by many economists as an engine of growth (Acemoglu and Pischke, 1998; Sadoi, 2008, 2009). Several studies point to: a strong link between skills and productivity (Acemoglu, 1996); a country's knowledge base being an important

resource for innovation; and links between cross-national differences in education and persistent disparities in per capita income across national economies (Romer, 1990).

Both Japan and Taiwan developed relatively stable systems of skill formation, but based on very different principles and sustained by quite different institutional arrangements. Vogel (1991) provided substantial evidence of investment by the Taiwanese government to step up the supply of technically-oriented graduates in Taiwan. Both systems have been successful in achieving high skill based industries. Japan is best known for its extensive, firm-based system of training strongly associated with complementary personnel policies such as seniority wages and internal career ladders (Thelen, 2004; Sadoi, 2009). Taiwan's system of vocational training approaches the ideal typical collective solution.

In Taiwan, the government has been successful in upgrading the educational and technological levels of the labour force through the use of vocational schools (see Vogel, 1991; Chen, 2003). During the 1960s, while the period of compulsory education was extended to nine years, the proportion in vocational schools increased from 40 per cent in 1960 to 57 per cent in 1970 and by 1990 the proportion in vocational schools had increased to 72 per cent (Ashton *et al.*, 2002). Skill formation and technological upgrading programs by state intervention played an important role in setting up research institutes and in developing high-level engineers and entrepreneurs (Ashton *et al.*, 2002; Sato, 2008).

As a result, Taiwan achieved high technological levels in the manufacturing industry by the 1990s, using the competitive advantage of its flexible and strong supplier networks. Having integrated capital intensive technology and tie-ups in global value chains, Taiwan developed original equipment manufacturing and original design manufacturing production and export. The historical progress of technological development and learning process and product skills and know-how of electronics in East Asian countries were observed as examples of latecomers technology transfer (Hobday, 1995). Some authors think that the Taiwanese model of semiconductor manufacturing is market-driven, export-oriented, privately owned and managed, with no government controls over any of the firms involved in the industry. However, as argued by Mathews (1997), Amsden and Chu (2003), Rasiah and Lin (2005) and Rasiah *et al.* (2010), Taiwanese nurturing and guidance have been entirely the product of government support.

Despite this support, Taiwan as well as other Asian NIEs experienced falling competitiveness in export markets due to a rise in labour costs since the 1980s and the rapid development of China. Rising labour costs have driven the relocation of a significant share of production from Taiwan to China and Southeast Asia. Since the official clearance of investment to China

in 1991, Taiwan has been playing an important role in the Chinese economy. Taiwan started investing in China indirectly through Hong Kong in the 1980s and accelerated the pace directly from the 1990s.

Both Japan and Taiwan, which have developed high skill and technology based industries, have expanded production in China and transferred their skills and technology in the process, with important ramifications for the international division of labour of firms in China vis-à-vis Japan and Taiwan. This raises an important question about how local firms in China have responded to such stimuli from Japan and Taiwan. It is arising from such a question that this paper seeks to examine the position of national firms in China vis-à-vis firms in Japan and Taiwan in the international division of labour involving automotive parts, and die and mould value chains.

Li and Sadoi (2008) had examined the technical division of labour among Taiwanese automotive parts producers in China using a company survey of 72 firms earlier (Li and Sadoi, 2008). The evidence showed that the technical and international division of labour among Taiwanese supplier-linked Chinese automotive assemblers was one where the Taiwanese firms in China were heavily dependent on technology from Japan that was fused with Taiwanese conventional body parts technology to meet Chinese and Taiwanese joint-venture assembly demands.

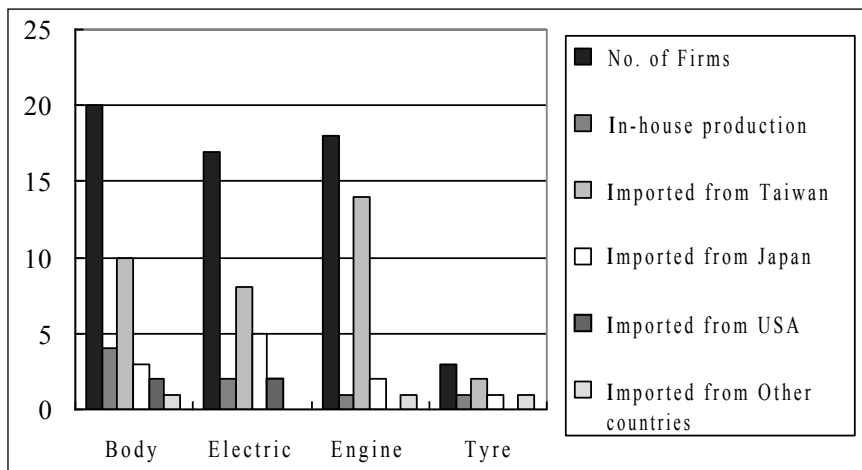
Die and mould making requires high levels of skill and knowledge and is largely used for making parts in the automotive, electronics and other high-tech industries. The proliferation of precision engineering in machine tool manufacturing has led to major changes in the demand for skilled workers at the intermediate precision level. In addition, sub-micron precision parts have forced the replacement of skilled workers with machines (see Rasiah, 1988). Although manufacturing is becoming easier than ever due to advances in computer technology, some dies and moulds for special high-precision parts still require human skills where computer-controlled technology cannot be substituted.

This paper, thus, seeks to use the theory of technology transfer drawn largely from the technological capability framework, to examine possible movement of Taiwanese supplier firms engaged in part, and die and mould manufacturing in the division of labour with firms in Japan and Taiwan. In doing so, a comparison is made between the 2010 survey with the surveys conducted in 2005 and 2006.

3. International Division of Labour in Automotive Parts

Rising labour costs and bilateral policies have driven the relocation of automotive parts production from Taiwan to China. Li and Sadoi (2008) showed the production location of key parts and non-key parts of the Taiwanese

Figure 1: Key Parts Procurement by Taiwanese Suppliers in China



Note: 48 firms had multiple answers.

Source: Li and Sadoi (2008).

automobile parts manufacturers in China. The Taiwanese auto parts firms in China had in the past imported their key parts from abroad. Figure 1 shows the number of firms and the procurement source of the key parts' sources of Taiwanese suppliers in China. The data is based on the number of firms who answered "yes" to the question if they imported key parts from abroad. Forty eight firms provided multiple answers to the question of input source of key parts used in production, out of a total of 60 firms using multiple answers.

In the case of body parts, exactly 20 per cent (4 out of 20) of the Taiwanese firms in China produced their key parts in-house (see Figure 1). The percentage is the highest among all categories of parts firms' researched. Taiwan still remained the main sourcing target for key body parts with 50 per cent (10 out of 20), with Japan accounting for 15 per cent (3 out of 20).

In the case of electric and electronics parts, the share of in-house production is slightly lower than that of automotive body parts firms (2 out of 17). About 47 per cent (8 out of 17) of electric parts firms purchase their key parts from their mother companies in Taiwan. It is noteworthy that nearly 30 per cent (5 out of 17) of those firms import their key parts from Japan, which is nearly two times higher than that of the body parts firms and three times higher than that of engine parts firms. The five firms are engaged in the production of motors, distributors, air-conditioner assemblies, centre door locks, and lamps. Three out of the five enjoyed joint venture operations with Japanese capital.

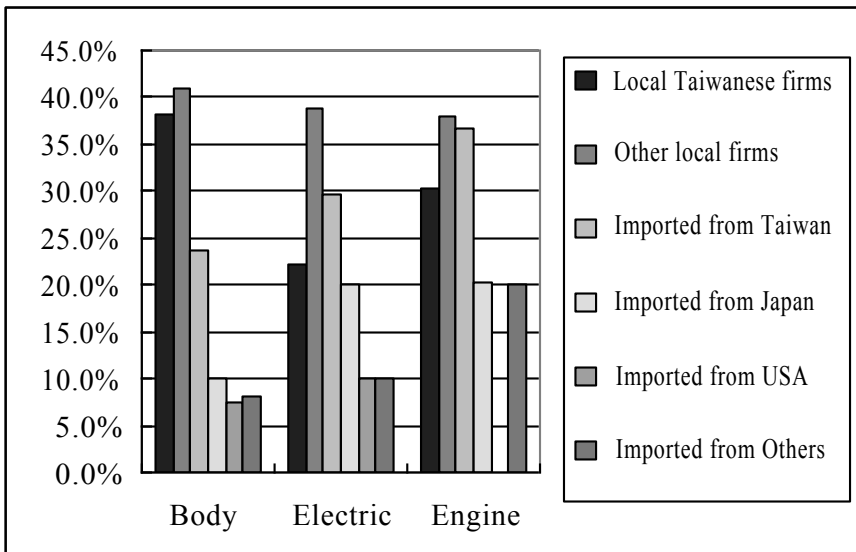
In the case of engine parts, only one of the engine parts firms produced key parts in-house. Nearly 80 per cent of engine parts firms imported their key

parts from Taiwan. However, the number of engine parts firms who import their key parts from Japan is low. Only 11 per cent (2 out of 18) imported key parts from Japan. For example, firms producing major engine and control parts such as crankshafts, connecting rods, and brake cylinders are solely Taiwanese firms, though they receive technological support and enjoy imports of non-key parts from Japan.

Consistent with our findings, the Industrial Technology Intelligence Service, Taiwan (2000) reported that the key parts are mostly produced and controlled by firms in Taiwan. We found that the share of in-house production of the key parts is 10 per cent or lower depending on the parts categories. Even in the highest categories, the share reached only 20 per cent, demonstrating that key parts are sourced primarily from Taiwan. Overall, the average in-house production of key parts is around 13 per cent, which is less than the 18 per cent imported from Japan. The share of imports from Taiwan is 57 per cent.

In contrast, in the case of non-key parts, most of the Taiwanese auto parts firms in China purchased parts and materials from the three channels, viz., local Taiwanese firms, other local firms, and imports from Taiwan. While most of the firms import parts from Taiwan, it is noteworthy that in all body, electric, and engine firms, about half of them import parts from Japan. It is slightly higher in the electric firms, but all the categories show the same trend (Li and Sadoi, 2008).

Figure 2: Average Share of Parts Procurement Sources, 2006



Source: Li and Sadoi (2008).

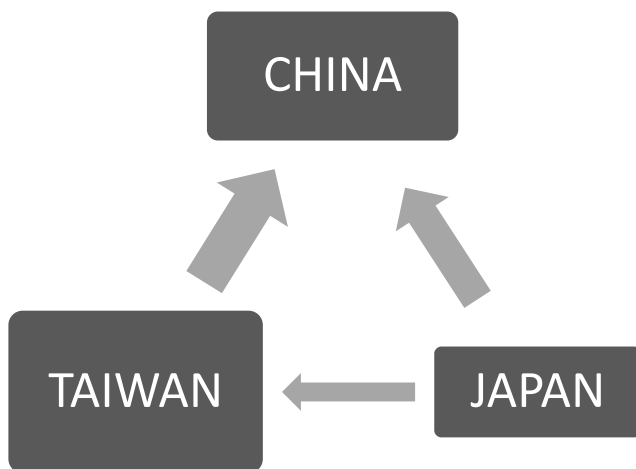
In order to look at the relative importance of these sources, firms were asked the share of sourcing from each of the locations. Figure 2 shows the average share of procurement of each firm. The average was calculated only for companies that indicated their procurement sources as percentages. Firms procuring parts are from more than one source, with the total percentage for each set of firms adding up to more than 100 per cent. On average, body parts firms purchased about 38 per cent of their parts from local Taiwanese firms. About 41 per cent of their procurement came from local firms other than Taiwanese. Twenty three per cent of them were imported from Taiwan, while ten per cent or less was imported from Japan, the United States, and other countries.

In the case of electric parts firms, purchasing from local firms other than Taiwanese accounted for nearly 40 per cent of the total, which is the highest source among all, which shows that the majority of electric and electronic parts were locally produced.

Engine parts firms show a slightly different trend. Firstly, imported parts dominated parts inputs. Secondly, the highest imports came from Taiwan. On average, 37 per cent of the total purchase per firm came as imports from Taiwan. Japan contributed 20 per cent of total purchase per firm, which is similar to that of electric parts firms (see Figure 3).

Li and Sadoi (2008) also pointed out that one characteristic feature of Taiwanese activities in China was that there is no Taiwan parts suppliers with R&D centres in their Chinese subsidiaries. Table 1 shows the division of labour between China, Taiwan, and Japan by R&D, production technology,

Figure 3: Engine Parts Procurement of Taiwanese Parts Suppliers in China



Source: Author.

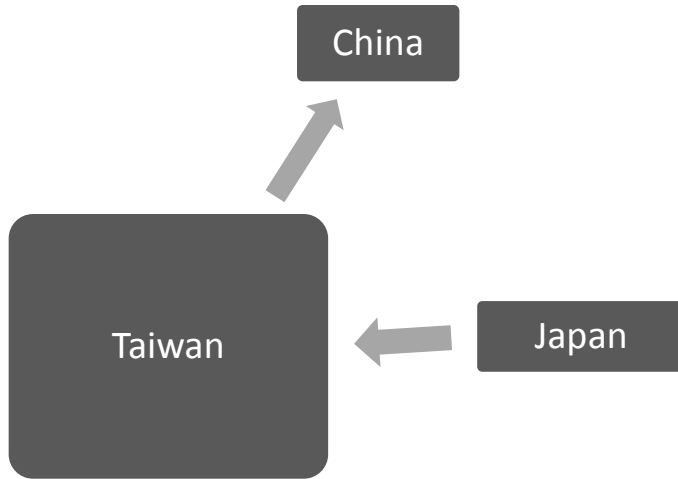
Table 1: Division of Labour in China, Taiwan, and Japan, 2006

		Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	
	Parts	Seat	Piston Ring	Cylinder Block	Wire Harness	Key Parts	Tyre	
	Advanced Development	T	T	T	T	C	T	
	Specification Planning	T	C	T	T	C	T	
	Designing	T	J	T	T	C	T	
	Prototype	T	J	T	T	C	T	
	Evaluation	T·J	C	T	T	C	T	
	Process Planning	C	C	C	T·C	C	T·C	
	Process Designing	C	C	C	T·C	C	T·C	
	Production Preparing	C	C	C	T·C	C	T·C	
	Production Equipment	T·C	T·J	T·C	J·T	T·C	T	
	Production	C	C	C	C	C	C	
		R&D			Production Technology			Production

Note: T·C indicated in Production Technology means that China cannot operate alone.

Source: Li and Sadoi (2008: 132).

Figure 4: International Division of Labour in Key Parts R&D, 2010



Source: Author.

and production processes. With respect to R&D involving parts, and especially the key parts, it is confined (with the exception of Firm E) to operations in Taiwan (see Figure 4).

In short, the evidence presented shows that the international division of labour of Taiwanese automobile parts manufacturers in China is mirrored in Figures 3 and 4. High value added activities – including R&D – are still sourced from Taiwan and Japan. Viewed through Lall's (2001) lenses, Taiwan still remains the prime source of high tech imports by these suppliers, though local supplies have increased in importance since the 2006 survey. Imports from Taiwan still account for the high value added activities that produce the key parts.

4. International Division of Labour in Dies and Moulds

This section analyzes changes in the international division of labour in dies and moulds from a survey of firms in Kunshan China, conducted in March and April 2010. Taiwanese suppliers in Kunshan are examined against the locations from where inputs are sourced.

Kunshan is located about 50 km west of Shanghai and constitutes one of the biggest and most successful high-tech industrial districts in China. In Kunshan, Taiwanese investments play an important role in automotive supply activities. Kunshan developed rapidly after the year 2000 and forms one of the most successful and highest developing industrial districts in China. One of the leading EMS firms, Foxconn, is located there.

To meet high quality and productivity requirements of high-precision production, die and mould technology is very important. There are many die and mould firms supplying high-tech industries in Kunshan area. Of around 4,000 Taiwanese firms in China, about 2,000 of them are located in Kunshan.

Plant managers at the mould firm C&C Industrial Co. Ltd. (C&C) both in China and in Taiwan head office, were interviewed by the author in March and April 2010. Following its establishment in 1987, C&C grew rapidly alongside the electronics boom in Taiwan. Like other international Taiwanese investors, C&C started operations in China in 1996 to access higher scale operations and to use its large reserves of labour. Owned 100 per cent by Taiwan capital, C&C developed as a designer and manufacturer of precision tools in the Greater China area.

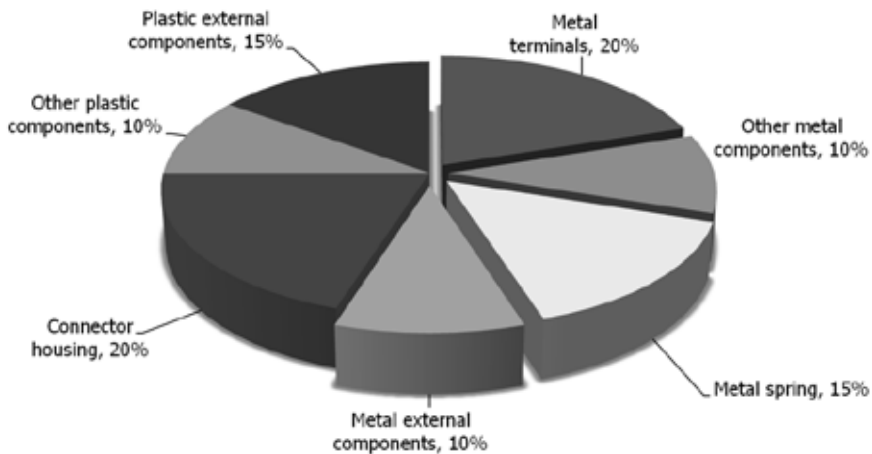
C&C currently has four major operation facilities in China, offering machining, precision grinding, profile grinding, jig grinding, and designing and fabrication of moulds and dies. End applications for C&C products have expanded to cover tooling for components for desktops and notebooks, digital cameras, mobile phones, auto-, aviation- and marine- electronics, 3C connectors and waterproof outdoor connectors. C&C's services cover the greater part of China, with its four major facilities located in Kunshan, Tianjin, Dongguan and Zhuhai to serve markets in the eastern, northern and southern parts of China. C&C's monthly production capacity reached 250-300 sets of tools in 2010, including moulds and dies, which was achieved through the installation of state-of-the-art equipment from Mikron, Hass, DMG, Sodick, AgieCharmilles, Waida and Mitsubishi.

The company has obtained ISO certifications for its production facilities and at the time of the interviews, it was in the process of upgrading its management information systems, material requirements planning (MRP) and enterprise resource planning (ERP), to strengthen its internal auditing and control systems. It has appointed Deloitte and Touche as auditor and financial adviser to enhance its financial transparency, and Yuanta Securities as financial adviser to underwrite its initial public offering.

C&C Industrial established a wholly owned Taiwanese subsidiary in Kunshan in October 2000 with the approval of the Kunshan Foreign Trade and Economic Relations Commission. It is located in the High-Tech Industrial Park of Kunshan with a total investment of US\$4.2 million, and specializes in manufacturing and processing a variety of precision dies and moulds, such as continuous punching dies like terminals and metal spring leaves, plastic moulds, CNC wire cut machining, grinding machining, electric discharge machining, whole-set mould design, fabrication and development.¹

As pressures on quality rose, C&C Kunshan obtained the TUV ISO9000 Quality Management System Certification in 2002. As business grew, C&C Kunshan expanded its site area to 14,800 square metres of land, with an area

Figure 5: Production Share of Dies and Moulds, C&C Corporation, 2010



Source: C&C Corporation.

of 7,000 square metres for the first phase, and 5,500 for the second phase for the new plant. The new plant enjoyed modern manufacturing machinery and equipment.

C&C produces die and moulds for various metal and plastic products. The moulds for metals accounted for 55 per cent and dies for plastics accounted for 45 per cent of production in 2010 (see Figure 5). The metal moulds comprised 20 per cent of moulds for metal terminals, 10 per cent for other metal components, 15 per cent for metal springs, and 10 per cent for external metal components. The breakdown for plastic moulds consisted of 15 per cent for use in plastic external components, 10 per cent for plastic components, and 20 per cent for housing connectors.

C&C Kunshan is the largest and the most profitable operation in the C&C Group. Maximum capacity could reach 130 sets of dies/moulds per month but with a normal average of about 90 sets per month. About 70 per cent of the sales of this plant come from whole set moulds and dies fabrication, and 30 per cent from machining. C&C Kunshan employed 382 employees in 2010, comprising 325 engineers, 17 quality control personnel, 17 sales staff, and 23 administrative staff.

5. The Taiwanese Die and Mould Industry in China

The technological division of labour can also be analyzed into the following two points in die and mould production. In the first, it will help to identify the country in which the machine tools used for manufacturing die and moulds are

produced. Machine tools play an important role in the quality and productivity of products. In the second, it will help to identify the customers. The share of participation of the Taiwanese, Chinese, and Japanese firms responding to the above two questions will reflect the international division of labour.

The majority of the machine tools used by the Taiwanese suppliers in China are imported from Japan. Table 2 shows the list of major machine tools used for making dies and moulds in the supplier firms. The bulk of the major machine tools are imported from Japan, but some are imported from Germany and the United States. It is noteworthy that in the major machine tools, there are no Taiwanese and Chinese machine tools used in the supplier firms. Only the conventional machine tools used in the supplier firms are imported from Taiwan or bought from firms in China.

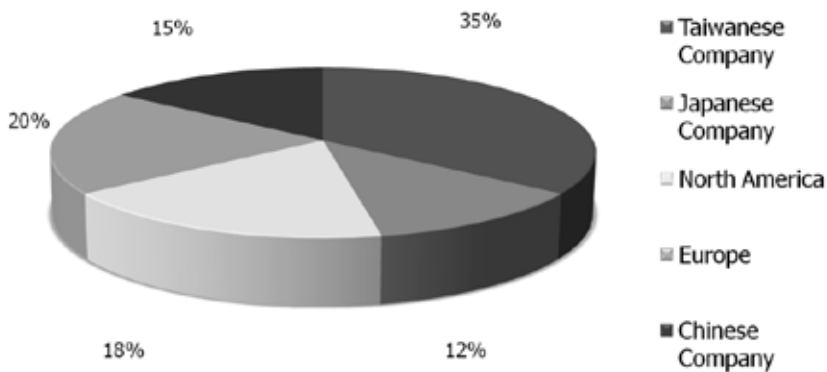
Table 2: List of Machine Tools used for making Die and Mould, 2010

<p>Wire-cutting machine 57units Sodick oil-cutting machine (Japan) Tolerance$\leq\pm 0.002\text{mm}$ Sodick wire-cutting machine (Japan) Tolerance$\leq\pm 0.003\text{mm}$ Mitsubishi wire-cutting machine (Japan) Tolerance$\leq\pm 0.003\text{mm}$</p>
<p>CNC Highspeed-milling machine 17units Mikron (Germany) Tolerance$\leq\pm 0.01\text{mm}$ Speed:more than 40'000 min-1 Deckel (Germany) Tolerance$\leq\pm 0.01\text{mm}$ Speed:more than 30'000 min-1 Haas (USA) Tolerance$\leq\pm 0.01\text{mm}$ Speed:more than 8'000 min-1</p>
<p>EDM 58units Charmilles (Switzerland) Tolerance$\leq\pm 0.005\text{mm}$ Mitsubishi (Japan) Tolerance$\leq\pm 0.005\text{mm}$</p>
<p>Profile Grinding Machine 2units Waida (Japan) Tolerance$\leq\pm 0.002\text{mm}$</p>

Source: C&C Corporation.

Figure 6 shows the share of the customers sourcing dies and moulds. About 35 per cent (the largest group) of the customers are Taiwanese firms. The majority of those Taiwanese firms are Taiwanese EMS firms operating in China. Many of them are international EMS firms using it for manufacturing mobile phones, auto electronics, personal computers, notebooks and other electronic products and components. European firms accounted for about 20 per cent of the purchasers, while another 18 per cent are purchased by North American firms. Chinese and Japanese firms bought around 15 per cent and 12 per cent respectively. Those numbers included Chinese subsidiaries of foreign multinationals. Within the Kunshan area, C&C's customers were 30 per cent Taiwanese firms in China, 30 per cent Japanese firms in China, 30 per cent foreign firms in China and 10 per cent Chinese national firms.

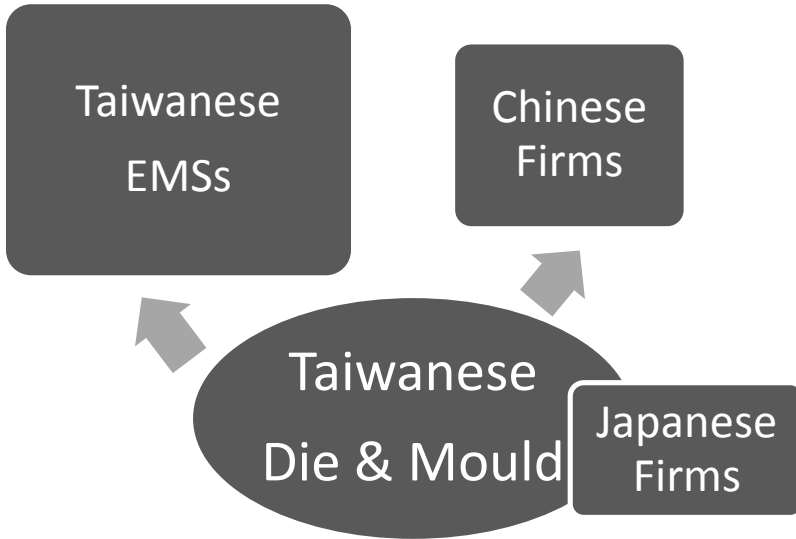
Figure 6: Customer Breakdown, C&C, 2010



Source: C&C Corporation.

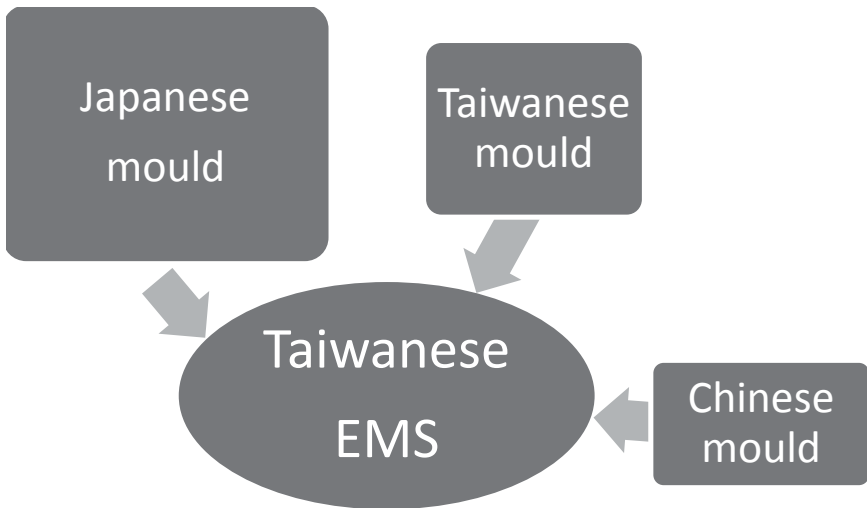
Figure 7 shows Taiwanese die and mould firms and their customers in the international division of labour between China, Taiwan and Japan. For the Taiwanese die and mould industry, Taiwanese EMS firms in China play a critical role, while Japanese firms play a minor role. However, viewed from the technological level of die and moulds, Japan's role in the international division of labour is still important (see Figure 8). For example, C&C Kunshan's vice president is a Japanese, who was hired following his retirement from Sodiec in Taiwan. He reported that about 10 of the 100 die and mould firms in Kunshan are Japanese controlled. He noted that the Japanese firms enjoyed the highest technology, followed by the Taiwanese firms whose technology he regarded as at the intermediate level. Although Chinese firms are increasingly entering the die and mould market, he considered their technology as still of low end. Nevertheless, he predicted that the Chinese firms will quickly catch up with the Taiwanese firms.

Figure 7: Taiwanese Die and Mould Firms and Customers, 2010



Source: Author.

Figure 8: Technological Level of Die and Mould Firms using EMS, China, 2010



Source: Author.

The price of the Taiwanese dies and moulds is about 30-40 per cent lower than that of the Japanese. The strong point of Taiwanese firms is their ability to speed up production quickly in order to achieve short delivery times. C&C Kunshan installed high performance machinery using mainly Japanese parts to meet the quickening of delivery times.

Chinese die and mould firms are also catching up in the technological ladder of dies and moulds. Japan's *Nikkei Business Daily*, 27 March 2010: 1 reported that a Chinese car and battery maker BYD Co Ltd. will buy a plant from a major Japanese metal die manufacturer to enhance its competitive edge in auto production. BYD will take over Ogihara Corporation's factory in Tatebayashi, Gunma Prefecture, which is located about 70 km (43 miles) north of Tokyo, to manufacture high-precision metal dies for use in its Chinese factories.

According to *Nikkei Business Daily*, 24 September 2010: 2, the above plan is to help BYD narrow its technical gap with Japanese and Western rivals as the higher-precision dies would improve the quality of auto bodies and other products. Boosted by rapid demand, which helped China overtake the United States to become the world's largest car market in 2009, BYD plans to take advantage of it to raise capital expenditure by 58 per cent in 2010 as it embarks on an aggressive expansion plan. The Hong Kong-listed firm's vehicle business is its strongest-performing segment, accounting for more than half of its revenue in 2009.

6. Conclusions

This paper aimed to examine the international division of labour in automotive parts, and dies and moulds production between Taiwanese firms in China, and firms in Japan and Taiwan based on interviews carried out in 2010. The results show some upgrading in the Taiwanese suppliers in Kunshan compared to earlier work carried out in 2006 (see Li and Sadoi, 2008).

The main findings from the 2010 interviews are: one, Taiwanese automotive parts suppliers have accumulated advanced technologies from Japan through technology collaboration and expenditure on capital equipment years as they sought upgrading to compete better; two, the Chinese subsidiaries receive direct and indirect technology transfer from Taiwan and Japan with the former supplying conventional technology and the latter providing advanced technology; three, few Taiwan parts suppliers set up R&D centres in China; and four, the catching up speed of Chinese firms in China has accelerated significantly owing to intense competition from firms in Japan and Taiwan. The division of labour of automotive parts, and dies and moulds appear to show firms in Japan enjoying cutting edge technology, in Taiwan intermediate technology while those in China, low end technology.

Nevertheless, the evidence shows that the division of labour for automotive parts, and dies and moulds firms between Japan, Taiwan and China has narrowed. In fact, interviews show that Chinese firms are fast closing the gap with Taiwanese firms. Following the establishment of China as the world's largest automobile market in 2009, the progression of suppliers located in China in the technology ladder is all the more likely to happen fairly soon.

Note

1. Author's interview on 24 March 2010.

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