Inter-firm Networks and Industrial Development in the Global Manufacturing System: Lessons from Taiwan

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Abstract

The link between inter-firm networks and industrial development in Taiwan has rarely been conspicuously identified in the extant literature. This paper highlights the existence of such a link, first in the labour-intensive phase of industrialisation from early 1960s to late 1970s, and then in the current phase of technology-intensive industrial development in Taiwan. However, established forms of inter-firm networks within and across the Taiwanese border have structural limitations to generate innovation from within the networks. This impedes further development of Taiwan's industries, in particular those which are more technology-intensive. Using the information technology industry as a case study, this paper examines the role of the state and the private businesses in fostering the formation of newer forms of inter-firm networks which contribute to Taiwan's further industrial development.

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Introduction

The extant literature examining inter-firm networks and industrial development in Taiwan tackles different research questions. Literature studying business groups (BGs) (Hamilton and Kao, 1990, Whitley, 1992, Numazaki, 1992) subcontracting networks (SNs) (Shieh, 1992, Poon1996) and cooperative networks (CNs) (Chen, 1994) attempts to understand how and why economic activities are organised in Taiwan. By contrast, the neoclassical approach (Little, 1981; Balassa, 1988), modernisation theory (Hobday, 1995), statist perspective (Deyo, 1987, Wade, 1990a), dependency development theory (Gold, 1986; Shieh, 1992) and world system approach (Cummings, 1984; So and Chiu, 1995) seek to identify the reasons behind Taiwan's post-war economic 'miracle'. In other words, the latter theories try to find out why the levels and kinds of economic development take place in Taiwan. Asking different research questions, the two strands of literature seldom cross one another's path. They somehow complement each other nicely upon close examination. Reasons accounting for the emergence of various types of inter-firm networks in Taiwan also explain the phenomenal economic growth of the country. In fact, the existence and operation of inter-firm networks in Taiwan are found to foster industrial development in different ways.

In the sections which follow, the link between inter-firm networks and industrial development in Taiwan will first be identified. These networks are, however, increasingly faced with structural limitations to facilitate further industrial development of Taiwan, beyond the labour-intensive phase of industrialisation. In the current state of industrial development, Taiwanese manufacturers are involved more in a global manufacturing system where a finished commodity travels through the processes of production, marketing and distribution scattered in a number of countries before reaching the end-consumers. Further industrial upgrading demands a move of Taiwanese manufacturers from engaging in the lower value-added to the higher value-added segments along the commodity chains. By examining the case of the information technology (IT) industry, it is found that both the state and the private businesses are actively fostering the formation of newer forms of inter-firm networks to facilitate the move to those segments of the global commodity chains encompassing a higher proportion of profits.

The Contribution of Inter-firm Networks to Industrial Development in Taiwan

Organisational theorists interested to understand how and why economic activities are organised in a particular way highlight three types of inter-firm networks in Taiwan. They are the BGs, SNs and CNs. BGs comprise looselycoupled independent firms with the objective of furthering economic interests of the group. These groups are normally controlled by a single family or by several individuals in limited partnership. Although operating very much independently with each other, firms within a group have a relationship characterised by trust, loyalty and predictability (Orru, Biggart and Hamilton, 1991: 384).

Another form of inter-firm network is SNs which comprise networks of independent production units vertically relating to each other to manufacture a finished product. Receiving production orders from domestic trading companies or overseas buyers, local factories subcontract work to SMEs that is beyond their present capacity to absorb or that requires the use of specialised equipment. These small- and medium-sized enterprises (SMES) may in turn put out work to the homeworkers (Shieh, 1992: 59-64; Poon, 1996). SNs operate to minimise production costs and maximise manufacturing flexibility.

Four types of CNs are discussed in the literature (Chen, 1994: 24-27). The first one is called 'internalised subcontracting network' in which subcontractor works with their own equipment and machineries in the contractors' factory premises using raw materials provided by the latter. The second type is called 'externalised subcontracting network'. This type of network differs from the first in that raw materials are processed by the subcontractors into semi-finished products in their own rather than the contractors' premises. Semi-finished goods will then be assembled into final products by the contractors. The third type of CN is the 'horizontal cooperative production network' in which firms cooperate with one another on a complimentary basis to obtain, for instance, special components or perform specific kinds of processing service. Finally, 'horizontal production and marketing cooperative network' emerges when firm A receives an order beyond its capacity to absorb and hence transfers part of the order to firm B. Firm B will cooperate with firm A in similar situations. In the CNs, cooperation between firms of various sizes increases production capacity, upgrade manufacturing capability and maximise the use of human, financial and technological resources (Chen, 1994: 27-36).

There are cultural and social reasons explaining why and how these different kinds of inter-firm networks emerge in Taiwan. BGs are seen as

emerging out of the particular Taiwanese institutional context which supports the growth of patrilineal networks built around family ties. The Chinese system of equal inheritance for all sons and the ease in pooling together financial and human resources in the extended family contribute to the fragmentation of family holdings. This trend is further sustained by the readiness of the business groups to establish new firms (Orru, Biggart and Hamilton, 1991: 385). SNs are developed to satisfy the career advancement aspirations of employees working in local firms. Opportunities for climbing up the career ladder is often blocked by the paternalistic style of management. The lack of security in wage employment and the absence of a comprehensive social welfare system in Taiwan further aggravate the adverse terms of employment. By starting their business as subcontractors in various layers of the SNs, employees will then become their own boss rather than working unwillingly for others (Shieh, 1992: 180-189; Whitley, 1991: 15). Firms participated in CNs because of the familistic and ethnic ties between the owner-operators. The way that economic activities are carried out and financial resources managed by various kinds of CNs is socially embedded in the structure of society (Chen, 1994: 189-248).[11]

The formation of BGs, SNs and CNs can also be explained by institutional factors. The lack of direct state intervention to develop selected firms in chosen sectors enable Taiwanese entrepreneurs to run business groups freely in the less capital-intensive industries (Orru, Biggart and Hamilton, 1991: 385; Whitley, 1992: 154). With the labour movement controlled by the state, BGs and their group of subcontractors flourish in an environment relatively free of workers' unrest (Whitley, 1992: 156). Although the state imposes tight control on politics, firms in SNs and CNs cooperate with one another in a context of 'state permissiveness' so long as the legitimacy of the government is respected (Chen, 1994: 249-318).

Occasionally factors present at the international level, such as the existence of structural opportunities in global manufacturing for low-cost flexible production, is drawn into explaining why specific kinds of inter-firm networks developed in Taiwan. Subcontracting systems are seen to be developed as a result of Taiwanese manufacturers exploiting the structural opportunities in the global production system. Opportunities are provided by sourcing agents of large retailers and multinationals in the advanced industrialised countries, searching for cheaper production sites to manufacture labour-intensive consumer goods. Subcontractors are used by Taiwanese manufacturers in the production process to meet the demands of fluctuating quantity, close deadlines and to quickly cope with changes in basic product design (Shieh, 1992: 61-64; Poon, 1996).

For theorists interested to find out why the levels and kinds of economic development take place in Taiwan, their explanations come from different perspectives and disciplinary focuses. The neo-classical economic approach emphasises the importance of exploiting comparative advantage based on free trade and markets (Little, 1979, 1981; Hughes, 1993). Modernisation theorists highlight the role of economic learning from advanced foreign firms by latecomer local private businesses through different kinds of cross-border networks such as joint ventures and licensing agreements (Hobday, 1995). Statists advocate the saliency of 'developmental state' in formulating and implementing strategic industrial policy to create competitive advantage (Deyo, 1987; Wade, 1990a, 1990b; Appelbaum and Henderson, 1992). Theorists supporting a dependent development approach interpret Taiwan's development as depending on its links with advanced industrialised countries through aid, investment, and trade (Cold, 1986, 1988). Finally, world system theorists see the operation of global dynamics as privotal to influence the development of Taiwan first as a peripheral and then later as a semi-peripheral country (Cumings, 1984, So and Chiu, 1995).

Despite having different disciplinary focuses, the theoretical perspectives discussed examining Taiwan's industrial development are underlined by one common theme. To put it simply: Taiwan could hardly experience any post-war economic 'miracle' if not for technology transfer and diffusion through various kinds of cross-border networks. For neo-classical economists, Taiwanese manufacturers derive dynamic benefits through learning by doing, technological acquisition and productivity growth. By pursuing comparative advantage, there is a continuous transfer of knowledge in production engineering, process and product innovations from investors and purchasers abroad to Taiwanese manufacturers (Pack, 1992: 88). From a modernisaton perspective, Hobday (1995) captures well how local Taiwanese companies make use of various kinds of networks to acquire and improve upon technology. Through the information networks with foreign and local buyers, original equipment manufacture (OEM), original design and manufacture (ODM), licensing arrangements and joint ventures, local manufacturers gradually develop and upgrade their technological capabilities from simple assembly skills to process and even product innovation.

Apart from cross-border networks, the 'economic miracle' in Taiwan has also been brought about by production flexibility through the operation of BGs, SNs and CNs. The highly adaptable and flexible nature of BGs enable Taiwanese manufacturers to adjust readily to the changing demands of consumer goods in the international market, by shifting quickly from producing one commodity to other (Hamilton and Kao, 1990: 149; Orru,

Biggart and Hamilton, 1991: 385-386). Most Taiwanese manufacturers are therefore dominant producers of an extensive range of medium- to high-quality consumer goods, requiring very little research and development. (Hamilton and Biggart, 1988: S85). The operation of SNs allows Taiwanese manufacturers to pursue a flexible-niche strategy to compete by focussing on market segments. This strategy concentrates on short product cycles, quick product delivery schedules, short production runs, and mixes of products aimed at particular market niches (Biggs and Levy, 1991: 380). The dispersed but yet strong SMEs are woven into CNs which are highly adaptable as they can modify swiftly the styles of the products or shift quickly to manufacture new products, adjusting to the demands of external markets (Chen, 1994: 37).

The technology of the SMEs forming into SNs and CNs is upgraded by the intensification of labour in the production process. In other words, technology is developed out of investing into labour-power rather than by capital and out of production experience rather than professional technological expertise. Through continuous learning by doing, imitating and exploring, manufacturers can quantitatively increase production capability and also qualitatively improve and upgrade manufacturing technologies and processes. As many workers set up their own workshops after they have accumulated enough experience, technology is therefore transferred from one enterprise to another. The whole process of upgrading this kind of 'experience-oriented technology' hence repeats itself (Chen, 1995: Ch.4, 1-24).

Flexible, speedy and low-cost production offered by BGs, SNs and CNs attracts foreign investment and overseas orders in the form of OEM linkages, joint ventures and licensing agreements. These linkages, in turn, provide the necessary channels through which Taiwanese firms learn and assimilate technology from foreign multinationals and overseas buyers. In fact, the prevalence of OEM linkages, joint ventures between Taiwanese and foreign firms induce the development of more effective inter-firm networks within the border. Conversely, the effectiveness of firm networks within Taiwan reinforces the development of cross-border networks. It is through the interaction between firm networks operated within national boundary and across the border which contributes to industrial development in Taiwan.

The existence and operation of these different kinds of firm networks would have been meaningless without the existence of structural opportunities for low-cost and flexible manufacturing. This premise underlies the global level of analysis adopted by both the world system perspective and

the dependency development approach. In the former perspective, it was argued that the Taiwanese manufacturers capitalised on the opportunities for low-cost and flexible production which emerged at a time when there was fierce competition among multinationals and growing working class demands in the advanced industrialised countries. To survive and to make profits, numerous multinationals and buying groups of large retail chains in the core countries searched for low-cost manufacturing in peripheral economies such as Taiwan. In the latter approach, it was pointed out that a plentiful supply of cheap labour had drawn Taiwan into the global production system, churning out labour-intensive goods for export to advanced capitalist countries. Such participation, however, occurred within a structural dependant framework whereby development of Taiwan's manufacturing industries relied very much on orders from foreign capital to produce labour-intensive consumer goods for overseas markets.

Alternatively, proponents of both the neo-classical economic perspective and statism pitch their analyses of Taiwan's industrial development at the national level. Economic exchange between Taiwanese manufacturers and foreign companies was interpreted by neo-classical economists as the outcome of enterprises operating under national free trade regimes by capitalising on their comparative advantage. Private businesses in Taiwan chose to produce commodities that were comparatively cheaper at home in exchange for other commodities that were relatively more expensive to produce. The statists, by contrast, were of the view that industrial development of Taiwan occurred as a result of strategic industrial policies formulated and implemented by the state bureaucracy in Taiwan, fostering the competitiveness of selective domestic industries by exposing them to international pressures. Finally, modernisation theorists drew one's attention to the role played by organisational factors in accounting for Taiwan's industrial growth. Economic learning and development took place as a result of technology transfer from advanced foreign firms to local Taiwanese businesses through cross-border networks such as joint ventures and licensing agreements.

In sum, embedded in various theoretical perspectives attempting to account for Taiwan's industrial growth is the message that inter-firm networks formed within and across the Taiwanese border contribute to such a process. Although aiming to answer different research questions, literature examining inter-firm networks and industrial development in Taiwan comes nicely together. Reasons explaining the formation of inter-firm networks can also account for the phenomenal economic growth in Taiwan. The reverse holds as well. In fact, it depends on how far theorists interested

in inter-firm networks want to go. Reasons offered to explain the formation and operation of firm networks in Taiwan range from cultural and social factors at the local level, through institutional factors at the national level and finally to the impact of global dynamics at the international level. Conversely, theorists eager to explain dynamic industrial development in Taiwan search from top down for their answers at the international, national, local and organisational levels. The thorny issue for these theorists is which level of analysis is most appropriate to adopt in examining industrial development in Taiwan?

The Current State of Industrial Development of Taiwan: A Global Commodity Chains Analysis

Notwithstanding the contribution made by various theoretical perspectives discussed to identify either explicitly or implicitly the link between inter-firm networks and industrial development in Taiwan, it is suggested in this paper that the Global Commodity Chain (GCC) perspective is more useful in conducting such an analysis. By examining how industries are organised globally through networks of firms and how countries are developed through engaging in different functions to produce and market a finished commodity, the GCC perspective naturally brings the subject matter of inter-firm networks and industrial development together. While pitching its analysis at the global level, the GCC perspective is able to accommodate comfortably in its theoretical framework the impact of national and local diversities on industrial development because the industrial sector rather than the state or the organisation is the unit to be analysed.

A central concept in the GCC analysis is the 'commodity chain'. A commodity chain, as defined by Hopkins and Wallerstein (1986:159), is 'a network of labour and production processes whose end result is a finished commodity'. Moving backward from the end of the commodity chain, one will start from the final production process of a consumable good until the raw material input stage is reached. Gereffi and Korzeniewicz (1990: 50) later extend the concept of the commodity chain to include the forward as well as the backward linkages from the production stage. In other words, a typical product travels through a number of functional stages along the commodity chain from raw material supply, production, exporting, marketing and sales until it reaches the hands of the final consumers.

Production and distribution of a commodity is now neither contained within a regional district nor a single country. Functions such as raw material supply as well as production, marketing and distribution of com-

modities are geographically scattered in various advanced industrialised and developing countries (Gereffi, 1989: 97-100; Dicken, 1992: 3-5). Networks of firms, formed within and across various countries, coordinated with one another in specific manners to produce and distribute different commodities. Hence the commodity chains are global rather than local, linking firms in different countries together.

A GCC comprises both core and peripheral activities at any point in time. Core activities are those that command a large share of profit produced within a commodity chain while peripheral activities are those that command little or no such profit. How much profit is located in which segment of the commodity chain is conditioned by several factors. They are the components or sub-assemblies of the commodity in question, the locations of the production process, the forms of labour force, the technology used and the scale and types of capital as well as the production units involved. The role of the state is also important in assisting various economic agents in the country to carve out from the commodity chain a higher proportion of profit (Gereffi and Korzeniewicz, 1990:55; Appelbaum and Gereffi, 1994:45,47).

Developing countries participate in the global manufacturing system by inserting into different segments of the GCCs. The development of a country depends on its capability to upgrade the mix of core-peripheral activities (Gereffi and Korzeniewicz, 1990). In order to advance in the world economy, countries strive to play a major role in those segments of commodity chains with the highest ratio of core to peripheral activities, that is, where the profit is the greatest (Gereffi and Korzeniewicz, 1990: 48-54). Countries improve their position in the international economy by moving to high-value (most profitable) rather than high-volume economic activities (Gereffi, 1994: 225).

Gereffi (1994: 222-224) identifies five types of export roles in the GCCs to which firms in the developing countries can hook up. These export roles reflect different mixes of core-peripheral economic activities. They are:

- The primary commodity export role, where the predominant proportion of exports is primary commodities.
- The export-processing role, in which the labour-intensive assembly of manufactured goods is carried out in subsidiaries of foreign-owned multinationals in the export processing zones.
- The component-supplier role, in which component-parts of the products in the technology- and capital-intensive industries are manufactured by local subcontractors for export and final assembly in the developed countries.

- The original equipment manufacturer (OEM) role, in which finished consumer goods, made to specification, are produced by local sub-contractors for distribution by large trading companies, retail chains or their agents. This process is also known as contract manufacturing (or specification contracting).
- The original brandname manufacturer (OBM) role, in which local firms export and distribute products bearing the proprietary brand-names through the retail networks of the developed countries.

Taiwan has long been inserted in the GCCs by playing the OEM role. During its export-oriented period of industrialisation from early 1960s to late 1970s, Taiwan's economic growth is very much fostered by being an OEM, producing at low costs, finished commodities ordered by large buying groups of multinationals and retailers in the advanced industrialised countries such as the U.S. and Japan. In other words, many Taiwanese manufacturers are engaged in the manufacturing segment of various GCCs, producing commodities such as textiles, garments, electronics and plastics industries for export. Manufacturing is, in most cases, according to specifications supplied by overseas agents or trading companies.

At that time, Taiwan enjoys the comparative advantage of having plenty of low-waged workers to produce labour-intensive commodities. Various types of inter-firm networks such as BGs, SNs and CNs operate to contribute to Taiwan's industrial development by allowing manufacturers to produce cheaply and flexibly. Cross-border networks such as OEM linkages, joint ventures and licensing agreements enable Taiwanese manufacturers to acquire and improve technology from the mature end of the product life cycle. However, the proportion of profit that can be carved out is getting less and less as manufacturing alone embodies only a very small share of the value-added along the commodity chain.

Starting from the early 1980s, Taiwan's comparative advantage of low-cost manufacturing has been gradually eroded because of both internal and external threats. Externally, there is the growing competitive market, increasing protectionism and the rise of the South East Asian countries, such as Vietnam, Malaysia and Indonesia, as emerging low-cost manufacturing contenders. Internally, there is the problem of the appreciation of the new Taiwanese dollars, the shortage of labour and the huge increase in operation and production costs. The Taiwanese government responded by pursuing an espoused official policy of promoting the manufacture of high-tech and high value-added products. The Stature for Upgrading Industries was enacted in 1990 with the major objective of assisting firms to upgrade their

level of technology and, by offering them incentives, to enhance their R&D capabilities.

With such a shift in comparative advantage, there has been a gradual trend of structural diversification of Taiwan's manufacturing industries. The significance of the labour-intensive manufacturing industries such as textiles, garments, food processing, leather wares has decreased while that of the capital- and technology-intensive industries such as chemicals, petrochemicals, information technology, and the electrical and electronic equipment has increased. For example, the share of GDP of the textiles industry has decreased from 15.16% in 1951 to 7.26% in 1992 whereas that of the electrical and electronics manufacturing industry has increased from 0.55% to 13.63% over the same period (TIER, 1994: 52). Exports from Taiwan have recently encompassed a substantial amount of medium- to high-tech products. The proportion of high-tech to non hi-tech products exported has increased from 27% in 1985 to 42% in 1994 (Department of Statistics, Ministry of Finance, 1995: 337-339).

Taiwan is no longer just a receiver of foreign direct investment (FDI) from advanced industrialised countries. Starting from 1986, there is a wave of FDI flowing from Taiwan to both the advanced industrialised countries such as the U.S., Europe and the developing countries such as Malaysia, Indonesia, Thailand, the Phillipines and the Mainland China (Chung, 1994). There is, however, no reliable figure to indicate the magnitude of Taiwan's FDI in East Asia. One estimate is that US 16 billion dollars has been invested in ASEAN and US 13 billion have been invested in mainland China (Yu, 1994: 3).

With the technology-intensive industries getting more important in Taiwan, will existing forms of inter-firm networks continue to foster further economic growth in Taiwan beyond the labour-intensive phase of industrialisation? How can Taiwanese manufacturers move to and engage in those segments of the GCCs which encompass a higher proportion of value-added? These questions will be examined in the next two sections, using the information technology (IT) industry as a case for analysis.

The Development of Taiwan's Information Technology Industry

In Taiwan, starting from the 1960s, the IT industry had grown gradually but swiftly through the seventies and the first half of the eighties to became the third largest industry in 1987, following electronics and textiles (Chang, 1992). In 1995, Taiwan became the world's third largest producer of

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information products, only behind the U.S. and Japan. The total value of production was US $ 2.3 billion in 1986 but had grown more than fivefold to US $ 15.8 billion in 1995. Of the total value of production, hardware products accounted for over 90% with the remaining less than 10% contributed by software products (Taiwan Cooperative Bank, 1995: 9). Over 90% of the information hardware products are manufactured for export. The ratio of overseas to domestic sales for hardware products is 94 percent to 6 percent while that for software products is 6% to 94% (IDCC, 1994: 139).

Major IT products exported from Taiwan captured a very big world market share. In 1995, the export of mouse, motherboard and keyboard, image scanner, monitor, network card and power supply from Taiwan accounted for 75%, 65%, 64%, 57%, 38% and 35% of the world market share respectively. IC production in Taiwan, however, has not been solely developed for export. In 1994, 55% of Taiwan's IC output was exported. Supply to the growing domestic market is, however, increasingly important for IC companies (Mathews, 1995: 15).

In the global context of manufacturing IT commodities, Taiwanese companies design and manufacture hardware products for export to major markets such as the U.S. and Europe. Firms in these advanced industrialised countries market and distribute products, bearing their own brandnames, made by manufacturers in Taiwan. Taiwanese manufacturers are said to be engaged in ODM. Such an export role is similar to OEM, except that the products are designed by Taiwanese manufacturers themselves rather than according to supplied specifications. In 1994, contract manufacturing (including both OEM and ODM) accounted for 68% of the production value of the hardware products, two-third of which was in ODM (Taiwanese Cooperative Bank, 1995: 31). This means that Taiwanese manufacturers are moving away from just engaging in OEM of the IT products. With soaring labour and land costs in Taiwan, production of low-end peripherals such as monitors and keyboards has increasingly been moved to China and South East Asian countries such as Thailand and Malaysia (111, 1994: 151, 166).

Some IT manufacturers in Taiwan engage in OBM as well. It means that they export and sell their branded products through their own overseas distribution channels. In 1992, 31% of all the PCs produced in Taiwan was under OBM. However, with fierce competition as a result of big systems manufacturers such as Compaq and IBM dramatically cutting the price of PCs, OBM's share in Taiwan's exported PCs lowered to 22% in 1993 (III, 1994: 148-149). There are companies in Taiwan designing circuits and fabricating various kinds of ICs used as critical components in making

computer systems (Mathews, 1995: 12-15). Taiwan's systems manufacturers are, however, heavily relying on imports of such critical components such as liquid crystal displays (LCDs), cathode ray tubes (CRTs), dynamic random access memories (DRAMs) and central processing units (CPUs). Even production of low-end peripherals such as monitors relies on imports from Japan for 60% of the picture tubes they need (III, 1993: 50).

In the relatively clear global structure of division of labour and technology in IT components and hardware, Taiwan is playing a significant part in some of the segments as outlined below (Taiwan Cooperative Bank, 1995: 30):

- Conceptualisation and formulation of industry standard is located primarily in the U.S. with Japan playing a secondary role.
- Design and manufacture of parts and components is very much in the hands of the companies in Japan and the United States, with Taiwan and South Korea playing a minor role.
- Design and manufacture of sub-assemblies is located in Taiwan, South Korea and Singapore.
- Product design is carried out in Taiwan and South Korea.
- Product assembly and manufacture is located in Thailand, Malaysia and China, with Singapore playing a minor role.
- Distribution and sales is controlled in the hands of the U.S. and West European companies, with Taiwanese companies playing a minor role.
- After-sale and maintenance services are more adequately offered by the U.S. and Western European companies.

As a result of many IT hardware products becoming mature, there is little differentiation in products and competition is based very much on price alone. In fact, cut-throat competition among major systems manufacturers in the United States forces the price of information hardware products to rapidly decline. The profit margin of computers is further squeezed by the emergence of mass merchandisers, computer supermarkets and direct marketing challenging traditional distribution channels.[2] This has threatened the survival of many small- and medium-sized manufacturers in Taiwan. However, such a threat paradoxically increases the volume of OEM/ODM contracts for those Taiwanese manufacturers who possess engineering capabilities to mass produce and deliver commodities in high volume quickly to the market (Taiwan Cooperative Bank, 1995; Soo, 1995: 34).

The source of profits now come from components and parts (e.g. CPUs, LCDs and HDDs) rather than systems. With the computer systems shifting

from an exclusive (closed) to an open framework, any firm with the knowledge of existing published standards can manufacture computer systems without much difficulties. Barriers to entry into the IT industry lies not so much in manufacturing as in the control of requisite technology to design and manufacture core components. (III, 1993: 6). As the markets for computer systems are increasingly consumer- rather than manufacturer-led, the major source of profits has also shifted from hardware to software services (111, 1993: 6). What is significant to the end-users is whether and how the computers can be used and whether they can be deployed for new applications. Companies that can define how computers are used, not how they are manufactured, will create real value (Rappaport and Halevi, 1991: 69-70). A classic example is Microsoft defining the computer operating environments, first with MS-DOS and then recently with Windows using the graphical user interface (GUI).

Another very important source of profit comes from the establishment and control of architectural standards based on proprietary technology and products developed. This is because companies which set standards based on proprietary technology will not be subject to competition from clone makers trying hard to catch up with the requisite technology. The architectural standard for (X86) microprocessors in PCs set by Intel and for (Sparc) microprocessors in workstations set by Sun are good examples. These standards define how programmes and commands will work and how data will move around the system (Morris and Ferguson, 1993: 88). As a result of the integration of computer, communication and consumer electronics, companies also compete to establish and control the industry standard of new products such as Personal Data Assistants (PDAs) developed out of proprietary design or technologies (Rappaport and Halevi, 1991: 78).

It is clear that the strength of Taiwan's information industry lies in its design and production capabilities of sub-assemblies and finished products. Many years of experience in OEM has brought Taiwanese manufacturers highly skilled technical manpower with adaptive engineering capability to produce skilfully, cheaply, flexibly and quickly. Taiwanese manufacturers will not be the first to come up with new products, they will, however, be definitely the first to come up with compatible products that are cheaper but yet with good quality. This is because the engineers are most capable to improve on existing design, manufacturing process, and equipment to produce lower-cost products with even better features more quickly (Soo, 1995: 34). Such manufacturing strength has attracted American, Japanese and even South Korean companies to Taiwan, seeking OEM and ODM suppliers (HI, 1993: 15). Further OEM/ODM business can help Taiwanese

manufacturers achieve economies scale of production and enhance their production technology and quality. With strong technical and production capabilities, Taiwanese firms have positioned themselves as quick followers of international technological developments (111, 1993: 52)

The relative weaknesses of Taiwan's IT industry lie in its lack of involvement in setting industry standard, in its minor role in designing and manufacturing critical parts and components, distributing and providing adequate sales and after-sale services. As Taiwanese firms are mostly SMEs, they are faced with constraints in raising capital to invest in R&D. They are also inadequately equipped with advanced technology, technical and innovative manpower, and the level of quality-consciousness required to engage in large scale manufacturing of critical components. In fact, SMEs can rarely achieve the required economies of scale to make production of critical components cost-effective (Ill, 1993: 19-20). An inadequate supply of critical components such as DRAMS, precision mini-motors, magnetic heads undermines the ability of Taiwanese manufacturers to involve in the production of disk drives, printers, and other high-end peripheral equipment. The problem is further aggravated by the lack of critical technology for precision mechanical processing and electromechanical integration (IDB, 1994: 16).

Low-cost production advantage in Taiwan has been challenged by mainland China and South East Asian countries which have an abundant supply of cheap labour and land. Such a threat is, however, turned into an opportunity by Taiwanese manufacturers transferring the assembly and production of low-end products to these countries to keep their price competitive. In fact, there is a gradual trend for Asia to become a key production base for computer systems and the centre of the globalised computer industry. The output value of Japan and the newly industrialised countries has recently surpassed the output of Europe and is approaching the level of U.S. (Ill, 1993: 5-6). The Asia-Pacific region has also become an increasingly important market for information products. In 1992, Asia-Pacific and other areas accounted for 29.5% of the value of the global information market, compared with 17% of the same in 1985 (III, 1993: 5).

Inter-firm Networks and Further Development of Taiwan's IT Industry

From the above analysis, it is clear that the most profitable segments of the IT GCC are controlled by the U.S. and Japanese companies. A majority of the Taiwanese manufacturers engage in computer systems design and

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manufacture which are much less profitable. Why are Taiwanese manufacturers only marginally involved in the more profitable activities of designing and manufacturing critical parts and components, distributing and providing sales and after-sale services and not at all in the setting of industry standard? Part of the reason lies with the structural limitation of various types of existing inter-firm networks to generate innovation from within the system.

The kind of innovation needed to forge any breakthrough in technologies, product designs and production processes is not facilitated by the operation of SNs and CNs. With ready specifications supplied by the contractors or buyers, there is not much incentive for firms in SNs to come up with innovative product design (MSBA, 1992: 97). Most of the subcontractors in SNs and CNs use very rudimentary equipment sold to them by their contractors (Shieh, 1992: 117). This downward circulation of technology contributes little to upgrade quality and encourage innovation (MSBA, 1992: 86-87). The subcontractors in these firm networks are not given much technical assistance by their contractors who are afraid to breed competition by upgrading capabilities of the former (Chen, 1994: 161-164). The cultural values of familism and the social factors fuelling the desire of many to start their own business are working against the development of long-term and stable cooperative relationship between contractors and subcontractors in firm networks (Chen, 1994: 167-169; Chen, 1995: Ch.6; 11).

In fact, it is only possible to have innovation by absorbing and processing voluminous information and mastering abstract concepts. These capabilities are very difficult to develop with the existing model of technological advancement based on intensification of labour to accumulate experience by learning and imitation. As technology is accumulated by experience rather than developed by tracking market requirements to come up with appropriate product design, manufacturers can hardly appreciate the significance of investing money into such intangible function as R&D. Such an orientation in turn reinforces the perpetuation of 'experience-oriented technology'.

Cross border networks such as OEM linkages certainly assist Taiwanese firms to acquire and upgrade technologies and skills, technological advancement, however, only occurs behind the innovation frontier set by market leaders in the advanced industrialised countries. As technology is getting more complex and product life cycle (PLC) much shorter, the innovation frontier is receding in an ever quicker pace. The strategy of the Taiwanese firms entering, from the mature end of the technology ladder and catching up, little by little, with the market leaders along the PLC does

not work too well. In fact, without directly involved in marketing and distributing their products, manufacturers are being cut off from demanding users and can hardly plan for production, predict what products are in high demand and invest in improving appropriate production processes (Chen,1994: 164-167; Chen, 1995: Ch.6; 7-26).

It is true that engaging in OEM/ODM can stablise volume and allow Taiwanese manufacturers to achieve economies of scale in production and to transfer technologies. The kind of low-cost flexible production which attracts OEM business, however, very often compromise a degree of product quality. Relying on such an export role too much is also highly risky. Taiwanese manufacturers, being themselves cut off from the consumer market, are at the mercy of big overseas companies which may shift their orders elsewhere for whatever reasons. To reduce the level of such a risk, manufacturers need to involve in marketing and distribution themselves by collecting adequate market information to position their products and by establishing their own sales channels and outlets (III, 1993: 20).

How can Taiwanese manufacturers consolidate their strengths and overcome their weaknesses in the globalised IT industry? How can they exploit current opportunities and counteract the threats emerged out of the development of the industry in question? The profitable segments of the IT GCC have been shifted from systems manufacturing to the setting of industry standard, the design and manufacture of critical parts and components, marketing and distribution as well as from hardware to software and services. How can Taiwanese manufacturers sustain the development of IT industry by playing a more significant part in these segments? The answers to these questions lie in the formation of newer forms of inter-firm networks, out of manufacturers' own initiatives as well as fostered by the government, to facilitate in the upgrading of the IT industry.

To consolidate manufacturing strength to produce in high speed, low cost, great flexibility and with good quality, the government has since 1984 promoted the Centre-Satellite (C-S) system to foster cooperative relationship of firms in networks. The relationship between firms in the C-S system is similar to that in CNs and SNs. However, firms participated in the C-S system have a more stable relationship with one another so that quality of production can be upgraded, management improved, cost lowered and operation streamlined. There are two kinds of production networks, promoted under the system, to increase cooperation among firms in the up, middle and down stream of the industry. The first kind is between upstream small component suppliers (satellite factories) and downstream big manufacturers (centre factories). The other kind of production network is be-

tween big raw material suppliers (centre factories) and downstream smaller manufacturers (satellite factories).[3] (CSD Industrial Coordination Centre, 1994). There are currently 29 C-S systems up and running in the IT industry (Su, 1996).

To add value to its production strength, system manufacturers in Taiwan such as Acer and Mitac have recently engaged in Original Design and Logistics (ODL) arrangements to shorten the time of delivering IT products to the markets, still with the overall costs contained. Both Acer's Fast Food Business Model and Mitac's Modular Manufacturing System illustrate the ODL arrangements very well. In both systems, component parts are shipped from Taiwan in modules to be assembled into PCs where the customers are and according to their requirements. The cost of and time used in various stages of the IT value chain are managed to ensure an overall low logistics costs, high product quality and short time-to-market. These stages include raw material supply, production, transportation, marketing, sales and the provision of after sales service (Chen, 1994: 90; Soo, 1995: 33; Nikkei Electronics Asia, 1995: 71; Poon, 1997: 17-26). Taiwanese manufacturers, through the ODL arrangements, learn more about the marketing and distribution processes from their OEM/ODM customers and hence move one step closer to engage in OBM.

Taiwanese firms are formed into joint ventures to explore and develop new and increasingly important markets in South East Asia. Forty Taiwanese PC manufacturers, including Acer and FIC, formed a joint venture firm called Fuya Inc. with Chinese counterparts to develop the China market. Taiwanese PC vendors have set up offices on Shanghai's 'Electronics Street', built by the municipal government especially for Taiwanese computer makers in 1994. At present, Taiwanese companies in Electronics Street are mostly involved in wholesaleing hardware and developing software products (Nikkei Electronics Asia, 1995:60-61).

The formation of inter-industry exchange networks have been guided by Medium and Small Business Administration (MSBA) and promoted by the China Productivity Centre since 1993 to nurture the ability of both product and process innovation. They are formed to facilitate information exchange, encourage development of innovative business ideas, new technologies and new products (MSBA, 1995: 5).

With the assistance of government-funded bodies and various industry associations, R&D consortia were formed to enable Taiwanese firms to be involved in the conceptualisation and formulation of industry standards as well as the design and manufacture of critical components. One such example is the Taiwan NewPC Consortium (TNPC) formed by 32 Taiwan-

ese manufacturers of PC and related computer products, under the guidance of Industrial Technology Research Institute, to develop computer systems and subsystems based on PowerPC microprocessor. Such a kind of microprocessor is developed by the Apple-IBM-Motorola alliance to challenge Intel's Pentium microprocessor as the industry standard. By participating in the consortium, Taiwanese manufacturers position themselves at the leading edge of new microprocessor technology. They even participate in the development of the PowerPC architecture, which may become the industry standard of the next generation PC products (Mathews and Poon, 1995).

To strengthen the ability in software development which commands an increasingly higher proportion of profits, III in 1989 brought together 32 companies to participate in a four-year Software Engineering Environment Development (SEED) project. The objective of the project is to establish technical standards and a healthy software environment to make significant advancement in the IT industry (Wang, 1993: 704-705).

Out of manufacturers' own initiatives and with the assistance of the government, newer forms of inter-firm networks such as those in the C-S system, the ODL arrangements, joint ventures, inter-industry exchange networks, R&D consortia and project teams were developed in the IT industry. These different kinds of inter-firm networks play various roles to consolidate the manufacturing strength and overcome the weakness of Taiwanese manufacturers. Through the operation of the newer forms of inter-firms networks discussed, Taiwanese manufacturers are striving to move to and engage in those segments of the IT GCC commanding a greater proportion of profit.

Conclusion

Upon examining the extant literature on inter-firm networks and industrial development in Taiwan, it is found that various types of inter-firm networks contribute to Taiwan's industrial growth in its labour-intensive phase of industrialisation. They include firm networks formed both within and across the Taiwanese border. Inter-firm networks within Taiwan such as BGs, SNs and CNs offer flexible, speedy and low-cost production which attract manufacturing orders from advanced industrialised countries to produce labour-intensive commodities. Cross border networks such as OEM linkages, joint ventures and licensing agreements are channels through which technologies are transferred from foreign multinationals to Taiwanese firms. The effectiveness of firm networks within Taiwan reinforces the

development of cross border networks. The prevalence of the cross border networks in turn stimulates a more effective operation of inter-firm networks within Taiwan. The labour-intensive industries have therefore developed fast in Taiwan within such a context.

However, these established kinds of inter-firm networks have structural limitations to generate innovation from within the networks. This largely impedes further development of Taiwan's industries, in particular the more technology-intensive ones which are getting more important. In the current context of global manufacturing where the processes of production, exporting, marketing and distribution of commodities are scattered in various countries, the upgrading of a country's industries takes place as manufacturers move along the GCCs to engage in those segments encompassing a higher proportion of profits. Examining the IT industry, it is found that both the Taiwanese government and the private businesses are actively involved in fostering the formation of newer forms of inter-firm networks to facilitate further industrial growth in Taiwan. Firm networks present in the C-S system, the ODL arrangements, the inter-industry exchange networks and the R&D consortia can all be identified to be operating in the IT industry, enabling Taiwanese manufacturers to move to those segments in the IT GCC which command a higher proportion of profits.

Notes

1 For example, making workers feel being 'part of the family' is an important mechanism of motivation and in soliciting additional financial resources when required.

2 Examples include Packard Bell entering the U.S. market in 1988 as a mass merchandising store and Bell relying on direct telephone marketing to sell computers. Both companies adopt the 'zero-tier'concept, doing away with various levels of distributors between manufacturers and retailers and hence can offer a very competitive price on computers (MIC, 1995: 22-24).

3 A third type of network in the C-S system forms between manufacturers (satellite factories) and specialised trading or exporting companies (centre firms). This is not a popular form of network in the C-S system found in the IT industry.

References

Appelbaum, Richard P. and Gereffi, Cary (1994), 'Power and Profits in the Apparel Commodity Chain', in Edna Bonacich, Lucie Cheng, Norma Chinchilla, Nora Hamilton and Paul Ong (eds), *Global Production: the Apparel Industry in the Pacific* Rim. Philadelphia: Temple University Press.

Appelbaum, Richard P. and Henderson, Jeffrey (eds) (1992) *States and Development in the Asian Pacific Rim.* Newbury Park, California: Sage Publicationa, Inc.

Balassa, Bela (1988) 'The Lessons of East Asian Development: An Overview' *Economic Development and Cultural Change,* April, Vol. 36, pp. S273-291.

Biggs, T.S. and Levy, B.D. (1991) 'Strategic Interventions and the Political Economy of Industrial Policy in Developing Countries' in Perkins, P.J. and Roemer, M. *Reforming Economic Systems in Developing Countries.* Harvard University Press.

Chang, Chung-chau (1992) 'The Development of Taiwan's Personal Computer Industry', in N. T. Wang (ed), *Taiwan Enterprises in Global Perspective.* New York: M.E. Sharpe, Inc.

Chen, C.C. (1994) 'Information Industry in Taiwan: the Close Encounter of the Second Crisis', *Commonwealth.* 1 January (In Chinese).

Chen, Jieh-shyuan (1994) *Cooperative Network and the Structure of Living: A Socio-economic Analysis of Taiwan's Small and Medium Enterprises.* Taipei: Lien Jien Publishing Co (In Chinese).

Chen, Jieh-ying (1995) *Technology and Society: A Sociological Analysis of Technological Development of the Small and Medium Enterprises in Taiwan.* Ph.D Dissertation, Department of Sociology. Tung Hai University (In Chinese).

Cumings, Bruce (1984) 'The Origins and Development of the Northeast Asian Political Economy: Industrial Sectors, Product Cycles, and Political Consequences', *International Organization* Vol. 38, No. 1, Winter, pp. 1-40.

Department of Statistics 1995. *The Import Export Trade Statistics Monthly Report on Taiwan, R.0.C.* April. Ministry of Finance.

Deyo, Frederick (ed) (1987) *The Political Economy of the New Asian Industrialism.* Ithaca: Cornell University Press.

Dicken, Peter (1992) *Global Shift: The Internationalisation of Economic Activity.* Second Edition, New York: Guildford Publications.

Gereffi, Cary (1989) 'Development Strategies and the Global Factory' *The Annals of the American Academy of Political and Social Science.* Vol. 55, September, pp. 92-104.

Gereffi, Gary (1994) 'The International Economy and Economic Development', in Neil J. Smelser and Richard Swedberg (eds) *The Handbook of Economic Sociology.* Princeton, NJ: Princeton University Press.

Gereffi, Gary and Korzeniewicz, Miguel (1990) 'Commodity Chains and Footwear Exports in the Semiperiphery', in W. C. Martin (ed), *Semiperipheral States in the World Economy.* Westport, CT: Greenwood Press.

Gold, Thomas (1986) *State and Society in the Taiwan Miracle.* N.Y.: M.E. Sharpe.

Gold, Thomas (1988) 'Entrepreneurs, Multinationals and the State', in Edwin A. Winckler and Susan Greenhalgh (eds), *Contending Approaches to the Political Economy of Taiwan.* London: M.E. Sharpe Inc.

Hamilton, Gary G. and Biggart, Nicole Woolsey (1988) 'Market, Culture, and Authority: A Comparative Analysis of Management and Organization in the Far East', *American Journal of Sociology,* Vol. 94 Supplement S 52-94.

Hamilton, Cary G. and Kao, Cheng-Shu (1990) 'The Institutional Foundations of Chinese Business: The Family Firm in Taiwan', *Comparative Social Research,* Vol. 12, pp. 135-151.

Hobday, M. (1995) *Innovation in East Asia: The Challenge to Japan.* England: Edward Elger.

Hopkins, Terrence K. and Wallerstein. Immanuel (1986) 'Commodity Chains in the World Economy prior to 1800' *Review, Vol.* 10, No. 1, pp.157-170.

Huges, Helen (1993) *East Asia: Is There an East Asian Model?* Economics Division Working Papers, Research School of Pacific Studies, Australian National University.

IDB (1994) *Strategies and Measures for the Development of the Top Ten Emerging Industries.* Taipei: Industrial Development Bureau, Ministry of Economic Affairs.

IDCC (1994) *White Paper on Industrial Development. Taipei: Industrial Development Consultative Committee,* Ministry of Economic Affairs.

III (1993) *Information Industry Yearbook,* Taiwan, R.0.C. Taipei: Institute for Information Industry, Ministry of Economic Affairs

III (1994) *The 1994 Information Industry Yearbook,* Taiwan, R.O.C. Taipei: Institute for Information Industry, Ministry of Economic Affairs.

Little, I. M.D. (1979) 'An Economic Reconnaissance', in W. Calenson (ed) *Economic Growth and Structural Change in Taiwan.* Ithaca: Cornell University Press.

Little, I. M.D. (1981) 'The Experience and Causes of Rapid Labour-Intensive Development in Korea, Taiwan Province, Hong Kong and Singapore; and the Possibilities of Emulation' in Eddy Lee (ed), *Export-led Industrialisation and Development,* International Labour Organisation.

Mathews, John (1995) *High-Technology Industrialisation in East Asia: The Case of the Semiconductor Industry in Taiwan and Korea.* Contemporary Economic Issues Series No. 4, Taipei: CIER.

Mathews, John and Poon, Teresa Shuk-ching (1995) 'Technological Upgrading through Alliance Formation: The Case of Taiwan's NewPC Consortium' *Industry of Free China.* Vol. LXXXIV, No. 6. December, pp. 43-58.

MIC (1995) *The Trend of Future Development of the Personal Computer Industry in the Asian Pacific Region.* Taipei: Market Intelligence Centre, Institute for Information Industry, Ministry of Economic Affairs.

Morris, Charles R. and Ferguson, Charles H. (1993) 'How Architecture Wins Technology *Wars' Harvard Business Review,* March-April. pp. 86-96.

MSBA (1992) *White Paper on Small- and Medium- Enterprises. Taipei: Medium and Small Business Administration,* Ministry of Economic Affairs.

MSBA (1995) *A Compendium of Activities: The Inter-industry Exchange Networks.* Medium and Small Business Administration, Ministry of Economic Affairs.

Nikkei Electronics Asia (1995) *Taiwan Expands* Out, *Scales Up.* June.

Numazaki, Ichiro (1992) *Networks and Partnerships: The Social Organization of the Chinese Business Elite in Taiwan.* Ph.D. Dissertation in Department of Anthropology, Michigan State University, U.S.

Orru, Marco, Biggart, Nicole Woolsey and Hamilton, Gary, G. (1991) 'Organisational Isomorphism in East Asia', in Walter W. Powell and Paul J. DiMaggio (eds) *The New Institutionalism in Organizational Analysis.* Chicago: The University of Chicago Press.

Pack, Howard (1992) 'New Perspectives on Industrial Growth in Taiwan' In Gustav Ranis (ed.) *Taiwan: From Developing to Mature Economy.* Boulder, Colorado: Westview Press.

Poon, Teresa Shuk-ching (1996) 'Dependent Development: The Subcontracting Networks in the Tiger Economies' *Human Resource Management Journal. pp.* 38-49.

Poon, Teresa Shuk-ching Poon. (1997) 'Inter-firm Networks and Industrial Upgrading in Taiwan: The Case of the Information Technology Industry' *Paper presented*

at the Third ASEAN Inter-University Seminars on Social Development held in Pekanbaru, Sumatra, Indonesia, 16 to 19 June 1997.

Rappaport Andrew S. and Halevi Shmuel. (1991) 'The Computerless Computer Company'. *Harvard Business Review.* July-August, pp. 69-80.

Shieh, Cwo-shyong (1992) *'Boss Island: The Subcontracting Network and MicroEntrepreneurship in Taiwan's Development.* New York: Peter Lang Publishing, Inc.

So, Alvin and Chiu, Stephen (1995) *East Asia and the World Economy.* Thousand Oaks, California: Sage Publications, Inc.

Soo, Y.C. (1995) 'Taiwan: The Global Industrial Cooperative Island' *Commonwealth.* 5 June.

Su, Chin-ho, President, Corporate Synergy Development Centre. *Personal Interview.* 20 August 1996.

Taiwanese Cooperative Bank (1995) *The Present and Future o the Information Indus try in Taiwan (Part I).* The Survey and Research Unit.

TIER (1994) *The 1994 Almanac of Information Industry in the People's Republic of China.* Taipei: Taiwan Institute of Economic Research.

Yu, Tzong-shian (1994) *Taiwan's Foreign Direct Investment and Economic Development.* Occasional Paper Series No. 9402. April, pp. 1-8.

Wade, R. (1990a) *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization.* New Jersey: Princeton University Press.

Wade, R. (1990b) 'Industrial Policy in East Asia: Does It Lead or Follow the Market?' In G. Gereffi. and D. L. Wyman (eds.) *Manufacturing Miracles: Paths of Industrialization in Latin America and East Asia.* Princeton, New Jersey, Princeton University Press.

Wang, J. C. (1993) 'Cooperative Research in a Newly Industrialised Country: Taiwan'. *Research Policy.* 23. 1994. 607-71 1.

Whitley, Richard (1991) 'The Social Construction of Business Systems in East Asia', *Organisation Studies,* Vol. 12, No. 1, pp. 1-28.

Whitley, Richard (1992) *Business Systems in East Asia: Firms, Markets and Societies. London: Sage Publications Ltd.*